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CORPORATE GOVERNANCE AND MULTI-DIMENSIONAL PERFORMANCE

Doctoral Thesis

Douglas Nanka-Bruce

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By

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Abstract

Corporate governance is not a new concept although business researchers have only shown exponential interest dating back a few decades. The recent financial turmoil of global proportions has merited a revitalised interest as shareholders have seen their shareholding wealth tumble markedly. Management and the board of directors of companies have been accused of not doing much in safeguarding the interests of their shareholders. This study revisits the impact of some corporate governance variables on performance by extending the performance measures of previous studies; as extant empirical literature purveys contradicting results in both single and cross-country studies.

Data from seventeen *OECD* countries; sixteen of which are in the European Union and the other being the *USA* is utilised. These countries have similar or different legal origins and different levels of investor protection. In addition to the study of governance, an investigation is made of technical efficiency and productivity differences between the countries and the industrial sectors represented. This is achieved by using a bootstrap approach that enables better statistical inferences through data envelopment analysis techniques. This is to see if differences in corporate governance practices are related to differences in technical efficiency and productivity growth.

This study involves an extensive literature review of corporate governance codes and indices, narrowing down to a few of these governance characteristics used in preparing the governance index. These are: corporate shareholding concentration and type; board characteristics of size and composition; *CEO*-chairman separation, and; a firm's financial policy. The literature goes on to link these characteristics to performance, reviewing the performance measures traditionally used to evaluate the effects of corporate governance. A review of studies in investor protection is also given. The various control variables used in moderating the link between performance and governance are discussed. The concepts of technical efficiency and total factor productivity are explained into detail here and some results of previous studies that have sought to link these with corporate governance are reviewed. The governance characteristics are linked to investor protection and performance through the conceptual framework of positive agency theory and institutional theory.

In the empirical aspect, technical efficiency and productivity analyses are carried out. After the conventional univariate and bivariate analyses of the data, cross-sectional analyses are performed. Justification is then provided for performing pooled analysis, curtailing endogeneity problems. Pooling data gives rise to issues of panel heteroskedasticity and serial correlation. A Prais-Winsten cross-sectional time series transformation is utilised to eschew these problems. In the case of technical efficiency and total factor productivity, this method is inappropriate as the data is censored, so a bootstrapped truncated regression is utilised. In a section of the literature, the relationship between governance and valuation has been argued to be non-monotonic/non-linear. This study utilises piecewise linear and quadratic specifications to investigate this argument.

Subsequently, the global model developed for this study is tested at the individual country levels. Finally, the link between corporate governance, investor protection and valuation is investigated.

In general, there is support for most of the hypotheses of governance effects on performance except the influence of investor protection. Concentrating ownership leads to decreased market valuation but increased technical efficiency and mixed effects on profitability. Board size has a negative effect on most of the performance proxies but it exhibits a concave relationship with valuation. Separating the duties of the *CEO* and board chairman is of no import to firm performance. Board outsiders exert a positive impact on market valuation, a negative impact on technical efficiency and insignificant influences on the other performance measures. The number of governance codes introduced by a country has adjustment implications for firms as a negative influence on firm performance is observed.

In the light of these findings, a composite measure of performance is recommended while the theoretical framework that is used to examine governance and performance issues needs to be expanded to accommodate contrasting conceptual frameworks. The stakeholder approach is particularly encouraged as positive agency theory on its own will not fully explain why firms are governed the way they are and why the investment decisions of some shareholding categories are not wholly from a financial view point.

Resumen

A pesar de que los investigadores en el ámbito de la gestión empresarial le han prestado atención creciente desde tan solo hace unas décadas, el Gobierno Corporativo (*GC*) no es un concepto nuevo. Así, la reciente crisis financiera mundial ha generado entre los accionistas un creciente y revitalizado interés por el tema, al ver éstos una reducción importante en el valor de sus acciones. Como reacción lógica, se acusa al grupo directivo, y a los miembros de los órganos de gobierno corporativo, de no preservar adecuadamente los intereses generales. Este estudio analiza el impacto de algunas variables relativas al *GC* en los resultados de las empresas, para ello se recogen las variables utilizadas en estudios previos, a la vez que se proponen nuevas variables, pues los resultados obtenidos hasta el momento ofrecen resultados contradictorios tanto en las aplicaciones circunscritas a países concretos como en los estudios de ámbito internacional.

Los datos utilizados en la parte empírica del trabajo provienen de diecisiete países miembros de la *OCDE*, de los cuales dieciséis son miembros de la Unión Europea, mientras que el restante corresponde a los *EEUU*. Adicionalmente al estudio del *GC*, también se presenta una investigación relativa a los niveles de eficiencia técnica y productividad entre diferentes países y sectores industriales, realizando estimaciones *bootstrap*.

El trabajo realiza una revisión de los códigos de *GC*, y de los índices propuestos, para, a continuación, escoger aquellos que resultan más adecuados en la elaboración de un índice general de *CG*. Los indicadores escogidos son: la separación del Director Gerente y la estrategia financiera de las empresas. Los tradicionales indicadores de resultados utilizados en investigaciones previas también son revisados, al igual que los indicadores de protección de los inversores.

Después de estimar los niveles de eficiencia técnica y de productividad, estos resultados son utilizados en una segunda etapa, que utiliza técnicas de estimación paramétrica, en el que, junto a otras variables de resultado, se ponen en relación con variables de *GC*. Con el fin de conseguir estimaciones robustas, se realizan ajustes para corregir los problemas causados por la endogeneidad de las variables independientes, la heteroscedasticidad y la correlación serial. También son investigadas estimaciones cuadráticas y lineales a trozos.

En general, se encuentra soporte para la mayoría de las hipótesis que relacionan el *GC* con los resultados, excepto en el caso de la relativa a la protección del inversor. Así, los índices de concentración de la propiedad implican una reducción en la valoración del mercado junto a un incremento en los niveles de eficiencia técnica y unos resultados variables en los niveles de resultados. El tamaño del Consejo de Administración tiene un efecto negativo en la mayoría de los indicadores aunque, sin embargo, exhibe una relación cóncava con la valoración del mercado. La presencia de miembros externos ejerce un impacto positivo en la valoración del mercado, un impacto negativo en los niveles de eficiencia técnica y una influencia insignificante en los otros indicadores de resultado. Por su parte, se observa una relación negativa entre el número de sucesivos códigos de conducta y los indicadores de resultados.

Teniendo en cuenta los anteriores resultados, se propone una medida global de los resultados. Asimismo, se recomienda expandir el marco teórico usado para examinar la relación entre los resultados y las características del *GC*. En este sentido, la perspectiva de la moderna teoría de los grupos de interés resultaría recomendable, pues la teoría de la agencia resulta insuficiente para explicar las características de los órganos de *GC* y cómo es que las decisiones de inversión de ciertos accionistas no están guiadas por los postulados de la teoría financiera.

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1. PROBLEM STATEMENT AND PURPOSE OF RESEARCH

1.1 Introduction

Corporate governance has been part of research into the business profession since Adam Smith's (1776) seminal publication of *An Inquiry into the Nature and Causes of the Wealth of Nations* and undoubtedly given impetus through Berle and Means's (1932) classic publication of the separation of corporate ownership from control. The latter authors sought to explain why a firm with several dispersed shareholders gave vested control powers to the manager who may or may not have shares in the firm. After seventy-seven years of this classic publication, and with relevant guidance through the analytical lens of Jensen and Meckling's (1976) positivist agency theory, there is still unparalleled interest in the field of corporate governance.

Corporate governance is aimed at reducing conflicts of interest, short-sightedness of writing costless perfect contracts and monitoring of controlling interests of the firm; the absence of which firm value is decreased (Denis and McConnell, 2003). Good corporate governance can also be considered as the diligent way in which providers of corporate financial capital guarantee appropriate rewards in a legal and ethically moral way. There are both internal and external ways of achieving this (Jensen, 1993). The first is through the structure of ownership (shareholding concentration and voting rights), and board of directors or supervisory board in some regulatory regimes (who monitor firms and are supposed to work in the interest of shareholders).

The second is through the market for corporate control (takeover threats), regulatory intervention, and product and factor markets. Corporate governance codes that serve as templates of achieving value to shareholders (and stakeholders) have been written in several countries (see the European Corporate Governance Institute's website – www.ecgi.org for an exhaustive list for countries, *OECD*, pan-Europe, the Commonwealth of Nations, the World Bank, among others). Several other definitions of corporate governance have been given in the literature; a few of which have been provided below.

Definitions of corporate governance

Jensen (1993) defines corporate governance as the top-level control structure, consisting of the decision rights possessed by the board of directors and the *CEO*, the procedures for changing them, the size and membership of the board, and the compensation and equity holdings of managers and the board. This definition does not explicitly recognise the importance of suppliers of capital. Shleifer and Vishny (1997: 737) define it as "… ways in which suppliers of finance to corporations assure themselves of getting a return on their investment." La Porta et al. (2000: 4) define it "as a set of mechanisms through which outside investors protect themselves against expropriation by insiders" and that "corporate governance mechanisms are economical and legal institutions that can be altered through the political process" (Shleifer and Vishny, 1997: 738). Similarly, Denis and McConnell (2003:2) elaborate on Shleifer and Vishny's definition by defining corporate governance as "a set of mechanisms – both institutional and market-based – that induces the self-interested controllers of a company (those that make decisions regarding how the company will be operated) to make decisions that maximise the value of the company to its owners (the suppliers of capital).

Background on corporate governance research

The seminal publication of Jensen and Meckling (1976) sparked an unprecedented increase in corporate governance research over three decades ago, albeit it was mostly limited to *US* listed firms with 'supposedly' dispersed ownership. Since the early 1990s, corporate governance research has been done in countries such as Japan, Germany, the *UK* and other Western European countries. Currently, although the research in these developed countries continues, there has been an explosion of research in emerging and developing economies. Nation-level comparative research has also been carried out, of which the works of La Porta et al. (1997 & 1998) are two of the most notable pioneering studies.

Aggarwal et al. (2007) assert that good governance helps firms to have favourable access to capital markets although this benefit holds little value to firms in under-developed capital markets or for firms with limited growth opportunities. Better governance restricts controlling shareholders' expropriation of minority and this loss of private benefit is even more in countries with low investor protection. Hence, countries that have weak protection for investors are expected to have worse corporate governance and hence enhanced firm-level governance can lead to a marked improvement in firm value.

Klapper and Love (2004) discuss four issues concerned with cross-country governance research. These are: whether countries with weak investor protection laws have better firm-level governance practices or have weak governance practices that lead to lowered degree of flexibility; whether countries with weak investor protection laws have better firm-level governance practices or have weak governance practices which weakens governance mechanisms and allows controlling owners to expropriate minority investors; whether firms with greater need for future financing adopt good governance practices, and; whether firm-level differences in governance mechanisms matter for performance, market valuation and access to external financing.

There is no one-fits-all template of corporate governance

As the literature review in the next chapter will reveal, there is no single template for analysing the effect of corporate governance on shareholder value under the *orthodox* positivist agency theoretical lens that underpins the majority of empirical investigations. The arguments that ownership concentration has a monotonic and positive effect on firm value or that dispersed ownership exists in the large public corporation have not lingered on. Quadratic and cubic relationships have been reported across the globe when ownership concentration and insider ownership are concerned (De Miguel et al., 2005). Added consideration of ownership identity even blurs the value that corporate governance has on a firm. Global empirical research has also shown that large public corporations are far from having dispersed ownership, even in the Anglo-Saxon setting.

The path-dependent institutional environment matters for corporate governance and its acknowledgement and analytical complementarity by researchers has recently been brought to the fore by authors such as: La Porta et al. (1997, 1998, 1999, 2000, 2002, 2006); Pedersen and Thomsen (1999); Pagano and Volpin (2001); Aguilera and Jackson (2003); Denis and McConnell (2003); O'Connell (2003), and; Aguilera (2004). Others are: Aguilera and Cuervo-Cazurra (2004); Klapper and Love (2004); Stulz et al. (2004); Beck and Walgenback (2005); Durnev and Kim (2005); Gomez-Meija et al. (2005); Lubatkin et al. (2005); Lubatkin (2007), and; Djankov et al. (2008).

The institutional environment measures the degree of investor protection (Shleifer & Vishny, 1997), and depending on political and socio-cultural factors (North, 1990 & 1992; DiMaggio & Powell, 1983 & 1991), different countries have reported different effects of corporate governance on firm value (Pagano & Volpin, 2001; Klapper & Love, 2004). Even within the same country, several conflicting effects have been reported. Countries with a common legal origin have been reported to show more similarities in governance than with different legal origins.

Corporate governance has also being widened to look at the relationship between the firm and all its stakeholders, instead of only its shareholders, since the firm operates as a unit of a bigger social entity. Corporate governance indices, that seek to look at value-decreasing activities leading to decreased return on shareholding assets, have been constructed for developed and emerging countries.

Measures of performance

Another element of debate in research, whether in corporate governance or the broader field of business management, has been how to assess firm performance. Market valuation by way of Tobin's *Q* and market-to-book-value, profits, prices and rates of return are the most popular. Market value depends on investor confidence which is forward looking and profitability depends on many factors outside the direct control of firms, can be manipulated by management and may not be a true measure of firm performance that can be attributable to firm specific characteristics. There has also been a burgeoning literature on an alternative measure of performance in terms of productive efficiency through both parametric and non-parametric approaches.

The non-parametric analysis, which does not have a pre-specified production function, allows one to construct a production frontier based on similar inputs and outputs for a sample of firms, evaluating firms in the best possible light. Hence, one can envelop all data points and analyse for productive differentials using mathematical programming techniques. As opposed to a mean-variance technique, this alternative measure of performance –data envelopment analysis- uses an extreme-point method (and this comes with its advantages and disadvantages that are discussed in Chapter Two). With the kind of analytical flexibility of this approach, a firm's relative performance in getting the best value out of its assets can be ascertained and compared with the traditional measures of firm performance.

Setbacks in governance and performance research

Bøhren and Ødegaard (2004) identify four main problems with governance research: 1) the use of partial approaches due to limited availability of data like that in Demsetz and Lehn (1985), Mørck et al. (1988), McConnell and Servaes (1990) and unfortunately, this study as well; 2) context specificity whereby most extant research have been on large *US* firms that cannot be reproduced in smaller sized firms or other countries with different law origins like civil law-origin countries; 3) absence of rich quality data (in terms of variable measures and number of years) that makes conclusions distorted, and; 4) the aspects concerned with endogeneity and reverse causality.

A simultaneous equation model has been used to capture these two mechanisms of endogeneity and reverse causality as has been applied in Cho (1998), Demsetz and Villalonga (2001) and Bøhren and Ødegaard (2004). According to the last authors, the governance-performance relationship is sensitive to the choice of instruments in the simultaneous equation model to control for endogeneity and reverse causality. Bøhren and Ødegaard (2004) therefore argue that endogeneity tests do not indicate significant relationships and that the theory relating governance to performance may be underdeveloped. Therefore in their opinion, using a broader set of mechanisms is not necessary for capturing the effects of a single mechanism. The choice of a performance measure is what matters most; like using Tobin's *Q*, book return on assets (*ROA*) and market return on equity (*ROE*). We will also add that the choice of control variables also matters in capturing these mechanism effects.

Some continental European countries only allow shareholdings above a minimum threshold to be reported while smaller holdings are not reported. Bøhren and Ødegaard remark that "[a]s changes in large shareholdings are only registered at certain discrete thresholds, any stake between these discrete points is estimated with error, and every stake above the highest reporting threshold is underestimated" (2004: 1).

1.2 Objectives

Based on some of the setbacks encountered in corporate governance studies, the main objective of this thesis is to verify the effects that corporate governance has on firm valuation, productive efficiency, profitability and growth. Most studies in corporate governance analyse firms in various industrial classifications that have different production functions. This study additionally analyses firms that use similar inputs and outputs to verify the relationship that corporate governance has on firm performance. The objectives are highlighted below:

1) To make a state-of-the art review of studies conducted in the field of corporate governance and performance measurements.

2) To verify the governance - performance relationship using several measures of valuation, profitability, dividend yield, cash flow, technical efficiency, asset growth, operating revenue growth and total factor productivity growth.

3) To verify the effect of investor protection on firm valuation using alternative proxies of investor protection.

4) To verify whether there are significant differences in technical efficiency, technical change and total factor productivity across industries, countries and legal origins.

The very few studies linking corporate governance to firm efficiency have been done in single-country contexts. This paper extends this to several countries to give added empirical evidence of a relationship. We suggest that technical efficiency captures internal governance improvements, at least, as much as the other performance proxies since the choice of inputs, outputs and orientation can be selected for optimal maximisation of these gains.

1.3 Research questions

The research questions that seek to address the objectives outlined above are:

1) Is there a systematic relationship between corporate governance and performance? If so, is it linear or otherwise? Does this relationship differ across institutions?

2) Does the size of the board of directors' systematically affect firm performance?

3) Does the composition of the board matter for performance?

4) Is separation of *CEO* and board chairman duties relevant for enhanced firm performance?

5) Does shareholding concentration systematically influence corporate performance?

6) Does the identity of firm ownership affect corporate performance?

7) Does financial policy matter in the corporate governance-performance relationship?

8) Do corporate governance variables relate to different measures of performance in the same direction?

9) Does the level of investor protection matter for firm performance and ownership concentration?

10) Is there a relationship between the number of governance codes (and recommendations) issued by a country and firm performance?

11) Are there systematic differences in technical efficiency and productivity growth across industries, countries and legal origins?

1.4 Relevance to thematic field of research

The thesis proposes to link the literature on corporate governance to efficiency and productivity analysis. Good corporate governance practices are argued to positively impact on performance. But what is the best proxy of performance to measure corporate governance? To answer this question, it is necessary to use several proxies of performance on the same sample with similar control variables for all performance model specifications. Firm valuation by way of Tobin's *Q* (and market-to-book-ratios) has mainly been used in analysing listed firms. Firm valuation depends on other issues beyond the control of the firm and has a forward looking perspective, factoring such intangible resources that may have erroneous estimates and gullible market perceptions. “The value of a firm as expressed by the return on assets, is the market value of expected stream benefits generated by an efficient production of outputs” (Lehmann et al., 2004: 285-286). The choice of inputs and the production processes is made by top executives in a firm and as such corporate governance must have an impact on firm efficiency and productivity growth.

Productivity considers how firms are efficient in maximising (multiple) outputs from (multiple) inputs. Productivity measures have sophisticated models which are lacking in theories of managerial approaches. Using productivity measures to examine whether good corporate governance mechanisms improve firm performance is therefore relevant. Although the few studies that look at the effect of corporate governance on productivity or technical efficiency have utilised parametric approaches like *stochastic frontier analysis*, a handful of researchers have utilised linear programming techniques that assign virtual weights to inputs and outputs that are endogenously determined. This is *data envelopment analysis* which is common in operational research. These studies have reported the significance of using technical efficiency measures. It also has the ability to curtail the endogeneity problems afflicting corporate governance studies with appropriate relevance.

Corporate governance has often been analysed with theoretical frameworks within the New Institutional Economics discipline of research enquiry. Other aspects, as regards to shareholder value creation, and the optimum mix of equity with debt have been approached from financial theories. The key theoretical lens that is utilised is derived from the agency theory. A hegemonic inculcation of institutional theory is necessary to complement the orthodox positivist agency approach (that has become acceptable by researchers, the business community and the media as the righteous theoretical lens for expatiating on corporate governance issues). Testing the governance-performance relationship on a more global level needs to be done complementing agency theory with the institutional approach. To this end, data from 17 countries is used to test the hypotheses generated from the conceptual framework expanding the empirical research done with corporate governance and technical efficiency studies to a multi-country analysis.

1.5 Justification of the study

Corporate failures have come about as a result of bad corporate decisions made by its leaders in attempts to expropriate rents. The inactment of codes of good corporate governance across the globe justifies the importance of this topic. Policy makers, the print and electronic media, and other interested groups have come to believe that performance is significantly influenced by good governance practices. However, the study of corporate governance is very broad and tedious. As a result, most studies concentrate on a few internal or external control mechanisms. The relationship of corporate governance to performance has also been carried out mostly using valuation measures for listed firms and accounting measures for non-listed firms. Studies linking governance to firm efficiency are very few and have been done in isolation to the other performance measures. Most studies have also been done in a single-country context. There is the need for a comprehensive study that integrates all these varied study types that have received mention above and this is what this study (within its scope) seeks to address.

1.6 Scope of the study

Although this study considers corporate governance in its entirety and as such focuses on an extensive state-of-the-art review in corporate governance indices, internal control and investor protection mechanisms dealing with corporate structure and board characteristics; we limit the empirical study to a few board of directors' characteristics (such as size, independence and *CEO*/chairman duality), the ownership identity, outsider ownership concentration, and financial policy and how these collectively affect firm performance using valuation, profitability, growth and technical efficiency measures. Investor protection and how these are shaped by a country's legal origin is also covered. Extensive corporate governance ratings of some listed firms by commercial rating agencies are available but expensive to obtain and very tedious to prepare on a scope for this multi-national study by an individual. These ratings are discussed based on prior empirical investigations. Even with this limited selection, we endeavour to use ten measures of performance with controls for firm size, investment opportunity set, risk/volatility, industry and country.

1.7 Outline of the chapters

Each chapter starts with an introduction and ends with a conclusion. The chapters on literature review, conceptual framework and data analysis have detailed appendices at the end of the thesis and readers are referred to the various appendix sections when required. Chapter Two discusses the broader literature review of corporate governance beginning with indices and codes the world over.

We then focus on ownership and board variables that are relevant to this study and relate these to performance measures. We subsequently review the literature on investor protection. Chapter Two then continues with explanations of the variable measures used in the corporate governance and performance relationship. We concentrate briefly on the derivation of Tobin's *Q* and detail out the derivations of technical efficiency and Malmquist indices using data envelopment analysis (*DEA*) techniques.

In Chapter Three, we develop the conceptual framework. Agency theory is espoused and mechanisms of reducing these agency costs are introduced to formulate most of our hypotheses. The cross-country nature of our enquiry and consequent investor protection laws (institutional and financial environments) necessitates the elaboration and integration of institutional theory which we do and formulate the rest of our hypotheses. In Chapter Four, we specify the data for the variables, its sources and how we go about deleting influential observations. Descriptive statistics of data for *DEA* are reported and we show details of how yearly, industry and country results are analysed. We then input these results into our parametric analysis of governance and performance. Cross-sectional and cross-sectional time series analyses with considerations of endogeneity, cross-sectional and panel heteroskedasticity and first-order serial correlation are all analysed. Evidence of non-linearity and/or non-monotonocity at a global and country level is then investigated. We finish the analysis by looking at the effect of investor protection on market valuation and some of our performance proxies.

We discuss our findings with previous empirical investigations in corporate governance, performance and the variables that moderate this relationship. We also discuss our findings of technical efficiency, technical change and total factor productivity growth differences amongst industries, countries, legal origins and the different time periods from years 2000 to 2005. In Chapter Five, we write on the significance of our findings to prior empirical research and thereupon provide insights into possible future research directions. The limitations of this study that have also impeded extensive cross-country governance studies are mentioned. A summary of our study and findings are listed to conclude the study. There is an appendix with a detailed discussion of institutional theory. Detailed results of technical efficiency, technical change and total factor productivity are contained in this appendix. It also contains preliminary methodologies and analyses of our study.

1.8 Chapter summary

We began this chapter by introducing the concept of corporate governance and its relevance to firm performance arguing for the use of technical efficiency as a crucial part of the measure of firm performance. Corporate governance indices and codes aimed at reducing value-decreasing mechanisms of decision makers are introduced. We have proceeded to discuss the objectives of the study and its contribution to the thematic field of research and put forward the relevant questions to be addressed. We have drawn out the scope of the study and have sought to justify its relevance as studies in this field have given contradictory results. Doing a cross-country study with most of the performance variables that have been used is therefore seen as verifying the extent of extant relationships. We have finished off the chapter by outlining the work we endeavour to do in the subsequent chapters.

2. CORPORATE GOVERNANCE AND PERFORMANCE: LITERATURE REVIEW

2.1 Introduction

Corporate governance looks at the structure of the rights and responsibilities of different stakeholders within a firm and to stakeholders with vested interests in the firm (for example, suppliers, customers, community, shareholders, Press, the State and non-governmental agencies). After a general introduction, and before we consider the structure of ownership and the board of directors, this section discusses codes of best governance practices and corporate governance indices that have recently emerged in the study of corporate governance.

This chapter is introduced with some remarks on corporate governance differences in *EU* countries. In countries like Austria, Denmark, Germany and Sweden, when companies get to a certain size, they can put employees on the supervisory board. Company bylaws can also stipulate that employees have a right to be on the supervisory board as is the practice in Finland and France. In most *EU* member countries, shareholders are authorised to elect all members of the board of directors. La Porta et al. (1998) explain voting rights that are different from the one-share-one vote that is thought to be ideal in good governance. There are non-voting shares, low-and-high voting shares, founder's shares with higher votes, or votes that increase when the shares are no longer held. There is also a restriction of votes when a shareholder goes beyond a minimum shareholding threshold. Priority shares (which have special voting privileges in such decisions as merger approvals, company liquidation, etc) are used in the Netherlands, *UK* and Germany. Preference shares (protective preference shares in Netherlands) also have voting privileges. It is primarily used as an anti-takeover defence in the Netherlands although that is not the practice in the other Western *EU* countries (de Jong et al., 2005).

In the Netherlands, Belgium and France, for instance, non-voting shares may be used. Company articles, bylaws and charters can provide anti-takeover provisions in the interest of important shareholders, the board of director and the executive management board. Two of such provisions are poison pill and golden parachute. Poison pill is the issuance of rights to all shareholders that can be converted into securities in case of an important incident such as when the company is acquired. This is to prevent potential bidders from attempting a takeover without the support of the board of directors. Golden parachute is the compensation paid to the board of directors and top-level management when the company is acquired. These benefits can take the form (or a combination) of a severance pay, stock options or a bonus.

Renneboog and Szilagyi (2007) comment the relatively small number of Dutch listed firms and that more than 90% of these listed firms restrict shareholder power. More than two-thirds of these have at least two shareholder power restrictions in place. They also mention the relatively small number of takeover activity while ownership is highly concentrated. They go on to state that corporate reporting is quite discretional and its enforcement is also weak.

There are some proposals concerning proportional ownership in Europe by the European Commission. These proposals argue against the use of such governance mechanisms as pyramids, cross-ownership, voting caps, dual class shares and golden shares. The proposals argue that the wedge created between shareholding rights and voting rights are to the detriment of minority shareholders as well as decreasing firm value. However, Bennedsen and Nielsen (2006) adapt these proposals to a sample of over 4000 listed companies and find no significant impact of these disproportional ownership structures on operating performance.

A study by Ernst & Young's Centre for Business Innovation (1998) called "measures that matter" concludes that 30% of a decision to buy, by 70% of investors, is based on non-financial performance indicators which include good corporate governance and stock of intangible assets. There has been a significant increase in the global research of the effect of financed-based corporate governance on economic performance. Some of these governance mechanisms are: the competitive environment of firms; legal protection rights of minority investors; the ownership structure of the firm; the financial policies pursued by a firm, as well as; the composition and functions of the board of directors.

In a recent survey by Bøhren and Ødegaard (2004), the authors suggest that empirical evidence on this subject is mixed and inconclusive, attributing this to the rather novel academic field and the difficulty of obtaining good quality data for analysis. Getting governance data for countries with underdeveloped and weak capital markets can be an overriding challenge for researchers as they are simply non-existent or very unreliable due to weak institutional environments. The authors agree that it is rather unsurprising that a positive or normative best governance system has not yet been prescribed. The approaches used have best been partial as corporate governance embodies too many mechanisms for a holistic interpretation of its effect on performance. Aggregating these mechanisms into one governance index also dampens the effects of the single mechanisms. With these setbacks mentioned, this empirical investigation will be modelled on a partial approach owing to data limitations.

The chapter now looks at corporate governance practices such as ownership structure, the board of directors, governance codes of best practice, governance indices, the role of the institutional environment in protecting investors and empirical studies conducted on these issues.

2.2 Corporate governance codes

Good corporate governance is related to shareholder rights, transparency and board accountability. To begin with the discussion, a systematic definition of corporate governance is given. A policy report on governance in the *EU* by the law firm, Weil, Gotshal and Manges (2002:11) define corporate governance code as:

> [A] systematically arranged set of principles, standards, best practices and/or recommendations [that is] precatory in nature [, is] neither legally nor contractually binding [, relates] to the internal governance of corporations (covering topics such as the treatment of shareholders, the organisation and practices of (supervisory) boards and corporate transparency) [,] and [is] issued by a collective body.

This definition therefore embraces standards (default laws), principles and best practices (codes to comply with or explain otherwise) and recommendations (codes that are entirely up to the firm's board for adoption) which is important when carrying out cross-country studies.

Principles of corporate governance

The set of mechanisms guiding good corporate decision making has been introduced in recent years through enactment of governance codes throughout the world. The recent corporate financial scandals that have affected global giants notably the *US*-based Enron has made good corporate governance the key phrase investors and other stakeholders look for when judging the success and viability of a corporation. The *US* Foodservice, Tyco and Adelphia have been exposed to having engaged in bad governance practices. European companies have also had their fair share notably the secret accounts to escape taxes of Banco Bilbao Vizcaya in Spain; the actions yet to be taken against the *CEO*/ Board chairman (Mr Botín) of the giant Spanish bank - Banco Santander Central Hispano -

(see text box A1[1] for an article that was written when this bank was in the process of acquiring *UK*'s Abbey National), and; manipulation of the Argentine subsidiary –Disco- of Ahold supermarket chain. Other organisations to have been embroiled in such scandals include the defunct Pakistani-founded Bank for Credit and Commerce International (in 1991 described as a "$20-billion-plus heist"), Worldcom, Marconi and Parmalat.

These scandals have resulted in countries introducing codes of good governance to complement their commercial codes or corporate laws. Table A1 provides an exhaustive list of codes for 16 Western *EU* countries and the *US* (the countries to be investigated) put together by the European Corporate Governance Institute (*ECGI* – see www.ecgi.org for corporate governance codes worldwide). The number of codes for each country is also given. The World Bank also has a databank of country codes on their website. Most principles of these governance codes are "comply or explain" with mandatory disclosure (exceptions to these are firms trading on either the London Stock Exchange or New York Stock Exchange). The majority are voluntary in nature, although as prescribed from institutional theory, these governance codes can be adjusted from time to time to make more of the principles compulsory, addition of more voluntary options, and removal of outmoded ones. Goncharov et al. (2006) find evidence that declared degree of compliance of listed firms on *DAX30* and *MDAX* to the 2002 German corporate governance code enhances stock value.

Non-compliance to the code issued by the New York Stock Exchange is a punishable offence and it is expected other stock exchanges around the world will follow this lead in due course. The Sarbanes-Oxley Act was signed into law in the *US* in 2002 and seeks to resolve corporate failures. The concept of good corporate governance was given impetus by the *UK*'s Cadbury [and later Greenbury) report[s] in 1992 (and 1995)] (see text box A2 for an overview of the Cadbury report). The Hampel report was released in 1998 and then later that year the Turnbull committee combined these reports with other recommendations on internal control to form the Combined Code (2003) which is now the status quo for good corporate governance in the *UK* and a listing requirement. Most countries have used this as a template to write their own codes.

The member states of the *OECD* have also been recommended to use a code of governance prepared by the organisation. Released in 1999, it took the corporate scandals of the *US* and the Sarbanes-Oxley Act to ginger revisions in 2004 although it is still of a "comply or explain" nature as opposed

[1] All text boxes and tables with their numbers prefixed by the letter 'A' are located in the appendices.

to the latter's "comply or be punished" underpinning. The market in the former is required to serve as a regulatory mechanism. The *OECD* report, (66-paged revised edition, 2004) lists six key principles in the following areas: 1) ensuring the right basis for an effective corporate governance mechanism; 2) the rights of investors and key ownership functions; 3) the equitable treatment of investors; 4) the role of stakeholders in the governance mechanism; 5) disclosure and transparency, and 6) the responsibilities of the board of directors. The requirement for all organisations to adopt best corporate governance practices is becoming a norm despite the resistance put up by some corporate executives.

The Unified Code (Conthe Code) on good corporate governance in Spain was drafted in January 2006 and underwent revisions prior to approval by the Comisión Nacional del Mercado de Valores (*CNMV*) and the voluntary recommendations took effect from the 2007 fiscal year. As is discussed later, it brings together the Aldama and Olivencia codes as well as other recommendations by the *EU*. Unquoted sources have already indicated that the code falls below the *UK*'s Combined Code which should be used as a standard and therefore needs improvement if it will stand the test of time. In other words, it still leans on a shareholder rather than a stakeholder approach and the measures are too voluntary in nature. The market however may serve as a discipline for compliance. Corporate bodies as usual however think the regulations in the code are too excessive.

Governance codes are becoming increasingly similar since companies trade on various stock exchanges and it is in their interest not to spend too much time adapting to the requirements of the various stock exchanges. This is a reason why the Unified Code is welcome to an extent. But the cost of implementing the recommendations has proved expensive. Mintz (2005) reports that the average cost of implementing the recommendations of the Sarbanes-Oxley Act by large companies in the *US,* in the first year, is around 35 million *US* dollars.

The Olivencia Report drawn up by a special commission appointed by the government with full support from the Spanish Stock Exchange Commission started to be implemented voluntarily later that year by some publicly listed firms. The report has 23 recommendations that discusses the size, composition and operating characteristics of the board in 11 sections: 1) the mission of the boards of directors; 2) their composition; 3) structure; 4) working of the board; 5) appointment and removal; 6) powers regarding information; 7) remuneration; 8) loyalty to duty; 9) how the board must relate to shareholders; 10) the relationship between boards and markets, and 11) the relationship between boards of directors and auditors.

Lozano (2000) however argues that the code is shareholder-based instead of being of a stakeholder-based nature in three ways: 1) confirming a company's profit maximising objective; 2) the role assigned to independent non-executives on the board, and; 3) the role of the vice-president. A careful look in the third section of the report which discusses the fourth general consideration of the code of good governance mentions that the "recommendations focus on Boards of Directors and are inspired by principles of accountability (including Board transparency and accountability) and efficacy, in the service of the corporate interest defined in line with the rule of creating shareholder value" (Olivencia Report, 1998: 23). Sison (2000) also looks at the ethical implications of the Olivencia report in terms of how loyalty, due diligence and transparency are understood in the Spanish context. He looks at how the political environment affects the culture, power distribution and accountability, equality, and the protection of property rights of corporate entities.

The second edition of Principles of Good Corporate Governance prepared by the Professional Standards Committee of the Instituto de Consejeros-Administradores (November 2005) provides board of directors of Spanish companies with a set of good corporate governance principles that are best practices of international standards. For some of these rules, Spanish boards are expected to comply or in the absence, explain the inability of compliance. Others are voluntary for firms that want to adhere to good governance practices. When the Spanish Public Administration intended to have a single code consolidated from the Aldama (2003) and Olivencia (1998) reports, the Instituto de Consejeros-Administradores requested the government to include some of the principles that they had proposed which are in consonance to best international practice so that the new code could be competitively sustainable in the projected future.

Gomez-Ansón and Fernández-Rodríguez (2001) make a survey with firm compliance of the Olivencia Code of Best Practice and report that the market gives a positive response to announcement by firms that seek to comply with the Code's recommendations by virtue of a major restructuring of the Board of Directors while announcements concerned with isolated recommendations do not positively impact. Another significant observation in their study is the fact that firms with prior worse performance and lower large shareholding ownership observe high abnormal returns.

The Financial Studies Foundation (Fundación de Estudios Financieros – *FEF*) in Spain has also done some work on good corporate governance of Spanish listed firms. Among other works, the foundation has published the "Information Excellence Index of *IBEX* 35", and a "Guide to Principles of Good Corporate Governance, Transparency of Information and Conflicts of Interests at Listed Companies". The second work is biased towards corporate practice, and is based on the Aldama and Olivencia Reports (Spain), the Higgs and Cadbury Reports (*UK*), and the legislation that sets out the regulations concerning these issues (*FEF*, 2003). The Foundation has, among several other achievements, set up an annual observatory of good corporate governance, and also grants annual awards (in collaboration with the "Grupo Editorial Recoletos") to listed firms with best governance practices in Spain. The first company to be granted this award (the first Prize for best Corporate Governance and Information Transparency Practices) was Indra Sistemas *S.A.*, together with two honourable mentions to Unión Fenosa and *BSCH* (the same bank discussed in text box A1 for bad governance by a *UK* report) for good governance practices in the 2003 fiscal year (*FEF*, 2005).

Litigations sparked off by shareholder activism, market pressures by State rules and regulations, and intense pressure from non-governmental organisations have served to increase voluntary compliance of firms to good governance practices, usually in listed companies and other large firms. The introduction of minimum requirements in corporate reporting and drafting of good governance principles by recognised agencies as well as governance ratings by private rating firms have all contributed to these developments in the developed countries. Other developing countries have also enacted voluntary codes of best practices.

2.3 Corporate governance indices

Quantifying improvements in shareholder value attributable to good corporate governance mechanisms is difficult because of the lack of comparable global data, but several indices have been constructed that attempt to compare these mechanisms across different firms and countries. It is also a relatively recent phenomenon and the study of the impact of the mechanisms on corporate performance has only recently gathered momentum. Research into whether the coding used in compiling these indices is consistent is a subject beyond the scope of this thesis.

Data on corporate governance has received interest in rating agencies and specialised financial institutions that utilise these data to rank firms. There has been a strong support that firms with good governance mechanisms have easier access to external finance, better market valuation and superior performance (Klapper and Love, 2004). Gompers et al. (2003) use 24 governance rules to construct a governance index to proxy for shareholder rights in about 1500 firms and report that higher shareholder rights relate to higher profits, sales growth, lower capital expenditures and fewer corporate acquisitions. Gompers et al. further suggest that the governance methods used in the *US* (an Anglo-Saxon model) rely in strength on such provisions as: charter provisions, corporate laws and bylaws, securities regulation and other rules. Their construction of a governance index focusing on governance provisions mainly relates to anti-takeovers.

The governance provisions of Gompers et al. (2003) in table A2 are from Investor Responsibility Research Center (*IRRC*) with four years of data for about 1500 large *US* firms. Each provision is awarded a point if it restricts shareholder rights (or increases managerial discretion). They build strongest and weakest shareholder rights portfolios. Their governance index is positively related to (and more so for firms with weaker shareholder rights): *S&P* 500 inclusion, Tobin's *Q*, dividend yield, book-to-market ratio, firm size, share price, monthly trading volume, and percentage of institutional ownership, and; negatively related to past 5-year sales growth, and past 5-year stock return. Low sales growth is therefore expected to increase good corporate governance practices as shareholders increasingly become dissatisfied with their investment returns. They use a firm's beta, market capitalisation and immediate past returns to forecast future returns.

Generally, their regression results of the effect of governance on performance do not lend a positive support. The authors hypothesise that there may be some omitted-variables biases that drive such governance test results they encountered. Their governance index is however constructed on shareholder rights in the 1990s.[2] Shareholder activism has since increased as well as the publications of codes of good corporate governance. Some recent studies that have extended the index to include other mechanisms such as disclosure, auditing and board of director rights find some significant governance effects on firm value.

Klapper and Love (2004) use a composite of 57 qualitative binary questions provided by Credit Lyonnais Securities Asia (*CSLA*) to develop an index for 14 emerging markets. Their questions fall in seven categories of governance: discipline, transparency, independence, accountability, responsibility, fairness, and social awareness. Durnev and Kim (2005) also apply the first six

[2] In the 1990s, corporate governance discussions were usually limited to the roles and responsibilities of the board of directors (and supervisory board where applicable) and the Shareholders' annual general meetings.

categories to develop a composite index for firms across 27 countries. Table A3 provides the provisions used in both studies).

Aggarwal et al. (2007) use seven dimensions of corporate governance attributes with five related to the board of directors (see table A4 for definitions and country scores of the attributes) in comparing *US* and foreign firms listed on stock exchanges in the *US*. These attributes are the: independence of the board; board size; *CEO*/board chairman duality; non-staggered board structure; independence of the board audit committee; the stock class (as having only single class common stock), and; ratification of auditors at annual general meetings of shareholders. They find firms with independence of the board and board audit committees to have more value than other firms while *CEO*/board chairman duality has no effect on board performance. They find that most foreign firms have worse governance mechanisms than *US* based firms and that 8% of the foreign firms that perform better than (or the same as) the *US* are from Canada and the *UK*, which are also of a common law origin.

Aggarwal et al. also find significant country and firm level differences in both governance attributes and firm valuation. Firms in countries such as Belgium, Germany, Italy and Portugal have a staggered board while Swedish and Finnish firms mostly have non-staggered boards. Apart from France where more than half of the firms have dual class stocks, most Western European countries have single class common stocks with countries like Austria, Germany, Greece, Ireland and Norway having no dual classes. Only 5% of firms in Norway ratify auditors at annual meetings while neighbouring Finland does this in all firms reported. The Nordic and Germanic firms have *CEO*/chairman separation while countries in the south have approximately half of each with the exception of Greece and Italy that have more separation.

Drobetz et al. (2004b, refer to table A5) gather 30 governance practices divided into five categories as follows: 1) corporate governance commitment; 2) shareholders' rights; 3) transparency; 4) management and supervisory board matters, and 5) auditing, using voluntary governance mechanism proxies. Their governance scores are derived using *DVFA* German Corporate Governance Scorecard, *CalPERS* German Market Principles and the Deminor Corporate Governance Checklist. Mintz (2005) also reports on a 2003 Governance Metrics International (*GMI*) survey involving 23 countries whereby *UK*, Canada and the *US* respectively took the first three positions in good corporate governance practices. Australia and Ireland took the fourth and fifth positions while Japan and

Greece ranked at the bottom of the ratings. This positions support La Porta et al.'s (1998, 1999, 2000 and 2006) notion that the legal origin of a country plays an important role in good corporate governance. Peter (2005) argues that the belief that the company law and governance model is Anglo-Saxon is fallacious since the *UK* shares much in common with most *EU* member States than with the *US*. The *UK* has been in the top bracket of global corporate governance surveys. She asserts that good governance develops and thrives well in competitive environments.

Bauer et al. (2004) use Deminor corporate governance ratings for companies included in the Eurotop 300 and follow the approach of Gompers et al. (2003) to build portfolios of well-governed and poorly governed firms. Their provisions are contained in table A6. They examine their effect on stock returns, firm value and profitability (net-profit margin and return on equity) and generally find a positive relationship for the first two indicators and a negative relationship for operating performance. The positive relationship is however significantly weakened when country differences are adjusted. Tables A7 to A11 contain various corporate governance provisions used in global empirical studies.

Most studies focus on the link between one or a few corporate governance mechanisms but increasingly, data being compiled by rating agencies has allowed the totality of governance mechanisms to be rated and linked to firm performance, although most of the rating agencies rank *US* listed firms. In other advanced economies, some studies have been reported. In Germany, Drobetz et al. (2004a) find a positive link between corporate governance and expected stock returns, after constructing a German governance score. Beiner et al. (2006) find a positive link between firm specific corporate governance and firm valuation. Ødegaard and Bøhren (2003) use Tobin's *Q* as firm value for firms listed on the Oslo Stock Exchange in Norway and report a significant effect of good governance ratings on firm value. Elsewhere in South Korea, Black et al. (2006) also find that good governance practices (and very markedly, board independence) positively affect market valuation (Tobin's *Q*, market to book and market to sales) using listed firms on the Korean Stock Exchange.

Investors and firms are using corporate governance reports to reduce risks and improve market value of firms. Weak governance in a firm does affect the value of shares and yet firms still continue to survive. *FTSE ISS CGI* Series Research Report for April 2005 argues that "it is more the risk that poor corporate governance becomes pervasive throughout the firm, and it is this fact that leads ultimately to poor share price performance." The research report continues in adding other governance mechanisms that research indicate links with firm performance as: compensation systems for executive and non-executive directors; executive and non-executive stock ownership; equity structure; structure and independence of the board of directors, and; independence and integrity of the audit process. In the subsequent sections, some of these mechanisms among others are considered in detail.

2.4 Corporate structure and performance

The study of corporate structures has historically been divided into two models: the continental model and the Anglo-Saxon model. In the continental model, there exists an insider system of ownership in the majority of firms. Only a small number of firms are quoted. There are very few hostile takeovers and ownership is highly concentrated (Franks & Mayer, 2001). Long-term debt financing and rather rigid labour markets exist. Family and industrial companies have significant shareholdings either directly or through complex pyramidal shareholding structures.

The Anglo-Saxon model has dispersed ownership; active market for corporate control; equity financing, and; flexible labour markets. There are strong management contract incentives, outside ownership concentration is very low, insider directors are common and there is an active market for corporate control (Bøhren & Ødegaard, 2004). Aguilera and Jackson (2003) have pointed out that the ownership dispersion found in the Anglo-Saxon model is as a result of the 1930s regulatory divide and mergers that occurred in the history of post-war market development of the *US* and *UK*. In the case of the *US*, they suggest that inter-corporate networks restricted inter-firm cooperation because of antitrust laws that encouraged the mergers and diluted ownership. Favourable property rights, bank financing and dense inter-firm networks that existed in continental Europe sustained block holding ownership.

While it has been argued that concentrated ownership controls the free-riding problem (associated with dispersed ownership) within the agency theoretical framework, private benefits are sometimes sacrificed for corporate efficiency to the detriment of minority investors. Ownership concentration therefore does not necessarily lead to good corporate governance or performance growth as the literature will bring out. Franks and Mayer (2001) find no significant difference in how both concentrated and dispersed owners discipline managers as regards to performance in German firms.

Jensen and Meckling (1979) argue that the ownership structure is part of a firm's production function as well as technology and production resources. In this regard, putting ownership as a variable input factor and keeping technology and other input resources constant must lead to different efficiency values for similar sized firms. Because empirical studies have shown that similar sized firms may have differing productivity levels, the issue of agency costs has been given grave importance in the literature. Ownership structures have also been argued to be attributable to regulation of prevailing institutions (institutional approach). There are differences in legislations in different countries. These affect the financial structures and ownership patterns. In the *US*, banks are not allowed large shares in industrial firms whereas in Germany, France and Spain, banks have significant corporate shares.

Empirical studies have usually compared the Anglo-Saxon and continental types of corporate governance. Other studies however use data from both types in empirical investigations. Table A12[3] presents a compilation of studies in corporate governance. The compilation of studies by Barca and Becht (2001, see table A13 for results of Belgium, Spain and the *UK*) indicate variations in the (previously considered monolithic) continental model. Some studies from developed, developing and emerging economies however lend partial support to any of the two typologies. The multi-national studies by La Porta et al. (1997, 1998, 1999, 2000, 2002 and 2006); Claessens et al. (2000), and; Djankov et al. (2008) have indicated that differences in corporate governance exist partly because of the country's legal origin which shapes its institutional and regulatory environments. Aguilera and Jackson argue that "multiple institutions within a specific country exert interdependent effects on firm-level outcomes" (2003: 448). For this reason, corporate governance mechanisms differ among firms but these differences are lower within a country than between countries.

2.4.1 Corporate ownership

Corporate ownership refers to residual claimants of a firm. The fewer owners a firm has, the more concentrated the percentage of shares. Shleifer and Vishny (1986) find large shareholders to increase firm performance. Ownership concentration is the share of the largest owner (Pedersen and Thomsen, 1999). Contrary to the classical publication by Berle and Means (1932) about dispersed ownership in the public corporation, empirical findings over the past twenty years point to the issue of concentrated ownership (see for example Demsetz & Lehn, 1985; Shleifer & Vishny, 1986; Holderness & Sheehan, 1988; Mørck et al., 1988; La Porta et al., 1999; Demsetz & Villalonga, 2001).

[3] Table A12 appears in several sections of Chapters Two and Three and is located in the appendix.

The theoretical argument by Demsetz (1983) that ownership concentration is endogenous to the owner's risk propensity and the benefits obtained from monitoring managers has sparked an interesting debate. Demsetz and Lehn (1985) having controlled for some variables did not find a significant relationship between ownership and accounting profitability. Still treating ownership as an endogenous variable but multi-dimensional, Demsetz and Villalonga (2001) find no statistically significant relationship between ownership structure and corporate performance (value and profitability). Therefore in their view, it does not matter whether ownership is dispersed or concentrated. This result is also reported in Pedersen and Thomsen's (1999) multi-national European survey testing a model initially developed using *US* data. Bøhren and Ødegaard (2004) also concur.

Cho (1998) applies ordinary least squares (*OLS*) regression where ownership structure affects investment and consequently corporate value. But, in applying simultaneous regression, the endogenous nature of ownership comes into play. Corporate value is seen to affect ownership structure while ownership structure has no effect on corporate value, in support of Demsetz and Lehn (1985). Mørck et al. (1988) however argue that Demsetz and Lehn's (1985) inability to find a significant relationship between ownership concentration and performance may be due to their use of a linear specification, which failed to capture any non-linear relationship. Leech and Leahy (1991) however report significant results using a linear specification of ownership concentration.

Short et al. (2002) argue that large external shareholders have incentives to monitor and curb the self-serving behaviour of managers because of their economic interests. These monitoring and curbing costs all generate costs of agency. The nature of agency cost-reducing mechanisms in terms of being complementary or substitutable as regards to shareholder/managerial equity and debt is still a subject of academic debate.

Dispersed ownership is still of significance for very obvious financial reasons. Firms with funds acquired through dispersed ownership can assume larger scale operations, even diversify and thus make use of scale and scope economies. Lauterbach and Vaninsky (1999: 189) suggest it "facilitates complex operations allowing the most skilled or expert managers to control the business […..] even when they do not have enough funds to own the firm." This leads diversified ownership firms to compensate for agency costs with improved efficiency and profitability. Dispersed ownership however can thrive when the institutional environment adequately protect investors from managerial expropriation.

These developments discussed above have led to inconclusive results that either support or do not support the ownership concentration-economic performance relationship. Perdersen and Thomsen (1999) and Gedajlovic and Shapiro (1998) have attributed this development to “system effects”. Stock market data however continue to lend some support to the positive association between ownership concentration and performance (Leech & Leahy, 1991; Zeckhauser & Pound, 1990; McConnell & Servaes, 1990, 1995; Smith, 1996; Short et al., 2002).

Highly concentrated ownership can generate operational inefficiencies when the owners are interested in short term gains rather than long term profit maximisation. This is because they may encourage managers to engage in risky short- term strategies not aimed at cost minimisation (Kohler, 1990). Large controlling shareholders may collude with managers to siphon resources from small shareholders (Short, 1994). The exercise of control to expropriate firm value, at the detriment of minority shareholders, has been referred to as the expropriation hypothesis (Lange and Sharpe, 1995).

The separation of ownership from control can be well understood from Fama and Jensen’s (1983) four stages of the decision process where initiation and implementation are decision management functions whereas ratification and monitoring are decision control functions. This separation leads to agency costs making owner controlled firms more efficient than management controlled firms (Fama and Jensen, 1983). But the issue of lack of specialisation and inefficient risk allocation also comes at a cost. Owner-managed firms are therefore smaller in size and not able to achieve scale and scope economies that lead to performance gains. Galve-Górriz and Salas-Fumás (1996 & 2005), and Lee (2004) look at the effect of family ownership and management on firm performance.

Short (1994: 204) argue that “management controlled firms have higher growth rates and lower profit rates than owner controlled firms”. However, performance of firms in one period can affect the ownership-control structure in a subsequent period and Demsetz and Lehn (1985) argue that the type of ownership-control structure has no effect on performance, and postulate ownership concentration to be a response in equilibrating an individual company’s operating characteristics, and that diffuse ownership and outsider-managed firms emerge as a response to value maximisation. Short (1994) argues that ownership concentration does not necessarily lead to control and that debt holders play an important role. Hence it is necessary to control for a firm’s financial structure. The effect of financial structure is discussed into detail later in this chapter and the subsequent conceptualisation.

While empirical studies lend support to the managerial hypothesis that owner controlled firms have higher profitability than manager controlled firms, these results have often been highly statistically insignificant (Short, 1994). Her surveys (1994: 208-215) cover studies where in some cases manager controlled firms outperform owner controlled firms. At the heart of the debate is why owners seek professional managers to run their businesses when they can perform better. A candidate answer takes us beyond the considerations of profit maximisation, the agency theoretical framework, and into the realm of institutional theory where owners employ managers for conformity to social legitimacy. Chapter Three discusses both alternatives from the viewpoint of Jensen and Meckling (1976) and Fama and Jensen (1983), and Di Maggio and Powell (1983 & 1991) and North (1990) among other proponents of agency theory, institutional theory or their complementarity.

Large external shareholders in most cases have control rights to the firm with a 51% or more of total ownership (La Porta et al., 1998). Large shareholders in a survey of corporate governance by Shleifer and Vishny (1997) have sometimes been reported to reduce discretionary spending such as research and development and advertising by managers when they have the incentives to monitor management. Ex post expropriation by large shareholders is not only through rent but by very close monitoring (according to Shleifer & Vishny) since it can lead to firm operational inefficiency by having adverse effects on *ex ante* intrinsic incentives by managers and employees which reduce firm-specific human capital investments. The effect of expropriation on minority investors can lead to a decline in external financing.

In Spain, for example, ownership concentration is high with a consequence of low floating stocks, and most transactions, according to Crespí-Cladera and Gispert (2002), need management consent. An alternative way of disciplining internal corporate control is the Spanish legislation that establishes that controlling shareholders acquiring more than the thresholds of 25% have to offer the same price to all shareholders. Block purchases are seen as a complement to takeover mechanisms in the light of agency theory predictions and serve to discipline managers. Martínez and Giné's (2005) empirical study of shareholders in Spain show that 80% of firms have the largest shareholder usually commanding 69% of the shares, while the second largest commands 12%. Therefore the largest two shareholders have reasonable control of the firm. Demsetz and Villalonga (2001) have however argued the importance of the first five largest shareholders in their *US* study.

Bøhren and Ødegaard's (2000) study of listed firms on the Oslo Stock Exchange makes an important discussion as to whether to use direct or indirect ownership measures. On the average (1989-1997), indirect ownership only represented 8% of the market capitalisation. They are of the view that firms in the early years of listing rather commonly have high representations of indirect owners but decrease phenomenally over time. Hence in their opinion, disregarding indirect ownership and utilising direct ownership measure only gives a "modest misestimation" of the wedge between cash flow rights and voting rights; as a measure of shareholding concentration. They support this with the fact that ownership is more concentrated in non-listed firms and that there may be a limit in using investments in these firms to garner voting power in listed firms.

After a test of the correlation between alternative measures of ownership concentration, Bøhren and Ødegaard (2000) recommend measures that are closely related like the Herfindahl index and the holdings of the three largest owners. Additionally, to study other concentration properties, they recommend picking the Herfindahl index and the holdings of the ten largest owners. Using Barca and Becht (2001) book on the governance of corporate Europe, Bøhren and Ødegaard compare aggregate holdings of ownership type and ownership concentration with Norway. In the latter, the *US* is also included in the study. The results are presented in tables A14 and A15. In table A14, the *UK* is separated because of its common law origin, while the rest have a civil law origin.

The ownership type by international firms in Spain is the highest and almost twice the average of all other countries. Non-financial and State ownership types are far below the average (almost half for State and less than a third for non-financial firms). The largest average fraction of voting equity held in Spanish listed firms (40%) is less than the average of the other European countries (46% excluding Spain and *UK*; and 43% excluding Spain); the highest being Belgium (56%), France (54%) and Austria (52%). Only Sweden (38%), Norway (29%) and the *UK* (14%) have lower concentrations of voting rights. The *UK* and *USA* (3%) as seen by their very low ownership concentration have a common law origin and Anglo-Saxon model of ownership dispersion. Table A15 shows that for most of the European companies (apart from Norway –being an outlier by civil law origin considerations, although the second largest is among the highest and the third highest shareholder has greater voting equity than in the other countries- and the *UK*), the largest owner is close to having majority control of the concerned firms. Spain is among the European countries where the second and third largest shareholders have the highest voting equity.

The literature on the effect of corporate ownership on performance is vast and increasing (as the compilation we have mentioned earlier in table A12 suggests). Gorton and Schmid (2000a) find a positive relationship between ownership concentration and performance for German firms; this is particularly strong with bank block ownership. Claessens and Djankov (1999) in a Czech study and Xu and Wang (1997) in a Chinese study use profitability as a performance measure and find that ownership concentration has a positive relationship. Claessens and Djankov (1997) in an earlier Czech study do not however find any effect of managerial equity holdings on performance. Denis and McConnell (2003) in their survey observe that non-*US* firms exhibit a more significant relationship between ownership concentration and performance.

2.4.2 Ownership identity

The basic assumption of both neoclassical economics and strategic management is the maximisation of shareholding value in terms of economic rents. Owners also maximise their own utility and in such intermediary owners like institutional owners, governments, banks and other corporate bodies who also have owners, this issue becomes more profound. Additionally, because markets are incomplete and all risks cannot be diversified away, disagreements about corporate strategies, among other issues, do not lead to rent maximisation (Thomsen and Pedersen, 2000). Thomsen and Pedersen (1996: 152) discuss how ownership differs with respect to "goals, economic competence, information access, and risk preference". These in turn determine how owners relate to stakeholders of the firm.

A controlling shareholder or ultimate owner is regarded as having more than 20% direct and indirect voting rights (La Porta et al., 1999). Applying this cut-off point to their empirical survey on medium-sized publicly traded firms in Spain, only family, State, and widely-held institutions/ corporations are ultimate owners in Spain. Widely-held financial and miscellaneous ultimate owners are under 1%.[4] Cross-shareholdings and pyramids, typically associated with concentrated ownership, are not frequent in their study, a viewpoint supported by Galve-Gorriz and Salas-Fumas (2005).

The identity of large shareholders differs in different institutional contexts. La Porta et al. (1999) in their global empirical study also find that, in Spanish firms, the probability of control by a single shareholder in a family firm, State, and widely-held financial firms are all 1.0 while widely-held corporation is 0.5. Galve-Górriz and Salas-Fumas (2005) using listed Spanish firms discuss the

[4] This is even the case when applying a 10% cut-off measure (The authors employed data from 1995).

highly concentrated ownership even among very large listed firms (see also Crespi & Garcia-Gestona, 2001). Thomsen and Pedersen (2000) argue that the identity of the owners has objective performance implications through how they exercise their franchise. The categories of ownership identity are discussed below.

Institutional Ownership

With institutional ownership (for example insurance companies and pension funds), firms tend to have a long-term planning horizon, adequate financial outlays and a low aversion towards risk (Thomsen and Pedersen, 2000). They also tend not to interfere too much with the daily management of the firm as characterised by their arms-length relationship (Sarkar and Sarkar, 2000). They pursue firms that share similar goals and objectives (Li and Simerly, 1998). Mostly however, they have minority shares in companies that do not encourage them to monitor managerial discretion. But for a given shareholding value, McConnell and Servaes (1990, 1995) and Smith (1996) have argued that they tend to have a performance impact.

The empirical results from studies on the effect of institutional ownership on firm performance are very mixed. Hellwig (1998), Mørck et al. (2000) and Goergen et al. (2005) find a negative relationship. Boehmer (2000) and Gorton and Schmid (2000a) find a positive relationship. Prowse (1992) and Zoido (1998) find no systematic relationship which leaves the subject still open to empirical debate.

Family/personal ownership

Family ownership has similar characteristics to owner-managed firms in that they tend to have a disproportionate share of their wealth invested in the company. They tend to be risk-averse and suffer from capital rationing. Nickel et al. (1997) find no relationship of family ownership on productivity. This category is however argued to have the best positive influence on firm performance from the agency theoretical framework.

Bank ownership

Several studies group banks with institutional ownership. In Germany and Spain, banks play a key role in firm ownership. When banks are part owners of a firm, they can internalise financial relationships. These firms are therefore less likely to be credit rationed by their banks (Ramirez, 1995) and hence bank-owned firms have the necessary capital to improve productivity (Cable, 1985).

Corporate/ industrial company ownership

Corporate ownership is when other firms are also shareholders in other firms. Specific assets (Williamson, 1985) lead to related firms acquiring shares in a company so as to be able to monitor managerial discretion. Kester (1992) however argues that there could be a significant loss of flexibility as well as the risk of inadequate mutual monitoring. Aside from financial capital outlays, this ownership form also facilitates knowledge transfer (Thomsen and Pedersen, 2000).

Government ownership

Hart et al. (1997) suggest the State is more interested in welfare economics like low prices for outputs, higher employment goals and other objectives that drain profitability. In terms of financial profitability, government-owned firms are argued to be the worst performers. Government ownership however leads to increased financial capital "in terms of credit, liquidity, or costs of capital" (Thomsen and Pedersen, 2000:694).

Foreign ownership

Barbosa and Louri (2005) argue that the presence of foreign ownership (foreign corporate investors) may bring positive performance to a firm because of firm-specific characteristics, product differentiation, market advantages, superior governance mechanisms or an ability to exploit scale economies with financial advantages. This is generally true for firms operating in developing economies but the evidence is more opaque in industrialised countries. Dimelis and Louri (2002) argue that foreign block holders can bring in advanced technologies in both production and distribution processes making them more efficient than local block holding firms. Spillovers lead to increase in productivity of local firms in due course.

Other categorisations of ownership

In another study, Thomsen and Pedersen (1996: 153; 1998: 388-390) identify six classes of ownership based on the identity and share of the largest owner and the type of ownership contract. Table 1 shows the different classifications according to these researchers.

Leech and Leahy (1991) also use ownership concentration and control type to define ownership in their study of ownership effect on performance. However, as with Thomsen and Pedersen (1996), they have foreign ownership as one of their categories. La Porta et al. (1999: 476) also classify ownership by voting rights with firms that are widely held or have ultimate owners. They come up with five types of ultimate owners which are: a family or an individual, the State, a widely held financial institution such as a bank or an insurance company, a widely held corporation, and miscellaneous which include cooperatives, voting trust or a group with no single controlling investor.

Table 1: Ownership classification

Dispersed ownership	No single owner owns more than 20% of the firm's shares
Dominant ownership	One person/family/firm owns a sizeable share between 20% to 50% of the firm
Personal/family ownership	One person/family owns a majority of the company
Government ownership	Government owns a majority of the company
Foreign ownership	Foreign firm owns a majority of the company
Cooperatives	The firm is registered as a cooperative or owned by a group of cooperatives

Source: Adapted from Thomsen and Pedersen (1996: 153)

2.4.3 Board structure

Board structure can be staggered or non-staggered. A staggered board is when directors are elected in several years while in non-staggered boards, directors are appointed at the same time for a specific term. It is argued that non-staggered structures lead to improved governance. In January 2007, around 3.6% of all board members at *IBEX* 35 were women. Gender activists the world over are lobbying for increased representation of women on company boards. Appointment to the board must be primarily merit-based and not just on a gender basis. Some countries for example Norway do require a specific percentage of women on all boards. The dynamics of the board of directors directly impact on firm value. There are two types of board structures; the unitary and two-tier systems. There are structural differences in these two types but in practice, they share more similarities than dissimilarities.

The unitary type does not have a clear-cut distinction between supervisory and management duties while this in not the case in the two-tier system where the supervisory function is distinct from the management role. The board of directors are empowered by shareholders to act in their interest with responsibility to see to the accomplishment of such issues as financial reporting, internal control systems and complying with the business laws of the land. The board structure of some seventeen industrialised countries together with how they impact on shareholder rights (using the index of Djankov et al. (2008, see the section 2.5 below about investor protection) are given in table 2.

Table 2: Corporate board structure in different countries

Member State	Board Structure	Employee Role in Supervisory Body	Separate Supervisory and Managerial Leadership	Revised Anti-Director Rights Index (*ADRI*) Scaled from 1 to 6
Austria	Two-tier	Yes	Yes	2.5
Belgium	Unitary*	No	Not Required	3.0
Denmark	Two-tier	Yes	Yes	4.0
Finland	Unitary*	Articles may provide	Yes	3.5
France	Unitary*	Articles may provide (& Advisory)	Not Required	3.5
Germany	Two-tier	Yes	Yes	3.5
Greece	Unitary*	No	Not Required	2.0
Ireland	Unitary	No	Not Required	5.0
Italy	Unitary**	No	Not Required	2.0
Netherlands	Two-tier	Advisory	Yes	2.5
Norway	Unitary* ***	Yes	Yes	3.5
Portugal	Unitary* **	No	Not Required	2.5
Spain	Unitary	No	Not Required	5.0
Sweden	Unitary	Yes	Yes	3.5
Switzerland	Unitary	No	Not required	3.0
UK	Unitary	No	Not Required	5.0
USA	Unitary	No	Not Required	3.0

Other structure is also available. ** Board of auditors is also required. *** Corporate assembly, made up of members selected by shareholders (two-thirds) and employees (one-third), elect members of the Board of Directors. Other duties of the Corporate Assembly include decision making, supervision and issuing opinions. Employees must be represented on the Board of Directors in the absence of a Corporate Assembly. Representatives of the executive management are not normally elected to the Board of Directors. Looking at the table, the Anti-Director Rights Index (*ADRI*) pertaining to a country does not seem to shape the corporate board structure. The average of the *ADRI* is 3.1 for two-tier and 3.4 for the unitary structure. Finland, Norway and Sweden require separate supervisory and managerial leadership although they mostly have a unitary structure. Their average *ADRI* is 3.3 which is below the average of that for unitary structure. The *ADRI* for countries that require separation of supervisory and managerial leadership is 3.3 while that for countries that do not require this split is 3.2 out of a possible 6.

Sources: Weil et al. (2002) for 14 EU countries; Djankov et al. (2008) for anti-director rights (shareholder protection) index.

2.4.4 Board size

Corporate governance codes recommend boards not to be too big and an ideal size of between five to sixteen depending on the size and diversification of the firm. Corporate governance indices that investigate firms to see how they conform to codes of good governance therefore evaluate firms with larger boards in a negative light. Board size has been hypothesised to have a relationship with firm value or corporate governance ratings (Drobetz et al., 2004a & 2004b).

Jensen (1993) attributes ineffectiveness of large boards to the rather undue emphasis on courtesy and politeness associated with bigger groups rather than being frank and truthful. Some board members are implicitly coerced into agreeing to boardroom decisions albeit, with some reservations which they fail to voice out. The agency problem also increases with board size as there are more conflicting groups representing their own diverse interests. Free-riding also increases as some directors neglect their monitoring and controlling duties to other colleagues on the board. Most companies also have a representative of minority shareholders on board that is not usually increased with increasing board size (Drobetz et al., 2004b). Brown and Caylor (2004) also propose that a board size of between six and fifteen members is the most ideal for improved firm performance.

Studies that find a negative relationship between board size and performance include Eisenberg et al. (1998), Carline et al. (2002), and Mak and Yuanto (2002). Aggarwal et al. (2007) however find no significant link between board size and firm valuation.

2.4.5 Board independence

When more than half of the board is made up of non-executive outsiders, they are referred to as being independent. Corporate governance indices give higher ratings to firms with independent boards. In general, literature posits that board independence improves firm performance. Baysinger and Hoskisson (1990) however argue that outsiders are employed on the board on a part-time basis which limit their scope in understanding the complexities entailed in making informed decisions. Ezzamel and Watson (2002) also concur that non-executive directors may collude with executive directors in setting up high remunerations for top managers as they then use this as benchmarks in negotiating remunerations at their own firms where they occupy top management positions. Consequently, for instance, remuneration communities on the board of directors have been found to have a mixed effect on top management pay for performance, as Conyon and Peck (1998) and Ezzamel and Watson (2002) report they increase top management compensation while having a negative effect on firm performance.

2.4.6 *CEO*/ board chairman duality

CEO duality causes information problems as he determines the agenda and information to the board (Jensen, 1993). The complexity of boards stems from the tendency in adopting institutionalised practices evolved from cultural and social norms that make response to adverse conditions delayed. A review by Kang and Zardkoohi (2005) on the effect of *CEO*/chairman duality, alongside moderating factors, on firm value seems to point out no significant relationship. Both *CEO*/chairman duality and separation do not substantively differ in their effect on financial performance and that this relationship depends on the composition of the board (Coles & Hesterly, 2000; Conyon & Murphy, 2000). Kang and Zardkoohi (2005: 786) therefore argue that duality is a non-random phenomenon dependent on appropriate conditions such as: a reward for a *CEO*'s good performance; a solution to environmental resource scarcity, complexity and dynamism; conformity to institutional pressures; a result of social exchange reciprocity, and; an imposition by a powerful *CEO*.

The first two conditions given by Kang and Zardkoohi (2005) are argued to have a good impact on financial performance while the last three are proposed to have a negative impact on performance. Their review of 30 articles reveal ten to have no significant relationship between *CEO* duality and performance; eight exhibit a strong to weak negative relationship; seven indicate a positive relationship (with only one having a significantly positive relationship), and; five indicate both a positive and negative relationship depending on the moderating variables. Aggarwal et al. (2007) find that *CEO*/board chairman separation has no effect on board performance.

2.4.7 Financial policy

Jensen and Meckling (1976) postulate that the optimal debt-equity ratio or capital structure for a firm is determined when marginal benefit of monitoring agent is equal to the marginal cost incurred as a result of risky behaviour, that is to say there is an incongruent interest between the principal who bears the results of actions undertaken by the agent. This is embedded in agency theoy which is considered in more detail in the next chapter. Hart (2001) suggests that an optimal incentive scheme (which can be done independent of the firm's financial structure as suggested by Jensen and Meckling) that gears the agent's wage to the economic performance of the firm can deal with this incongruence.

Another strand of agency framework deals with private information by managers (about future value of firm) rather than managerial decisions and actions. This is the strand pioneered by Myers and Maljuf (1984) and briefly explained in Shleifer and Vishny (1997). Myers and Maljuf (1984) use a pecking order of firm financing where managers would prefer debt to equity if they have shares in the firm. This results because current shares may be discounted from their true future value in order to attract investors diluting the value to current shareholders. Managers will prefer to sell shares when the discounted share value is less than financing through debt.

Hart (2001) suggests that managers may have only a fraction of the firm's shares and will not therefore act in the manner depicted by Myers and Maljuf (1984). Hart proposes that since managers are paid just a fraction of total market value, managers may still sell new shares at a discount since losses in current share value will be balanced by gains in new shares and the manager gets paid after the new balance. Hence managers will issue new shares irrespective of the financial structure leading to the additional inclusion of decision and control rights in financial contracting.

Debt has been argued to control managerial and board discretion since its repayment forces managers and the board to embark on profitable ventures and engage in less perquisites' consumption. This efficiency as postulated by Grossman and Hart (1982) are due to the three factors of the threat of bankruptcy, the loss of reputation and a lapse in firm control. There is an optimum point for debt financing beyond which it becomes too risky. With firm financing shifted from equity, shareholders prefer firms to engage in riskier projects since these bring more financial gains once the debt has been paid off. In the event of project failure, providers of the debt stand the risk of bearing much of the loss.

Providers of debt are therefore reluctant to provide the total capital for risky projects and shareholders have to take part of the risk. This results in a trade-off between external equity and debt. The costs of agency as regards to asset substitution, risk shifting and under-investment can become higher when debt financing is very high (Bathala et al., 1994). Managers with approval from the board therefore seek the optimal amount of debt and insider ownership for efficient firm performance. Financial policy therefore is necessary as a part of the corporate governance structure. Previous studies recognise this and have used it to control the latter's relationship with performance.

2.5 Investor protection

In environments with poor investor protection, large corporate holdings, takeovers and large creditors leverage legal protection. The best way to align cash flow and control rights of external investors is through concentration of shares. Shleifer and Vishny (1997) argue that substantial minority shareholders have enough incentive to collect information and monitor management. A few of these external block holders can use their voting rights to vote against management and an insider controlling shareholder. This however depends on the legal protection in a country.

Firms can take it upon themselves to adopt additional legal provisions that protect investors. Klapper and Love (2004: 704) list some of these provisions as "increasing disclosure, selecting well-functioning and independent boards, imposing disciplinary mechanisms to prevent management, and shareholders from engaging in expropriation of minority shareholders." These firm-level corporate governance mechanisms that serve to increase value are constructed to give an index. For this reason, firms that have the same legal environment may offer varying degrees of investor protection. Within the same country, La Porta et al. (1998) have suggested that better investor protection increases the willingness of investors to provide financing and should be reflected in lower costs of access to external finance. They also report investor protection to be inversely related to ownership concentration. Galve-Górriz and Salas-Fumas (1996) also highlight the importance of the institutional environment in shaping ownership and performance.

The relationship between shareholders and board of directors (investor protection) has been examined by La Porta et al. (1998). They construct an anti-director rights index using six measures being a country's protection of minority investment rights. These are: 1) the ability to mail proxy votes to the concerned firm; 2) availability of pre-emptive rights with only the shareholder being able to waive it; 3) that a share capital of 10 percent or less owned by an investor is adequate to call an extraordinary shareholders' meeting; 4) how perceived oppression of minority investors by the board of directors is provided for; 5) the ability of minority shareholdings or cumulative voting to be represented proportionally on the board; and 6) whether minority investors can waive requirements to share deposition prior to a general shareholders' meeting.

2.6 Performance and other measures in corporate governance

Productivity, valuation, profitability, growth and customer satisfaction are all measures of firm performance depending on the overall objectives of a company. From an economic perspective, firms optimise their objectives with constraints that are subject to a production technology. These constraints therefore represent inefficiencies (technical and organisational) that are consistent with firm optimising behaviour. Firms with greater productivity generally tend to have greater profitability and higher growth rates, but profitability depends on market conditions. Managerial expertise, proprietary technology and firm-specific advantages can also lead to profitable margins.

The variables used in the relationship between corporate governance and performance are varied. Renneboog (2000) argues for lagged data of ownership, performance and debt policy to be used to address endogeneity problems while correcting over or underperformance with industry peers. In Yeh and Woidtke's (2005) empirical study on shareholder commitment and entrenchment and their effect on firm valuation (by way of Tobin's *Q* derived as market value of equity plus its book value of debt, all divided by total assets), they use the following variables to control the relationship: prior fiv-year performance (an average of a firm's *EBIT* over total assets for the previous five years); the book value of total assets to control for firm size; the ratio of *R&D* and advertising expenditures over sales to control for risk; total debt over total assets (for leverage); adjusted industry firm value (a firm's Tobin's *Q* less the average Tobin's *Q* for firms in the same industry), and; ownership dummies (for >10%, >20%, >30%).

In testing for entrenchment and expropriation hypothesis of the effect of ownership on performance, Mørck et al. (1988) and De Miguel et al. (2004) use such variables as market value of share to replacement value of fixed assets as the dependent variable, firm size (logarithm of the replacement value of total assets), debt ratio, and (book value of) intangible fixed assets/ replacement value of fixed assets) in one of alternative model specifications. The shareholding value used is the percentage of all shareholders with significant shares and the square of this value.

The literature review in table A12 (which comprises 51 studies) reveals several measures of performance and governance. The control variables that moderate in this relationship are extensive and depend on data availability (or perhaps which of these support the relationships one is investigating). This section examines the variables that have been used so as to select the appropriate ones for the context of this study's empirical aspect.

A shortcoming of most of the papers on corporate governance and performance is the use of financial performance mostly stock valuation data. Lee (2004) argues that they are indirect measures of firm productivity. Demsetz and Lehn (1985) argue that accounting data might reflect yearly fluctuations in underlying business conditions, influenced by past investments, better than stock returns as the latter captures future developments that tend to obscure business fluctuations (cases in point are Yahoo's refusal for the hostile takeover bid by Microsoft and the 2008 global stock market crashes and consequent economic recessions). One cannot therefore conclude that stock returns have a superior measure despite its statistical advantage. The use of valuation measures often lead to the exclusion of financial firms since valuation ratios cannot be compared to non-financial firms (La Porta et al., 2002).

Gascón et al. (2002) for example has established a strong positive relationship between pure technical efficiency and market valuation. Traditional financial ratios can be included in the measure of productive efficiency. Feroz et al. (2003) decompose return on equity into measures of sales, net income, total assets and common equity. Though these measures give an indication of productive efficiency in revenue generating organisations, net income can be in the form of losses and it is difficult to model with traditional *DEA* (unless some further restrictions are imposed like in hyperbolic models or directional distance functions) and hence Feroz et al. use total assets, costs, and common equity (which are non-negative) as inputs and total revenues as output to indicate the use of minimum resources to generate maximum outputs.

Optimisation constraints that are imposed on a production technology by firms produce varying levels of inefficiencies. Some of these inefficiencies are due to agency problems of human activity that bedevil the production process. To place the concept of *DEA* in the main agency theoretical framework, some authors such as Bogetoft (1994, 1995) and Agrell et al. (2002), have modelled relationships between *DEA* and agency theory by assuming that the best production function of a firm is not *a priori* certain, although the production possibility set is known. *DEA* is therefore a useful tool of solving this problem based on firms that use a similar production function to minimise the extent of uncertainties.

Technical efficiency relates the success of firms to produce maximum outputs from a set of inputs under a given production technology. Technical efficiency measures are rare in governance studies. In a later section to this chapter, some studies that have utilised technical efficiency are reviewed. The concept of technical efficiency and its relation to some other similar concepts are also explained. Both parametric and non-parametric methods are discussed. The notion of productivity growth and how it is derived is also covered. Variables used in *DEA* input and output specification are also reviewed, and then limitations and advancements in the use of *DEA* models are also summarised.

2.6.1 Measuring performance

In their 2004 study on the effect of corporate governance on performance, Brown and Caylor justify their use of six performance measures of return on equity, net profit margin, sales growth, Tobin's *Q*, dividend yield, and stock repurchases, following their use in earlier empirical studies. They follow Shleifer and Vishny (1997) in using operating performance as a measure based on the argument that it captures corporate governance mechanisms. They argue that since effective governance mechanisms reduce the control rights managers wield on firms as opposed to stockholders and bondholders, managers are obliged to invest in positive present net value projects which are reflected in operating performance.

It is important to touch on which measure of firm performance is better when dealing with corporate governance. The study by Demsetz and Lehn (1985) utilised accounting profit rate as a measure of performance. Subsequent studies have utilised Tobin's *Q*; sometimes comparing the results to that of accounting profit rate. These two measures differ in their time perspective as accounting profit rate is backward looking and Tobin's *Q* is forward looking. The market value of the firm is included in estimates of Tobin *Q* which account for the value of a firm's intangible assets. Similarly, the replacement cost of a firm's tangible assets according to Demsetz and Villalonga (2001) excludes the cost of investments made in intangible assets.

Empirical studies involving Tobin's *Q* have made little attempt to calculate the replacement cost of tangible capital and rather use the depreciated book value of tangible capital which therefore make Tobin's *Q* calculations suffer from some of the setbacks in accounting measures. Accounting profits and market valuation correlate significantly and it makes sense to use both measures when studying the impact of firm variables on performance. Demsetz and Villalonga reports a correlation value of 0.60.

Kole (1993) use a measure of stock performance as market adjusted abnormal return. Daniel and Titman (2006:1606) argue that "there is no discernable relation between the return on a firm's common stock and its past fundamental performance, where fundamental performance is measured using standard accounting-based measures of growth per share". They decompose individual firm returns into two parts; one that is associated with past performance, based on accounting performance measures which they term tangible information, and; the other that is orthogonal to past performance, which they term intangible information. They show future returns to be only related to the second component.

Investors perceive well-governed firms as less risky and apply a lower expected rate of return which leads to higher firm valuation. Jensen and Meckling (1976) also suggest that better governed firms are more likely to have better operating efficiency resulting in higher expected future cash flow streams. Bauer et al. (2004) estimate operating efficiency with net profit margin (*NPM*) and return on equity (*ROE*). Renneboog (2000: 1977) suggest that as accounting earnings depend on the discretion of managerial accounting choices, he recommends using a combination of accounting, dividend, cash flow and market adjusted share returns. He uses operating earnings before interest and taxes which are standardised by total assets as they are insensitive to "financial policy, tax regime, windfall profits or extraordinary losses" and as such the use of operating income rather than net earnings reduces the impact of earnings management.

Drobetz et al. (2004a) utilise performance variables such as dividend yields, price earnings ratios and historical stock returns. Gedajlovic et al., (2005) use dividend payout ratio while Zeckhauser and Pound (1990) utilise earnings to price ratio. Drobetz et al. argue that in equilibrium, these accounting profitability ratios must equal the return that shareholders must hold for the shares of the firm in their portfolios. Drobetz et al. further remark that historical stock returns has an advantage since it is a stationary variable and can be observed directly. They thus use 50 months of total returns and calculate monthly geometric mean returns for their sample as well as annual dividend yields and price-earning ratios at the end of the sample year.

Tobin's Q and market-to-book ratio

Tobin's *Q* has been defined as the ratio of market value of equity plus total liabilities to total assets (Drobetz et al., 2004a). Tobin's *Q* together with market-to-book ratio is often used in studies involving the effect of corporate governance on publicly-listed firms' valuations. The market-to-book ratio is the ratio of market value of equity to its book value and is a useful measure for shareholders. Empirical studies on corporate governance that have utilised market-to-book ratio include; Denis and Denis (1994), Sarkar and Sarkar (2000), Thomsen and Pedersen (2000), Drobetz et al., and Dittmar and Mahrt-Smith (2007). Cross-sectional regressions usually find a positive link between book-to-market ratios and firm-specific governance (La Porta et al., 2002; Drobetz et al., 2004a; Black et al., 2006).

There have been several studies about the effect of corporate governance (of listed firms) on performance that have used this to proxy for firm value (Park & Song, 1995; Mørck et al., 1988; McConnell & Servaes, 1990). Lang et al. (1989, 1991) use Tobin's *Q* to examine the relation between managerial performance and the free-cash-flow hypothesis. The Lindenberg and Ross (1981) algorithm is seen as the superior Tobin's *Q* model but it is complex in nature and requires data that are often unavailable in most databases. Simplifications of Tobin's *Q* have been studied, see for example Chung and Pruitt (1994), Lewellen and Badrinath (1997), Lee and Tompkins (1999, a modification of Lewellen and Badrinath) and La Porta et al. (2002). With the exception of Lee and Tompkins (1999), the other three models are given below.

Chung and Pruitt (1994) approximate Tobin's *Q* as:

Approximate *Q* = Share price x Number of outstanding common stock shares + Liquidating value of firm's outstanding preferred stock + [Value of short-term liabilities net of short-term assets + Book value of long-term debt] / Book value of total assets.

The Lewellen and Badrinath measure of Tobin's *Q* is:

Tobin's *Q* = (Market values of common stock + Market values of preferred stock + Market value of long-term debt + Book value of short-term debt) / ((Book value of total assets – Book value of fixed assets – Book value of inventory + Replacement value of fixed assets + Replacement value of inventory) – [Book value of total liabilities – Book value of long-term debt – Book value of short-term debt]).

The market value of long-term debt (in the Lewellen and Badrinath measure) is calculated through the Brainard et al. (1980) procedure. The last three terms in the denominator subtract all liabilities other than debt.

La Porta et al. (2002: 1156) model Tobin's *Q* as:

Tobin's *Q* = [Book value of assets – Book value of equity – Deferred taxes + Market value of common stock] / Book value of assets

Tobin's *Q* can be adjusted by including that of other firms (but not part of the sample) within an industry classification and subtracted from the sample firm, as employed in Hermalin and Weisbach (1991) and La Porta et al. (2002).

Studies on corporate governance that have used the valuation measure of Tobin's *Q* include (for example) Holderness & Sheehan, 1988; Mørck et al., 1988; Hermalin & Weisbach, 1991; Kole, 1993 [and change in Tobin's *Q*]; Curcio, 1994; Denis & Denis, 1994; Agrawal & Knoeber, 1996; Cho, 1998; Himmelberg et al., 1999; Holderness et al., 1999 and Short & Keasey, 1999. Others are: Sarkar & Sarkar, 2000 [proxy for Tobin's *Q*]; Demsetz & Villalonga, 2001; Gompers et al., 2003; Bauer et al., 2004; Bøhren & Ødegaard, 2004; Drobetz et al., 2004b; Galve-Górriz & Salas-Fumás, 2005; Seifert et al., 2005; Pindado & de la Torre, 2006; Kapopoulos & Lazaretou, 2007; Dahya et al., 2008 [prior year's Tobin's *Q*]. Readers are urged to please refer to table A12 for a list of performance and control variables used in previous studies.

Market premiums are argued to exist for well-governed firms. As the numerator of Tobin's *Q* factors in the valuation from market participants, well-governed firms are expected to have a higher Tobin's *Q*. Most of the studies before the end of the last century which have the Tobin's measure of performance have been made on *US* and *UK* firms since these countries have a market oriented system of governance.

Cash flow

The free cash flow hypothesis of Michael Jensen argues that firms with control rights residing in the hands of managers are less likely to receive free cash flow as dividend payouts. This is because managers embark on capital expenditures that decrease firm value. Corporate governance studies that have employed cash flow as a performance variable include Mørck et al., 1988 by net cash flow to replacement cost of capital, and Dittmar and Mahrt-Smith, 2007 by cash flow to assets. Agrawal and Knoeber (1996) use cash flow return. Pindado and de la Torre (2006) calculate cash flow as equal to *EBIT* (earnings before interest and tax) plus depreciation plus different provisions reported in the profit and loss account, all divided by replacement value of total assets.

Dividend yield

Firms that pay out lesser dividends are also argued to have lower earnings growth. Brown and Caylor (2004) argue that well-governed firms pay out more dividends to shareholders than poorly-governed firms. Dividends are rents that accrue to shareholders of a company. The dividend yield expresses the dividend per share as a percentage of the current share price (Drobetz et al., 2004a). Pindado and de la Torre (2006) measure dividends as the ratio of the total amount of dividends based on the current year's net income to the replacement value of total assets. Thomsen and Pedersen (2000) measure dividend payout by the ratio of common dividends divided by the result obtained with net income before preferred dividends minus preferred dividends requirement. Zeckhauser and Pound (1990) measure dividend payout by the ratio of dividend to earnings. Denis and Denis (1994) also use dividend yields. After adjusting for growth differences, Lombardo and Pagano (2000), Bekaert and Harvey (2000), and Drobetz et al (2004a) use dividend yield to proxy for the cost of capital.

Profitability

Profitability, like valuation, is a popular measure of firm performance in corporate governance studies by way of return on assets *ROA* [by earnings before depreciation, interest and taxes (*EBIT*) to replacement value of assets (McConnell & Servaes, 1990; Hermalin & Weisbach, 1991; Leech & Leahy, 1991; Denis & Denis, 1994; Keasey et al., 1994; Li & Simerly, 1998; Himmelberg et al., 1999; Thomsen & Pedersen, 2000; Dimelis & Louri, 2002; Bøhren & Ødegaard, 2004); Galve-Górriz & Salas-Fumás, 2005; Gedajlovic et al., 2005] and return on equity *ROE* (Elliot, 1972; Boudreaux, 1973; Bothwell, 1980; Demsetz & Lehn, 1985; Leech & Leahy, 1991; Holderness & Sheehan, 1988; Denis & Denis, 1994; Thomsen & Pedersen, 1996; Li & Simerly, 1998; Pedersen & Thomsen, 1999; Short & Keasey, 1999; Sarkar & Sarkar, 2000; Demsetz & Villalonga, 2001; Gompers et al., 2003; Bøhren & Ødegaard, 2004; Earle et al., 2005; Kapopoulos & Lazaretou, 2007).

Return on sales *ROS* is also used (Leech & Leahy, 1991; Sarkar & Sarkar, 2000). Additionally, return on investments *ROI* (Li & Simerly, 1998); operating returns on assets *OROA* (Li & Simerly, 1998); change in *ROA* (Elliot, 1972; Kole, 1993); operating income to assets (Denis & Denis, 1994); average profit rate (Cubbin & Leech, 1986), and; industry adjusted *ROA* (Dittmar & Mahrt-Smith, 2007) have been used to determine profitability.

Sales growth

Some reseachers (Leech & Leahy, 1991; Thomsen & Pedersen, 1996; Thomsen & Pedersen, 2000; Gompers et al., 2003; Dittmar & Mahrt-Smith, 2007) use sales growth as a proxy for performance. Elliot (1972) employs change in sales while Thomsen and Pedersen (2000) apply total sales. The average of three or more years of sales growth can also be used to proxy for the investment possibility set (opportunities for growth).

Other measures of firm performance

Gugler (1998) also use the internal rate of return as a measure of firm performance. Other performance measures in corporate governance that have been used include: (the logarithm of) sales (Himmelberg et al., 2002); operational efficiency – by ratio of sales to number of employees (Earle et al., 2005); capital expenditure – by growth in fixed assets (Gedajlovic et al., 2005); property, plant and equipment (*PP&E*) over assets (Dittmar & Mahrt-Smith, 2007); cash to assets (Dittmar & Mahrt-Smith); net working capital to assets (Dittmar & Mahrt-Smith), and; assets adjusted for inflation (Dittmar & Mahrt-Smith).

The rest of the measures are: cumulative abnormal return (Agrawal & Mandelker, 1990); average monthly abnormal return (Eckbo & Smith, 1998); beta of a firm's stock (Gedajlovic et al., 2005); percentage of market capitalisation (Bøhren et al., 2005), and; stock return – by excess return for firm *i* during fiscal year *t* less the return of stock *i*'s benchmark portfolio during fiscal year *t* (Dittmar & Mahrt-Smith, 2007). Labour productivity (parametric analysis) has also been used as a performance proxy. Dimelis & Louri (2002) use sales as an output variable, and labour, capital and total assets as input variables. Firm performance has also been measured in recent studies by way of total factor productivity and technical efficiency.

2.6.2 Measuring corporate ownership and identity

The largest owner can be measured through direct or indirect (ultimate owner) means. We highlight some possible data limitations before the measures of ownership are discussed. As with La Porta et al. (1998, and also with Demsetz and Lehn, 1985; Mørck et al., 1988) and some other studies, the possibility of inter-affiliation of the major shareholders or a company owing the shares of its shareholders reduces the cash flow ownership. Corporate ownership pyramids which have the possibility of increasing the concentration of ownership are also important considerations. It is also important to acknowledge owner-controlled and management controlled dichotomy when data on this is available.

The degree of separation of ownership and control by minority investors is made difficult by cross-holdings of large shareholders (Yeh & Woidtke, 2005). These authors use cash flow rights to measure positive incentive effects and the divergence between cash flow and control rights to measure negative entrenchment effects. In their variable measure, they define ownership as the cash flow rights of the largest shareholder and control as the voting rights of the largest shareholder through direct and indirect ownership. They create two dummies to indicate whether the largest shareholder has *CEO*/chairman duality and whether there is a presence of another large shareholder. Bauer et al. (2004) argue that governance standards persist across dimensions of corporate governance and also over time hence governance data can be extended backwards or forward for a few years.

La Porta et al. (2002) use fraction of voting rights by largest shareholder (through direct and indirect shares); fraction of cash flow rights by controlling shareholder (measured as the product of all equity stakes along the control chains), and ; the difference (wedge) between control and cash flow rights.

Ownership patterns tend to be relatively stable for a period of time (La Porta et al., 1999) so using a year of ownership data for about three consecutive years is not expected to cause any major distortions. Other measures of ownership that have been used in the empirical studies in table A12 include Herfindahl index, shares of largest shareholder, shares of five, ten and twenty largest shareholders (or the logarithm of these), and the independence indicator.

For identifying the break points in the monitoring and entrenchment effects of ownership, such breakpoints in the ranges of 0-5%, 5-25% and 25-100% have been used. Others are holdings by five largest families and individuals, holdings by five largest institutional investors, insider stock ownership by managers and directors, and blockholdings as combined ownership by outsiders who have more than 5% ownership. The rest of the measures include dummy for presence of blockholders, insider ownership in the ranges of 0-5%, 5-25%, 25-100%, and insiders plus all blockholders in the ranges of 0-5%, 5-25%, 25-100%. Drobetz et al. (2004a) use this measure for determining the breakpoints of ownership in the monitoring and entrenchment effects: 25% if voting right of the largest shareholder ≥ 25%; voting rights of the largest shareholder < 25%; 25% ≤ voting rights < 50%, and; voting rights of the largest shareholder > 50%.

For the categories of ownership, it is more straightforward as described in section 2.4.2. One categorisation used in previous studies is banks, non-bank domestic, foreign, state, individual or family, and public or dispersed ownership. In this thesis, the definitions given in the OSIRIS database is utilised.

2.6.3 Measuring board characteristics

Board characteristics are usually included in corporate governance index studies. For *CEO*-board chairman separation, a dummy variable is used which equals zero if the *CEO* is the board chairman, and unity if there is separation of the two functions. As regards to the independence of the board, this is done by looking at the percentage of outsiders. Usually, a board is considered to be independent when more than 50% of the board members are outsiders. This measure can therefore be in scale form or nominal form where the dummy takes a value of unity when more than 50% members of the board are outsiders, and zero otherwise.

Board size can be an ordinal measure (1-5, 6-15 [seen as the ideal size], more than 15) or scale measure (1 …*n*). In addition, the scale measure is further scaled by the logarithm of the size of the company (by total assets and by number of employees). Dahya et al. (2008) present evidence that firm value is positively related to board independence for a sample of firms with a controlling shareholder in countries with poor investor protection. Denis and Denis (1994) use the fraction of outside board members and board size. Li and Simerly (1998) use *CEO*/Chairman duality as a control variable while Renneboog (2000) employ board size with his board variables as; separation of *CEO*/chairman function, tenure of *CEO*, and percentage of board outsiders.

2.6.4 Measuring financial policy

Short (1994) argues that ownership concentration does not necessarily lead to control and that debt holders play an important role. Hence it is necessary to recognise a firm's financial structure. Most studies recognise the importance of a firm's financial policy but do not explicitly associate it as a part of corporate governance but as an influence on corporate performance. In this study however, it is considered as a part of corporate governance as equity issues and debt structure matter a lot for corporate governance. The most popular measures of financial policy are gearing ratios especially the debt-to-equity ratio.

Gearing is a measure of financial leverage, demonstrating the degree to which a firm's activities are funded by owner's funds versus creditor's funds. Firm leverage and liquidity are commonly used to measure a firm's financial structure. Leverage can be measured by the ratio of the aggregate of short-term and long-term debt to net worth. Liquidity can be defined as the ratio of working capital to total assets. Dimelis and Louri (2002) use both leverage and liquidity to measure a firm's financial structure. The studies by Thomsen and Pedersen (2000) and Seifert et al. (2005) proxy for liquidity with the ratio of cash flow to total assets. Cho (1998) measure liquidity by cash flow to replacement cost of capital. Anderson and Reeb (2003) use the ratio of long-term debt to total assets as a measure of leverage.

Other studies that have employed financial policies and their measures are also given. Zeckhauser and Pound (1990) calculate leverage by the ratio of debt to debt plus market value of equity. Denis and Denis (1994), Holderness et al. (1999), and Short and Keasey (1999) use debt to asset ratio. Demsetz and Villalonga (2001) use the value of debt as a fraction of book value of assets. Pindado and de la Torre (2006) use the ratio of market value of long-term debt to market value of long-term debt and market value of equity.

Apart from leverage, Keasey et al. (1994) introduce a dummy for whether or not a debt is secured. Kole (1993) use long-term debt to size for financial policy. Nickell et al. (1997) use financial pressure which they measure by the ratio of interest payments to cash flow. McConnell and Servaes (1990) and Cho (1998) use the market value of long term debt to replacement cost of assets. Li and Simerly (1998) use the long-term debt to total equity. Lauterbach and Vaninsky (1999), Thomsen and Pedersen (2000), and Drobetz et al. (2004a) use the debt-to-equity ratio as firm leverage. Galve-Górriz and Salas-Fumás (2005) use long-term debt to total debt ratio and debt to assets ratio. Sarkar and Sarkar (2000) use long-term debt to total equity plus reserves.

Kapopoulos and Lazaretou (2007) use debt to book value of total assets. Mørck et al. (1988) use long-term debt to firm size. Gedajlovic et al. (2005) use the ratio of bank-mediated debt to total outstanding debt. Dittmar and Mahrt-Smith (2007) calculate leverage by long term debt plus short term debt to long term debt plus short term debt plus market value of equity. They also include net new equity issues plus net new debt issues and bond ratings in their measure of financial policy. Other debt variables have been used. Renneboog (2000) use debt to equity ratio, current ratio, quick ratio, interest coverage (ratio of *EBIT* to interest expenses) and argue that gearing is included to avoid multicollinearity in his model).

2.6.5 Measuring investor protection

La Porta et al. (1998) measure the degree of investor protection by using twenty four variables covering 49 countries from Company Laws or Commercial Codes, Bankruptcy and Reorganisation Laws, International Country Risk Guide (*ICR*) and other sources which are defined in text box A3. Shleifer and Vishny (1997), La Porta et al. (1997, 1998, 1999, 2000, 2002 & 2006), and Shleifer and Wolfenzon (2002) have all discussed tunnelling in great depth with empirical underpinnings utilising studies involving several countries. However in Djankov et al. (2008), an anti-director rights index developed in La Porta et al. (1998) is revised with much recent data and recoding.

A tunnelling index called anti-self dealing index (*ASDI*) which is used in the 2008 study involving 72 countries is prescribed to be more effective in predicting a variety of stock market outcomes than the anti-director rights index (*ADRI*). The indices' scores for seventeen countries are reported in table A16. Spamann (2006) however faults the two measures of investor protection in La Porta et al. (1998) and Djankov et al. (2008) by arguing that the coding used is inconsistent and that it is not a valid measure of shareholder protection, unpredictive of stock market outcomes and has no significantly distributed differences between common and civil law countries. He however confirms that the revised *ADRI* of Djankov et al. (2008) is a better measure but reinforces endogeneity issues regarding the components of the index. He recommends some guidelines for consistent coding after recoding the components of the two indices.

La Porta et al. (1998) [text box A3] develop and use legal efficiency (for example scores for Belgium is 9.5, Spain is 6.25 and the *UK* is 10 out of a maximum 10), creditor rights (for example Belgium 2, Spain 2, *UK* 4 out of a maximum 4 respectively, - although this result turns out to be insignificant in La Porta et al.'s, 2002 regression) and, shareholder rights (for example Belgium is zero, Spain is 4, and the *UK* is 5 out of a maximum 5) to proxy for protection of minority investors. The actual mean ownership concentration is 29.2% for *UK*, 58.3% for Spain and 60.6% for Belgium. Dahya et al. (2008) use the product of two indices (the Anti-Director Rights of La Porta et al., 1998 and Law and Order Enforcement from the International Country Risk Guide – a proxy for the quality of legal environment) to measure investor protection.

2.6.6 Measuring control variables

Firm size

Firm size is a very important variable that is used for most firm-level studies because of its risk-neutral effect on corporate ownership (Demsetz & Lehn, 1985). Large firms have economies of scope and scale and from that point are supposed to influence firm performance. At the same time, agency problems increase and diversification of activities to reduce firm-specific risk may also lead to firm inefficiencies. Studies (such as Cubbin and Leech, 1986; Leech and Leahy, 1991; Agrawal and Knoeber, 1996; Li and Simerly, 1998 – through a Herfindahl index, and; Sarkar and Sarkar, 2000) control for diversification effects. There have been several measures of firm size and table A12 gives an exhaustive list where firm size is used to control the governance – performance relationship.

The use of book value of total assets (or its logarithm) is by far the most popular in this empirical review. Keasey et al. (1994), Agrawal and Knoeber (1996), Gugler (1998), Holderness et al. (1999), Lauterbach and Vaninsky (1999), Pedersen and Thomsen (1999), Demsetz and Villalonga (2001), Gedajlovic et al. (2005), Sheu and Yang (2005) and Kapopoulos and Lazaretou (2007) use the book value of total assets to control for firm size. Thomsen and Pedersen (1996), Renneboog (2000), Anderson and Reeb (2003), and Bauer et al. (2004) use the logarithm of the book value of total assets as a proxy for firm size. Additionally, Thomsen and Pedersen (1996) include the logarithm of turnover of market share. Bauer et al. (2004) also use the logarithm of book to market value in addition to the logarithm of book value of assets. Drobetz et al. (2004a) use the logarithm of book assets value.

Demsetz and Lehn (1985) use market value of equity. Cho (1998), and Bøhren and Ødegaard (2000 & 2004) control their ownership and performance study with the logarithm of equity value. Cho (1998) argues that the equity value controls for managerial wealth constraints and risk aversion. Mørck et al. (1988), McConnell and Servaes (1990), and Denis and Denis (1994) use replacement cost of assets. Bøhren et al. (2005) use the logarithm of the market value of assets. Hermalin and Weisbach (1991) and Cho (1998, in his instrumental variable regression specification), and Pindado and de la Torre (2006) use logarithm of the replacement cost of assets. Both studies by Boudreaux (1973) and Short and Keasey (1999) use total sales. Leech and Leahy (1991), Himmelberg et al. (1999), and Sarkar and Sarkar (2000) use the logarithm of sales value. Additionally, Himmelberg et al. (1999) add the square of this value. Cubbin and Leech (1986) use net assets. Nickell et al. (1997) use total number of employees, and Renneboog (2000) use logarithm of total employees.

Firm age

The age of a firm has sometimes been proxied for its learning effects and is an influential variable in institutional theory empirics. Some relatively younger firms that embark on rapid acquisitions and diversification have shown that not all large firms are very old. The age of a firm from the point of view of institutional theory plays a major impact on corporate policies. Most activities are routinised aiding in technical efficiency and performance. At the same time, institutional change and deinstitutionalisation are slow to occur because of deep-rooted institutionalised patterns of behaviour that acts against conformity to new institutional norms from the environment. Hence improved managerial and production techniques take longer to be adopted in older firms than in younger firms.

The effect of age also depends on the particular industry and its environment. Leech and Leahy (1991), Li and Simerly (1998), Sarkar and Sarkar (2000), Dimelis and Louri (2002), Bauer et al. (2004), Keasey et al. (1994), Gedajlovic et al. (2005) and Nanka-Bruce (2006) use firm age as a control variable moderating in the governance-performance relationship. Drobetz et al. (2004a) use the logarithm of the number of years listed on the relevant stock exchange to control for the age of the firm. Drobetz et al. (2004a) use firm age as an instrument in their two-stage least squares regression. The impact of age though is very mixed with a negative, positive or no significant relationship reported in empirical studies. Age, for example, has a negative effect in Nanka-Bruce (2006). Other studies also include the square of the age variable in regression specifications.

Firm risk/volatility

Ownership concentration puts too much firm-specific risk on large shareholders; it has an incentive for outsiders to monitor managers while insiders also strive for returns on their holdings. When a firm's idiosyncratic risk is high, ownership is expected to be less concentrated. Demsetz and Lehn (1985) suggest that the higher the firm risk, the more the scope for managerial discretion and increasing costs of agency. Variables that control for managerial discretion (such as intangible assets) are therefore necessary. Demsetz and Lehn (1985) control for firm specific risk with the standard deviation of stock return and standard deviation of accounting return on equity while Cubbin and Leech (1986) use firms' betas. Leech and Leahy (1991) use beta risk and the standard deviation of returns. Denis and Denis (1994) use the variance of stock returns. Thomsen and Pedersen (1996) use both standard deviation of stock return and the standard deviation of return on equity.

Cho (1998) uses volatility measured as the standard deviation of profit rates for six years. Gugler (1998) use standard deviation of profit margin. Himmelberg et al. (1999) use the standard deviation of stock return. Pedersen and Thomsen (1999) use the standard deviation of return on equity. Thomsen and Pedersen (2000) use betas between 23 to 35 months. Demsetz and Villalonga (2001) employ both market risk of stock and firm-specific risk. Firms' betas are also used as instruments for test of endogeneity in two-stage least squares regression by Drobetz et al. (2004a). Seifert et al. (2005) also control for firm risk although they do not show how they measure it. Bøhren and Ødegaard (2004) use stock volatility, stock turnover and stock beta. Dahya et al. (2008) use the variance of stock returns measured as monthly returns over 24 months.

Firm investments

Managers acting in the interest of shareholders invest in projects with a positive 'net present value' obtained through methods such as the 'internal rate of return'. Research and development costs (*R&D*) and advertising costs are all investments that firms undertake for future improved financial performance. Bøhren and Ødegaard (2004) for instance control their ownership and performance study with investments to income. Demsetz and Lehn (1985) use advertising to total sales, *R&D* to total sales, and capital expenditure to total sales. Mørck et al. (1988) and Hermalin and Weisbach (1991) use *R&D* cost to size, and advertising cost to size.

Zeckhauser and Pound (1990) use asset specificity as a proxy for investment measured by the ratio of *R&D* to Sales. McConnell and Servaes (1990), and Kole (1993) use the ratios of *R&D* cost to replacement cost of assets, and advertising to replacement cost of assets. Denis and Denis (1994) use only the ratio of *R&D* to sales. Agrawal and Knoeber (1996) also employ *R&D* costs to assets and advertising costs to assets. Cho (1998) employ capital expenditure and *R&D* expenditure. Gugler (1998) use investment in capital stocks and financial assets. Himmelberg et al. (1999) use *R&D* to capital and advertising to capital as intangible investments' proxy and the logarithm of capital to sales ratio and the logarithm of the square of capital to sales ratio to proxy for tangible investments.

Pedersen and Thomsen (1999) use capital intensity measured as the ratio of asset to sales and a dummy if a firm's *R&D* is above 1% of corporate turnover. Short and Keasey (1999) employ *R&D* to total assets ratio. Renneboog (2000) measures investments made in innovation with a dummy variable to purge out firm-specific effects. Sarkar and Sarkar (2000) use advertising to total sales (advertising intensity for intangible investments) and depreciation expenditure to total sales (capital or depreciation intensity) for tangible investments. Demsetz and Villalonga (2001) employ advertising expenditures to sales revenue, *R&D* to sales revenue and fixed plant and equipment expenses to sales revenue as proxies for tangible and intangible investments.

Dimelis and Louri (2002) use the logarithm of capital intensity. Himmelberg et al. (2002) use sales to capital ratio, *R&D* to sales ratio (soft capital) and sales to capital ratio. La Porta et al. (2002) use the ratio of capital expenditure to sales as investments in growth opportunities. Klapper and Love (2004) use capital intensity measure for intangible assets and find that the proportion of fixed assets is negatively correlated with governance. Klapper and Love also use fixed capital (property, plant and equipment) to total sales as a measure of the relative importance of this capital in a firm's overall output. Lehmann et al. (2004) use total assets per employee to measure capital intensity. Leech and Leahy (1991) use capital to labour ratio.

Sheu and Yang (2005) use *R&D* expenses and Seifert et al. (2005) use capital expenditures scaled by total assets to control for investments. Dittmar and Mahrt-Smith (2007) use net assets and *R&D* expenses policy. Kapopoulos and Lazaretou (2007) follow Demsetz and Villalonga (2001) but use distribution (advertising and marketing) expenses as a fraction of sales revenues. Pindado and de la Torre (2006) calculate investment as [(net fixed assets as measured by the book value of tangible assets minus the accumulated book depreciation for year *t*) minus (net fixed assets as measured by the book value of tangible assets minus the accumulated book depreciation for year *t*-1) plus (book depreciation expense corresponding to year *t*)] divided by the replacement value of total assets. Dahya et al. (2008) use the ratio of intangible assets to total assets, and the ratio of *ROE* to 1-*ROE* measured over two years as a need of external financing for investments.

Growth

Himmelberg et al. (1999) use capital expenditures to capital stock as a proxy for the link between high growth and opportunities for discretionary projects. Klapper and Love (2004) also proxy future growth as the average of real growth rate in sales for the last three years. They observe past growth to be positively associated with good governance. Seifert et al. (2005) also use sales growth. Dahya et al. (2008) use the logarithm of prior year sales and two-year sales growth. Corporate governance-performance relation variables of interest used by La Porta et al. (2002) include; growth in sales (geometric average annual percentage growth in lagged (net) sales for up to three years, as well as industry adjusted geometric average annual percentage growth in lagged (net) sales. This is a proxy for growth opportunities. As robustness checks, they replace sales growth with asset growth.

Cubbin and Leech (1986) use asset growth rate, internal assets growth rate, and industry average profit rate. Kole (1993) measures firm growth as four-year average growth in sales. Short et al. (1994) use growth in assets. Thomsen and Pedersen (2000) use equity growth while Leech and Leahy (1991) utilise asset growth. Drobetz et al. (2004a) use such growth proxies as the average of historical growth rates (sales growth) and expected earnings per share growth rates (asset growth) (to control for endogeneity issues). Drobetz et al. also use average of adjusted sales and asset growth over the past five years. In a simple regression of corporate governance on market-to-book ratio, they control with the logarithm of book assets and the average of sales and asset growth. They find growth to be insignificant.

Industry and nation effects

Institutional theory posits why there are more similarities in firms that operate in an industry (country) than in different industries (countries). Within the same industry, firms in different countries are more heterogeneous than within a single country. These differences also extend to group of countries with the same legal origin. For a limited set of tests, industry can been accounted by subtracting average industry differences, in for example, Tobin's *Q* (if used as the dependent variable) from each observation of Tobin's *Q* (McConnell & Servaes, 1990). Like studies involving different industries where there is control for industry effects with dummies, nation effects are controlled with several other variables apart from dummy variables.

Some studies that have controlled for nation effects with dummies include Thomsen and Pedersen (1996, 1998 & 2000), and Pedersen and Thomsen (1999). Additionally, Pedersen and Thomsen (1999) add such variables like the size of economy by *GDP* and stock market capitalisation. Thomsen and Pedersen (2000) also include the effective interest rate of a nation. Following La Porta et al. (1998), Himmelberg et al. (2002) control for cross country differences with logarithm of *GNP* and logarithm of *GNP* per capita. La Porta et al. (1998) also add a Gini coefficient (for inequality of income distribution across countries). This is based on the logic that larger economies might have larger firms with lower ownership concentration. Also there is a need to control for legal origins (whether Scandinavian, English, Germanic or French).

2.7 Corporate governance and technical efficiency

The monitoring and entrenchment effects of large shareholders are reflected in firm productivity and market performance (Bartelsman & Doms, 2000; Köke & Renneboog, 2002; Lehmann et al., 2004). Studies involving the use of technical efficiency measures of performance with corporate governance characteristics are very few. One of the pioneering studies is Lauterbach and Vaninsky (1999) who employed the use of *DEA* scores and net income (the latter is also the output variable for *DEA*) in two *OLS* regression specifications using the same variables (apart from a non-professional owner dummy variable in the Net Income model). Both statistical analysis gave similar results (refer to table A12 for variables and results). This study was published in the Journal of Management and Governance. The well-known journals that have over the past 30 years published corporate governance and performance studies have been Journal of Finance and Journal of Financial Economics (refer here to same table A12 as above) and most studies have used market valuation although some articles have used accounting measures as well.

Market valuation as rightly pointed out by Demsetz and Villalonga (2001) is based in part on speculation. Speculation is based on too many unforeseen elements to give a near perfect reflection of firm performance. An online search in May 2007 revealed the following: *EBSCO HOST*'s *Econ*

Lit returned thirteen hits and "Business Source Elite" returned two hits for a combined general search of "Data Envelopment Analysis" and "Corporate Governance". The Journal of Finance and Journal of Financial Economics returned no hit for either "Technical Efficiency" or "Data Envelopment Analysis". Again, in October 2008, the combined search returned 1260 hits for Google Scholar and 8170 hits for the general Google search engine. *DEA* has been used extensively in operational research, economics and econometrics and its sophisticated analysis is suitable for all sorts of data with usually (non-negative – albeit, negatives are also possible) quantitative values. *DEA* application is therefore done in conjunction with the usual measures of performance for corporate governance so as to be able to argue the usefulness of this measure.

Regressions can then be performed using bootstrap procedures with data generating processes logically consistent with *DEA* efficiency estimates, making statistical inference both logical and possible as proposed by Simar and Wilson (2007). Following the semi-parametric models of Simar and Wilson, insights can also be drawn from Park et al. (2007) (which uses Arellano and Bond's -1991- version of the generalised method of moments – *GMM*) to apply to dynamic panel data to test hypotheses. The *GMM* model is to control for potential endogeneity and unobservable heterogeneity (using lagged values of corporate governance, similarly utilised by Köke and Renneboog (2002)). *GMM* can be used to test the effect of the aspects of governance on technical efficiency and productivity growth.

As a response to this clarion call, a few studies in corporate governance in recent times have employed technical efficiency measures. Some studies include Wen et al. (2002) for China, Drake and Simper (2003) for the *UK*, Lehmann et al. (2004) for Germany, Zheka (2005) for Ukraine, Nanka-Bruce (2006) for Spain, Zelenyuk and Zheka (2006) for Ukraine, and Destefanis and Sena (2007) for Italy.

Wen et al. (2002) apply technical efficiency scores computed through a stochastic frontier analysis – *SFA* to determine how it affects corporate ownership types. Their data is on large and small-sized firms in six industries in China. They pool the data across industries together in their stepwise and restricted regression analyses since they argue that relevant *t*- and *F*-statistics of the tests they conduct suggest so. Additionally, they add the labour to capital ratio of all the industries to control for industry heterogeneity. They use annual value added (calculated as the difference between gross output value and the value of material and intermediate inputs plus value-added tax, at constant prices) as the output valuable. The value of fixed assets net of depreciation and average number of employees are used as inputs. They report State-owned firms, followed by joint domestic and collective domestic enterprises, to be the least efficient in their twelve ownership categories.

Drake and Simper (2003) study the impact of corporate ownership on the efficiency and total factor productivity change (using Malmquist indices obtained through *DEA*) of major retail stock *plc* banks and mutual building societies in the *UK*. They find corporate ownership to significantly affect technological innovations and deployment.

Lehmann et al. (2004) use a panel data set of 361 German corporations to test the hypothesis whether firms with more efficient governance structures have higher profitability. Categorising the data into six groups based on the identity of ownership, they run *DEA* for each owner group with six years of data. They control for other firm systematic influences (like capital intensity – capital to labour ratio and debt to asset ratio) and argue that the governance structure determines firm investment, nature of growth and profitability. They argue that ownership concentration has an ambiguous relationship with firm performance because capital structure and investment have been taken for granted in several empirical tests.

Lehmann et al. (2004) therefore use *DEA* in introducing the other determinants of governance structure in regressions linking ownership structure to profitability. They assume ownership concentration, the firm's capital structure and capital intensity as inputs that generate the outputs – growth and investment[5] (as these outputs can be directly controlled by management). They also indicate that firms that generate these two outputs efficiently should be associated with higher *ROA*. In the case of over-investment in growth and investment (due to misuse of managerial discretion), then growth and investment should have a negative relationship with *ROA*. Their results indicate that efficiency scores contribute significantly to explaining differences in *ROA* even after controlling for industry and unobserved firm systematic effects.

Debasish (2006), in an Indian banking sector study of 93 commercial banks, uses *DEA* output-oriented *CRS* measure as a performance proxy with nine inputs and seven outputs. Banks with foreign ownership perform better than publicly and privately owned local commercial banks. Nanka-

[5] Investment is measured annual expenditures for tangible assets scaled by total assets. Firm growth is calculated as log change in annual turnover. *ROA* is calculated as gross profits (turnover minus expenses for personnel and materials) over total assets. Ownership concentration is measured by the Herfindahl index of outstanding voting stock.

Bruce (2006) links technical efficiency to corporate ownership using data from the Spanish real estate sector. The *DEA* method used in achieving a "reasonable" production frontier allows the detection and elimination of firms whose performance cannot be matched and firms whose presence mask the performance of others. He finds no systematic support for the effect of corporate ownership on technical efficiency after using a Tobit model to estimate the relationship.

Zelenyuk and Zheka (2006) link corporate governance measures to Leibenstein's (1966) notion of *X*-efficiency. This concept of *X*-efficiency and its relation to technical efficiency is discussed in section 2.8.1. They use constant returns to scale (*CRS*) output-oriented Farrell efficiency measure in the first stage and bootstrap regression (following Simar & Wilson, 2007) in the second stage. Their data is from seven industries covering 158 firms. They use total revenues as output and labour costs, capital costs, total costs and operational costs as inputs and pool all the data from the seven industries in a single *DEA* frontier estimation arguing that the use of cost and revenue for input and output actually include prices and justifies pooling data from several industries together. They find support for the effects of quality of governance and foreign ownership on firm efficiency. However, their relatively small sample size and crude measure of governance does dictate a more comprehensive study.

Destefanis and Sena (2007) relate corporate governance characteristics to *DEA* measures of technical efficiency in nine Italian manufacturing industries. They choose value added (at constant prices) as their output variable and gross book value of depreciable assets (at constant prices), labour (separate white and blue collars), degree of educational attainment and a binary variable for *R&D*. Ownership concentration (they allow for a non-monotonic relationship) and pyramidal group membership have positive effects on technical efficiency. These two characteristics are however inversely related in their relation to technical efficiency. They apply both *OLS* and Logit regressions. They argue that as efficiency scores are bounded between zero and one, applying *OLS* to transform efficiency scores as suggested by Banker and Johnston (1994) allows them to vary between -∞ and +∞.

Other studies into corporate governance and efficiency measurements include: Pi and Timme (1993) in the *US* banking sector where the efficiencies of *CEO*-chairman separation and duality as well as their levels of ownership are compared; Bosworth et al. (2002) where executive compensation is compared to the efficiency of large *US* bank holding companies; Bowlin et al. (2003) where *DEA* is applied, and report no significant differences in executive compensation for both males and females in a sample of Standard and Poors (*S&P*) 500 firms; Hughes et al. (2003) where, among other methodologies, *SFA* is used to determine managerial ownership, incentives, industry consolidation and performance for *US* bank holding companies;

The rest of the studies we mention are: Mohan & Ruggiero (2003) who also use *DEA* to investigate executive compensation differences between male and female *CEO*s of 40 publicly-listed *US* companies; Habib & Ljungqvist (2005) who apply *SFA* to a sample of *US*-listed firms to investigate the impact of managerial incentives on firm value; Fiordelisi (2007) who investigates shareholder value efficiency and cost and profit efficiency of European banks using *SFA*; Khiari et al. (2007) who use 320 *US*-listed firms to determine the relationship between governance efficiency index and performance using the *SFA* approach, and; Chen et al. (2009) who use *DEA* methodology in the first of a two-staged analysis to determine performance (efficiency) of *CEO*s of *US* banks over an eight-year period.

2.8 Technical and managerial efficiencies

Such concepts like *X*-efficiency, allocative efficiency and scale efficiency are encountered within production theory. This section briefly explains them and their link to technical efficiency.

2.8.1 *X*-efficiency

The notion of *X*-efficiency (from Leibenstein, 1966) is hereby put in the perspective of technical efficiency as it has been used by Zelenyuk and Zheka (2006) in their corporate governance study that is discussed in section 2.7. Leibenstein is basically trying to separate inefficiency that is not due to resource allocation but stemming up from technical (in)efficiency and (the agency theoretical underpinning of) unobservable agents' efforts (that can only be aligned by motivational incentives which can be called organisational or managerial (in)efficiency. Leibenstein (1978) attributes *X*-efficiency to incomplete contracts, effort discretion and non-maximising behaviour. Zelenyuk and Zheka (2006) approximate technical efficiency as a measure of *X*-efficiency.

Leibenstein's *X*-efficiency is similar to Debreu's (1951) measure of technical efficiency of production units and efficiency of an economic organisation. This excludes the under-employment of physical resources which Leibenstein refers to as allocative efficiency. In sum, *X*-efficiency is made up of technical efficiency and organisational efficiency but as is usual in empirical studies, researchers approximate organisational efficiency as technical efficiency. The difference between technical, organisational and *X*-efficiency is ambiguous. Leibenstein (1977) argues technical inefficiency to be a manifestation of *X*-efficiency. Pack (1974) associates *X*-efficiency with the quality of management (contracts made with technology use) and technical efficiency with a firm's access to technology. In effect, the argument made in this section supports Pack (1974). Firms have differing technical efficiencies due to the *X*-inefficiencies pointed out by Leibenstein. Although there are several internal and external factors heterogeneously affecting technical efficiency, we highlight the importance of corporate governance factors in contributing to firm differences.

2.8.2 Other types of productive efficiency

Price efficiency which is also allocative efficiency "measures a firm's success in choosing an optimal set of inputs" while technical efficiency is concerned with a firm's success "in producing maximum output[s] from a given set of inputs" (Farrell, 1957: 259). This definition of technical efficiency is first given by Koopmans (1951). The assumption is that the efficient production function is known. The more complex a production process is, the less accurate the production function is. Therefore the engineering theoretically best standard (according to Farrell, 1957) is not practical and the observed standard is more realistic. This is done through empirical analysis of inputs and outputs in firms with similar production functions. The computational difficulty arising from several multiple inputs and outputs for a lot of firms using the method proposed by Farrell is taken up by Charnes et al. (1978) who have proposed a linear programming method that envelope all the data for analysis.

Allocative efficiency is defined as the choice of an appropriate input and/or output mix at the going market prices. It differs from technical efficiency which refers to the (multiple) output to (multiple) input ratios of an organisation whereby no other organisation can be more efficient by reducing this input or increasing the output (hence it is said to be a best performer – but this does not take input or output prices into consideration). We illustrate the difference between allocative efficiency and technical efficiency by considering a production frontier. Any efficient mix of inputs will yield a maximum output that will be on the production frontier. However, the input mix on this frontier that leads to the least cost is said to be allocatively efficient as well.

Efficiency measurements by the (non) parametric model can be used to determine both (pure) technical and scale efficiencies. The product of these two gives as the total technical efficiency. Being technically efficient is how efficient a 'decision making unit' –*DMU*- is in converting inputs to outputs and is a ratio of optimal to actual performance, as defined by Farrell (1957). A firm's performance is measured against that of the best performer(s) in an industry. The efficiency frontier is constituted of best performing firms (with the same inputs, one cannot find any other firm(s) producing more outputs).

Scale efficiency is primarily concerned with whether a *DMU* is operating at its optimal capacity/ size in comparison to other *DMUs* in its industry. Scale efficiency can be determined in a technology with variable returns to scale (*VRS*). *VRS* is when a proportional increase in inputs does not lead to the same proportional increase in outputs. Scale efficiency can therefore be estimated by carrying out parametric or non-parametric tests under both *CRS* and *VRS* technologies and reading out the efficiency scores for the same *DMUs*. The quotients (*CRS/VRS*) in the efficiency scores indicate scale inefficiencies (Althaler & Slavova, 2002).

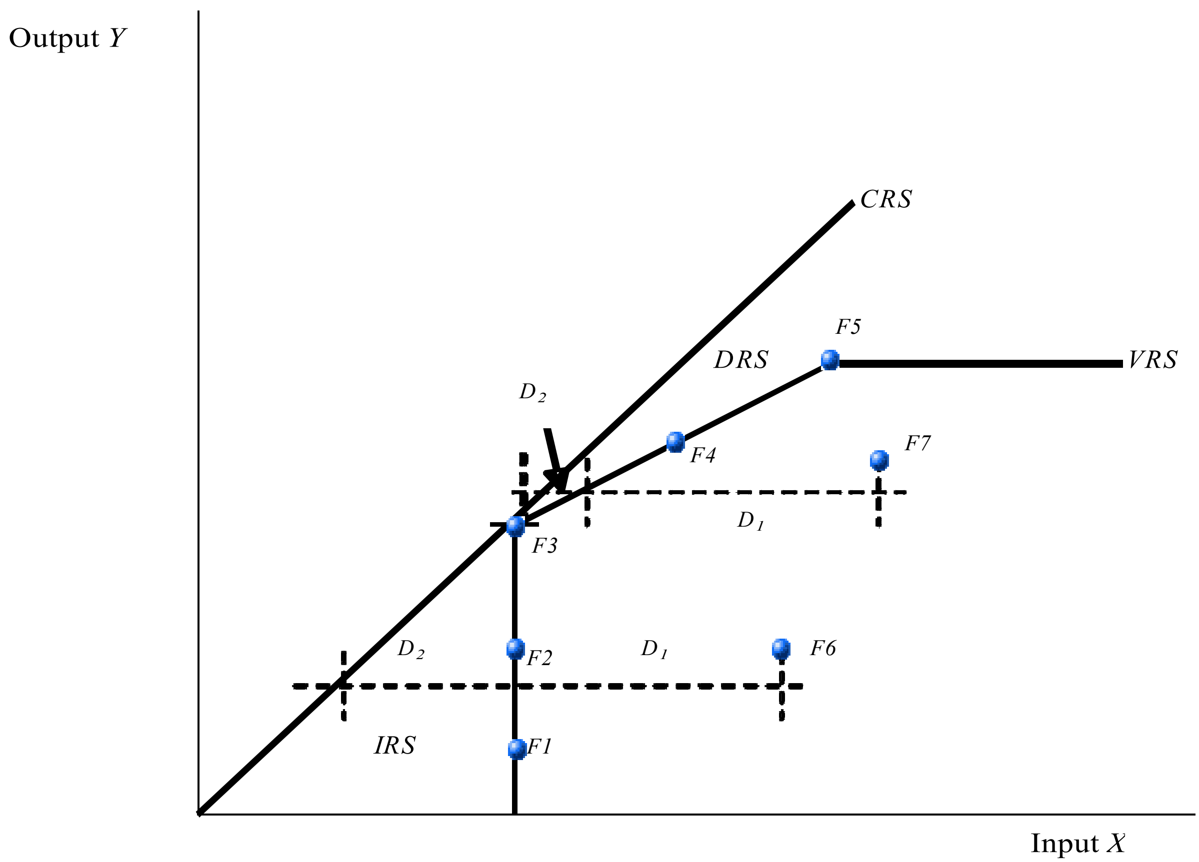
The good thing about a non-parametric *DEA* model is that one does not need to apply weights of prices to inputs and outputs. This therefore means that allocative efficiencies can only be measured with prices. *DEA* models have their disadvantages. *SFAs* are more appropriate for environments with noise components than linear *DEAs*. This is because the shape of the *DEA* frontier is more influenced by 'noise' in the environment by virtue of its unspecified production function. This makes *DEA* applications more suitable for multi-outputs public sector organisations where prices are difficult to define and random influences are less of an issue (Althaler & Slavova, 2002). *SFA* applications are also used in the multi-output cases.

DEA can be input oriented, output oriented or an input-output combination approach. In the former, the method defines the frontier by seeking the maximum proportional reduction in inputs holding the outputs constant. The second also seeks a maximum increase in outputs holding the inputs constant. The results from the two orientations are the same when a *CRS* technology (cf. Charnes et al, 1978) is invoked. In the case of a *VRS* technology (Banker et al, 1984), the technical efficiency of the two measures is different. The input-output combinations are considered in the hyperbolic efficiency (Färe et al., 1985) and directional distance function approaches (Chambers et al., 1998) which are related to the profit function.

The addition of the various percentages of the peers (or benchmark firms) gives an indication if the firm is in an increasing returns to scale (*IRS*) or decreasing returns to scale (*DRS*) relative to the best practice frontier (see figure 1). *DEA* has the benefit of not requiring any production function to be specified but has these statistical errors already mentioned, in addition to the aggregating problem (Delgado and Robinson, 1992). This leads to sensitivity in "data measurement errors and variable selection" (Turk, 1998:17). All important factors have to be well specified in the model to control for such errors.

Figure 1 is a simple example of two frontiers constructed in both *CRS* and *VRS* technologies with an input orientation. With the *CRS* technology, *F3* is the best practice *DMU* and the efficiencies of all other firms are measured with regards to this unit. When a *VRS* technology is used, units *F1*, *F2*, *F3*, *F4* and *F5* are all efficient and form the envelopment. Units *F6* and *F7* are inefficient with respect to both frontier technologies. The distances D_1 and D_2 measure the pure technical and scale inefficiencies of units *F6* and *F7*. The two measures of inefficiencies give the total technical inefficiency of units *F6* and *F7*.

Figure 1: *DEA* frontier with *CRS* and *VRS* technologies: Input orientation



The *DMU F3* which is the best practice firm serves as the point where firms above it are in *DRS* and firms below it are in *IRS*. Hence *F6* is in *IRS* and *F7* is in *DRS*. In order for *F7* to become efficient, it has to reduce inputs by some coefficients that are given by the *DEA* results. The sum of the coefficients signifies whether *IRS* or *DRS* is the prevailing technological situation concerning the returns to scale. When the sum of the coefficients is less than unity, it indicates *IRS* and when it is greater than unity, it indicates *DRS*.

In practice, there are three methods of measuring efficiency; index numbers (multi-factor productivity models, financial and operational ratios), econometric models (deterministic and stochastic frontier analysis - *SFA* models), and the linear programming *DEA* technique we have briefly discussed. Econometric models use average observations and linear programming models use best-practice observations. An overview of the *SFA* model is now given.

2.8.3 Stochastic frontier analysis

This deterministic production frontier is modelled out from Farrell's (1957) realised deviations from an ideal isoquant frontier. The mathematical derivation of the deterministic frontier presented here follows Kumbhakar and Lovell (2000) and Greene (2008).

Let X_{1i} and X_{2i} be two inputs that produce output Y_i for firm i. A Cobb-Douglas production function (deterministic frontier) for firm i can be modelled as follows:

$$Y_i = AX_{1i}^{\beta_1} X_{2i}^{\beta_2} W_i = Y_i^* W_i , \qquad (2.8.1)$$

W_i is a random disturbance between 0 and 1. $AX_{1i}^{\beta_1} X_{2i}^{\beta_2} = Y_i^*$ is the non-stochastic deterministic portion that is viewed as the frontier. Thereby the inefficient stochastic portion is W_i. The technical efficiency of firm i is therefore given as

$$Y_i / Y_i^* = W_i . \qquad (2.8.2)$$

The stochastic production frontier can also be expressed in the form

$$\begin{aligned} y_i &= d^*(x_i) - w_i \\ &= \alpha + \beta' x_i + z_i - w_i \end{aligned} \qquad (2.8.3)$$

$$= \alpha + \beta^{'} x_i + \varepsilon_i , \qquad (2.8.4)$$

Here, $w_i \geq 0$, z_i is unrestricted, w_i and z_i are mutually exclusive, y_i is firm i's output (or the logarithm of output), x_i is a d x 1 vector of transformations of the inputs of firm i, α is the intercept and β is a set of parameters. All firms are assumed to have stochastic production functions with technical efficiency for firm i as w_i. Kumbhakar and Lovell (2000) and Greene (2008) argue z_i to be independently and identically distributed $N(0,\varphi_z^2)$ while w_i is independently and identically half-normally distributed as $\left|N(0,\varphi_w^2)\right|$. The maximum likelihood approach can be used for the calculation of $\alpha, \beta, \varphi = \sqrt{\varphi_z^2 + \varphi_w^2}$, and $\pi = {}^{\varphi_w}\!/\!_{\varphi_z}$.

2.9 Data envelopment analysis

Data envelopment analysis –*DEA*- is a linear application derived from production theory and compares decision-making units –*DMUs*- that use the same inputs to generate outputs to get the relative (technical) efficiency measures of individual *DMU*s. *DEA* uses a mathematical programme to estimate the efficient production frontier. It does not need pre-specification of the production function. *DEA* models thus construct a non-parametric frontier over data points so that observations may lie below or on the frontiers (Charnes et al., 1978; Färe et al., 1994; Thiele & Brodersen, 1999).

DEA has been applied in several researches, and mostly with public sector data. In the two-stage approach, efficiency or ratio estimates are used as dependent variables in regression equations (see Gattoufi et al., 2004 for a comprehensive bibliographical coverage involving *DEA* application for the period 1951-2001 and Emrouznejad et al., 2008 for the first thirty years of scholarly *DEA* research). *DEA* analyses firms separately while measuring its efficiency relative to all the observations in the sample (*DMUs*). *DEA* models also take all forms of quantitative variables as proxies for inputs and output. After evaluating inefficiencies in *DMUs*, it also provides targets for improvements in the inefficient *DMUs* (Althaler & Slavova, 2002).

2.9.1 Some restrictions in solving problems with *DEA*

Lauterbach and Vaninsky (1999) list four restrictions that apply when *DEA* is used. The first restriction ensures that inputs of the optimal virtual firm being generated do not exceed the inputs of the actual firm under consideration, and yet its output is at least equal to the actual firm. The second restriction concerns that virtual outputs are at least equal to the actual outputs. The third restriction constrains the virtual firm to be a portfolio of existing firms with weights between zero and one. The fourth restriction considers that given the objective function and the second restriction, the output of the virtual firm will be optimal with respect to the inputs or scale of the actual firm.

Additionally outputs and inputs are assumed to be substitutable (Charnes et al., 1978; Banker et al., 1984). However, following Banker et al. (1989b), standard *DEA* indices following this substitutable assumption might underestimate organisational inefficiency in some instances. *CRS* and *VRS* technical efficiency indices in these instances should be adjusted for non-substitutability of outputs.[6] Charnes et al., (1978) proposed the constant returns to scale technology *CRS* while Banker et al. (1984) proposed the variable returns to scale technology *VRS* to allow for scale economies.[7]

It must be noted here that the resulting weights that are given in the *DEA* model are not necessarily from a managerial perspective because they are designed so as to put the firm in the best possible evaluation. Hence whether the firm has the best input –output balance or not, the model will assign the best possible conservative value.

2.9.2 Simple *DEA* models

Construction of virtual firms for all the actual firms in the sample leads to a production possibility frontier and subsequent computations of performance scores for individual firms. This is achieved by dividing actual output with virtual output. This ratio shows how (in)efficient a firm is, given the resources it currently engages in its production processes. The firm is said to be fully efficient when both its actual and real outputs are the same. In reality however, this virtual firm might not exist due to market imperfections, competition and agency costs. Charnes et al. (1978) building on Farrell's (1957) notion of technical efficiency applies this to several firms with similar production inputs and outputs in a programme.

Previous programmes are non-linear, and this complicates the estimation of the efficiency coefficients. The ratio form of the *CCR* model can be linearised in a programme using constaints. But in the primal form, every *DMU* must be computed separately implying having as many constraints as the *DMUs*. The dual form of this uses the inputs and outputs as constraints and is thus

[6] See Callen and Falk, 1993:63 for derivation of *DEA* technical efficiency indices for non-substitutable technologies).
[7] According to Banker and Maindiratta (1988), the *VRS* technology model is more useful than the *CRS* technology model since an observation that is ranked as inefficient by the former must also deviate unconditionally from profit maximisation.

preferred when analysing many firms. Since there are usually less inputs and outputs than *DMUs*, the dual problem can be more easily solved. If an additional constraint is introduced in the *CCR* model to control for scale effects, this results in the *BCC* model. The derivations of the models are detailed out in text box A4 located in the appendix A2.9.

2.10 Productivity growth

Productivity plays an important role in economics and considerable research is therefore made to its measurement. However, for many researchers, getting data to analyse firms can be very limited as regard to prices and quantities so the use of *DEA* is a welcome tool. Productivity is defined as the ratio of output(s) to input(s). Productivity growth (total factor productivity – *TFP*) is achieved over time with improved productivity ratios and is attributable to three sources: increase in technical efficiency, exploitation of scale economies and technological change (Färe et al., 1994b).

There have been several propositions as to how to derive productivity growth using ratios of outputs to inputs for two or more time-periods. Some of the measures used for computing total factor productivity growth include: the index numbers method such as Paasche, Laspeyres and Fisher quantity and price indices, and Törnqvist (translog) indices; production theory based measures such as the Malmquist indices; cost function based measures; net revenue function measures, and; the Divisia approach. Growth accounting (Solow, 1957) also provides a residual measure of total factor productivity growth.

Related to the work of Färe et al. (1989) is that of Aly and Grabowski (1988) about input usage. These authors decompose productivity change into input usage, technical change and technical efficiency change to explain overall growth. Firm-level productivity growth in part has been linked to good corporate governance (Bartelsman & Doms, 2000; Köke & Renneboog, 2002). *TFP* indices can also be computed from the results of *DEA*. The *DEA* methodology found in Simar and Wilson (1999: 460:462) with an input-oriented Malmquist *TFP* index between period t_2 and period t_1 is adapted for the literature review.

Consider that firms in a particular industrial sector produce *m* outputs from *n* inputs. Let $x \in \Re_{+}^{n}$ and $y \in \Re_{+}^{m}$ respectively denote input and output vectors. The production possibilities set at time *t* is given by the closed set

$$\wp^{t} = \{(x, y) \mid x \text{ can produce } y \text{ at time } t\}, \tag{2.10.1}$$

and this may be described in terms of sections

$$\chi^{t}(y) = \left\{x \in \Re_{+}^{n} \middle| (x, y) \in \wp^{t}\right\}, \tag{2.10.2}$$

regarding its specific input obligations. Simar and Wilson (1999) refers to Shephard's (1970) discussion on the assumptions made concerning $\chi^{t}(x)$ and $\wp^{t}$. They adopt $\chi^{t}(y)$ which is convex for all *y*, *t*; that all production requires use of some inputs given as $0 \notin \chi^{t}(y)$ if $y \geq 0$, $y \neq 0$; and that both inputs and outputs are strongly disposable.

Now, let subscript *i*, *i* =1,…..,*N*, denote a *DMU i*; the *N* firms are each observed at the same to points in time. The Shephard's input distance function for firm *i* at time t_1, relative to the technology existing at time t_2, is defined as

$$D_{i}^{t1|t2} \equiv \sup\left\{\theta > 0 \left| x_{it1})\right.\right\}. \tag{2.10.3}$$

The distance function $D_{i}^{t1|t2}$ gives a normalised measure of distance from the *i*th *DMU*'s position in the input/output space at time t_1 to the boundary of the production set at time t_2 in the hyperplane where outputs remain constant. Färe et al. (1992) give the Malmquist productivity index as

$$M_{i}(t_1, t_2) \equiv \frac{D_{i}^{t_2|t_2}}{D_{i}^{t_1|t_1}} * \left(\frac{D_{i}^{t_2|t_1}}{D_{i}^{t_2|t_2}} * \frac{D_{i}^{t_1|t_1}}{D_{i}^{t_1|t_2}}\right)^{(1/2)}, \tag{2.10.4}$$

where $t_2 > t_1$. Values $M_i(t_1,t_2)<1$ indicate improvements in productivity between t_1 and t_2. Values $M_i(t_1,t_2)=1$ indicate no change while values $M_i(t_1,t_2)>1$ indicate productivity loss. The ratio $D_{i}^{t_2|t_2} / D_{i}^{t_1|t_1}$ in equation (2.10.4) measures the input-oriented technical efficiency change between the two periods. The ratio $\left(D_{i}^{t_2|t_1} / D_{i}^{t_2|t_2} * D_{i}^{t_1|t_1} / D_{i}^{t_1|t_2}\right)^{(1/2)}$ in equation (2.10.4) measures the input-oriented technical change. If this ratio is more (less) than unity, there is technical progress (regress) and equal to unity indicates no technical change within the period.

In reality, the index in equation (2.10.4) is unobservable and must be solved. Substituting an estimator for the true distance function yields $\hat{M}_{i}(t_1, t_2)$. This requires estimating $\wp^{t}$ and $\chi^{t}(y)$. For the sample $\xi_n = \left\{(x_{it}, y_{it}) \mid i = 1,......, N; t = 1,2\right\}$ of observations on N firms in two periods, $\wp^t$ can be calculated by the canonical hull of the sample observations based on constant returns to scale assumptions of the production technology. The corresponding estimate of the input obligation set is

$$\hat{\chi}^t(y) = \left\{x \in \Re^n \;\middle|\; y \le Y^t q, x \ge X^t q, q \in \Re_+^N\right\}, \tag{2.10.5}$$

where $Y^t = [y_{1t}....y_{Nt}]$, $X^t = [x_{1t}....x_{Nt}]$, with x_{1t} and y_{1t} respectively denoting (nx1) and (mx1) vectors of observed inputs and outputs, and q is an (Nx1) vector of intensity variables. This implies the distance function estimator

$$\hat{D}_i^{t_1|t_2} \equiv \sup\left\{\lambda > 0 \;\middle|\; x_{it1} / \lambda \in \hat{\chi}^{t_2}(y_{it1})\right\}, \tag{2.10.6}$$

and this may be computed by solving the linear programme

$$(\hat{D}_i^{t_1|t_2})^{-1} = \min\left\{\lambda \;\middle|\; y_{it1} \le Y^{t_2} q_i, x_{it1} \ge X^{t_2} q_i, q_i \in \Re_+^N\right\}, \tag{2.10.7}$$

where t_1 (<,=,>) t_2.

Rather than using the canonical hull which imposes a constant returns to scale production technology, the free disposal hull of the sample observations can also be used, relaxing the assumption of constant returns to scale. Thus the corresponding estimate of the input obligation set of equation (2.10.5) can be rewritten imposing a restriction to a variable returns to scale production technology of $i'q$=1 in equation (2.10.8) where i' is an (1xN) vector with all the coefficients equal to unity as follows

$$\hat{\chi}^t(y) = \left\{x \in \Re^n \;\middle|\; y \le Y^t q, x \ge X^t q, i' q = 1, q \in \Re_+^N\right\}, \tag{2.10.8}$$

and the distance function estimated with equation (2.10.6) may then be computed by solving the linear programme

$$(\hat{D}_i^{t_1|t_2})^{-1} = \min\left\{\lambda \;\middle|\; y_{it1} \le Y^{t_2} q_i, x_{it1} \ge X^{t_2} q_i, i' q_i = 1, q_i \in \Re_+^N\right\}, \tag{2.10.9}$$

where t_1 (<,=,>) t_2.

2.11 Limitations and recent advances in DEA

A major difficulty of performance measurements is by defining the robust measures of inputs and outputs. In spite of this, it leads to better accountability improvements in the input mix and output quantities depending on the nature of the organisation under consideration. The statistical method assumes an inexact relationship between inputs and outputs due to measurement errors and some other factors. Since the functional form is generally unknown, arbitrary functional forms generate misspecification errors (Althaler & Slavova, 2002). Derivation of inefficiencies in this model can be weak because of production of residuals and the marked influence of outliers. Estimation of functions based on the average of observations overshadows the optimisation aspect as regards to selection of inputs by the different firms. But in *DEA* analysis, reduction of the sample size tends to inflate the average efficiency scores because it creates fewer organisations to compare with. Inefficient organisations might therefore end up on the frontier by default (*NSW* Treasury, 2001).

Unlike parametric approaches, *DEA* makes no assumption of the distribution of the underlying data and all deviations are assumed to be due to inefficiency (Banker et al., 1989a). This prevents such *DMU*s to be used as benchmarks. Their presence may also mask the performance of other *DMU*s. Simar and Wilson (2007) also point out that estimated efficiency values derived through *DEA* are serially correlated because of a lack of a coherent data generating process. Several authors (such as Avkiran, 2007; Simar and Wilson, 2007; Liu and Tone, 2008) have provided different sophisticated models aimed at improving the reliability of *DEA* efficiency estimates.

There are three lines under which research in advancing *DEA* has taken depending on maintained assumptions. These are assumptions about the; data generating process, objectives of the firm, and the production technology. Cherchye and Post (2003) discuss these issues in detail. The discussion in this section is based on the assumptions of the data generation process, i.e. sampling errors and error-in-variables. Sampling errors and errors-in-variables reduce the statistical significance of *DEA* estimates and hence recent advances have dealt with the data generating process which comes to the fore when high-quality data are unavailable and sample sizes are small. Knowledge about the sample distribution can be used to construct confidence intervals and correct small sample bias.

There are two ways of treating sampling error. These are analytical asymptotic analysis and bootstrapping. Bootstrapping, which is used in the analysis of the sensitivity of empirical estimators to sampling variations, has received the more attention because of its practical usefulness in multiple input and multiple output space. In bootstrapping, the data generating process is continuously simulated while the original estimator is applied to the simulated samples so that the latter copies the sampling distribution of the former. Simar and Wilson (2007) propose the use of both single and double bootstrap procedures to improve statistical efficiency in second-stage (truncated, rather than other types of) regressions. Errors-in-variables arise as a result of errors in the measurement of inputs and outputs. There are four ways of addressing these problems (Cherchye and Post, 2003): 1) outlier detection [example Wilson, 1995 – for over-efficient but not under-efficient firms]; 2) sensitivity analysis [for example Charnes et al., 1992 – computations of regions of stability]; 3) chance constrained programming [e.g. Cooper et al., 1998], and 4) non-parametric regression [Kneip & Simar, 1996 – kernel estimation; Post et al., 2002 – simple enumeration algorithm].

The algorithm for technical efficiency proposed by Simar and Wilson (2007: 42-44) which takes account of the bias term is now introduced. The convex hull of a free disposal hull of an observed pair (x_i, y_i) contained in ξ_n is used to estimate the production set P. The estimator is described as follows:

$$\hat{P} = [(x, y) \mid y \leq Yq,\ x \geq Xq,\ i'q = 1,\ q \in \Re^n_+], \qquad (2.11.1)$$

where $Y = [y_1......y_n]$, $X = [x_1.....x_n]$, i denotes an (n x 1) vector of ones, and q is an (n x 1) vector of intensity variables. $\hat{P}$ is a consistent estimator of P under a set of eight assumptions found in Simar and Wilson (2007: 34-37). Thus, estimators of the Farrell efficiency measure can be constructed by replacing P with $\hat{P}$ in the right hand side of $\delta(x_0, y_0 \mid P) = \dfrac{\omega(\delta(x_0, y_0|P)y_0)}{\omega(y_0)}$. The estimator of $\delta_0 = \delta(x_0, y_0|P)$ defined as $\delta_0 = \delta(x_0, y_0|P) \equiv \sup\{\delta|(x_0, \delta y_0) \in P, \delta > 0\}$ at a particular point (x_0, y_0)$\in \Re^{p+q}_+$ } can be written in terms of equation (2.11.2).

$$\begin{aligned}\hat{\delta}_0 &= \delta(x_0, y_0 \mid \hat{P}^{\cdot\cdot}) \\ &= \text{maximise } \{\theta > 0 \mid \theta y_0 \leq Yq, \quad x_0 \geq Xq, \quad i'q = 1 \quad q \in \Re^n_+\},\end{aligned} \qquad (2.11.2)$$

Step 1: Using the original data, compute $\hat{\delta}_i = \hat{\delta}(x_i, y_i \mid \hat{P})\ \forall\ i = 1,....,n$ using equation (2.11.2).

Step 2: Use the method of maximum likelihood to obtain an estimate $\hat{\beta}$ of β as well as an estimate $\hat{\sigma}_\varepsilon$ of σ_ε in the truncated regression of $\hat{\delta}_i$ on z_i in $\delta_i = z_i\beta + \xi \ \geq 1$ using the $m<n$ observations where $\hat{\delta}_i$>1.

Step 3: Loop over the next four steps 3.1 to 3.4 L_1 times to obtain n sets of bootstrap estimates $B_i = \{\hat{\delta}^*_{ib}\}_{b=1}^{L_1}$:

Step 3.1: For each i =1,…..,n draw ε_i from the $N(0, \hat{\sigma}^2_\varepsilon)$ distribution with left-truncation at $(1 - z_i\hat{\beta})$.

Step 3.2: Again for each i =1,…..,n, compute $\delta^*_i = z_i\hat{\beta} + \varepsilon_i$.

Step 3.3: Set $x_i^* = x$, $y_i^* = {y_i \hat{\delta}_i}\big/{\delta_i^*}$ for all i =1,…..,n.

Step 3.4: Compute $\hat{\delta}_i^* = \delta(x_i, y_i \,|\, \hat{P}^*) \forall i = 1,....,n,$ where $\hat{P}^*$ is obtained by replacing Y, X in equation (2.11.1) with $Y^* = [y_1^* .....y_n^*],\quad X^* = [x_1^* ......x_n^*].$

Step 4: For each i =1,…..,n, compute the bias-corrected estimator $\hat{\hat{\delta}}_i$ defined by $\hat{\hat{\delta}}_i = \hat{\delta}_i - \hat{B}(\hat{\delta}_i)$ where $\hat{B}$ is the bias. The right hand side of the equation has been achieved by assuming that the variance of a residual diminishes as sample size approaches infinity and hence the residual is typically of a smaller magnitude than the bias for a reasonable sample size. In this case the bootstrap estimator of the bias can be used to construct the bias-corrected estimator $\hat{\hat{\delta}}$ as indicated above. Hence using the bootstrap estimates B_i obtained in step 3.4 and the original estimate $\hat{\delta}_i$, we compute the bias-corrected estimator.

Step 5: Use the method of maximum likelihood to estimate the truncated regression of $\hat{\hat{\delta}}_i$ on z_i, yielding estimates ($\hat{\hat{\beta}}, \hat{\hat{\sigma}}$).

Step 6: Loop over the next three steps 6.1 to 6.3 L_2 times to obtain a set of bootstrap estimates $\kappa = \{ (\hat{\hat{\beta}}^*, \hat{\sigma}_\varepsilon^*)_b \}_{b=1}^{L_2}$:

Step 6.1: For each i= 1,…..,n, draw ε_i from the $N(0, \hat{\hat{\sigma}})$ distribution with left-truncation at $(1 - z_i \hat{\hat{\beta}})$.

Step 6.2: Again for each i= 1,…..,n, compute $\delta_i^{**} = z_i \hat{\hat{\beta}} + \varepsilon_i$.

Step 6.3: Use the maximum likelihood method to estimate the truncated regression of δ_i^{**} on z_i, yielding estimates $(\hat{\hat{\beta}}^*, \hat{\hat{\sigma}}^*)$.

Step 7: Use the bootstrap values in κ and the original estimates $\hat{\hat{\beta}}, \hat{\hat{\sigma}}$ to construct estimated confidence intervals for each element of β and for σ_ε as described below.

Assume that interest lies in β_j, the jth element of β, which has been estimated by $\hat{\hat{\beta}}_j$, the jth element of $\hat{\hat{\beta}}$. If the distribution of $(\hat{\hat{\beta}}_j - \beta_j)$ is known, a_α, b_α can be estimated such that

$$\mathrm{D}[-b_\alpha \le (\hat{\hat{\beta}}_j - \beta_j) \le -a_\alpha] = 1 - \alpha \qquad (2.11.3)$$

for small values of α , 0< α <1. Since the distribution of $(\hat{\hat{\beta}}_j - \beta_j)$ is not known, the *j*th element of each bootstrap value $\hat{\hat{\beta}}$ can be used to find a^*_α , b^*_α such that

$$\mathrm{D}[-b_\alpha \le (\hat{\hat{\beta}}^*_j - \hat{\hat{\beta}}_j) \le -a^*_\alpha] = 1 - \alpha \qquad (2.11.4)$$

with improving approximation as $L_2 \to \infty$. Substituting a^*_α, b^*_α for a_α, b_α in equation (2.11.2) leads to an estimated confidence interval $[\hat{\hat{\beta}}_j + a^*_\alpha,\ \hat{\hat{\beta}}_j + b^*_\alpha]$. STATA can be used to estimate truncated regression models after the software *FEAR* has been used in obtaining bias-corrected technical efficiency estimates.

In the case of Malmquist productivity indices, the standard errors and confidence intervals of the indices are calculated from the simulated distributions of the corresponding indices in the pseudo-samples. The procedure can also give bias-corrected estimates of the Malmquist indices, but these may have a larger variance than the original estimates. Some applications of the bootstrap method can be found in Odeck (2006) for the transportation sector in Norway and Tortosa-Ausina et al. (2008) for Spanish savings banks.

2.12 DEA input and output specification

A difficulty with *DEA* application is the choice and specification of inputs and outputs. Recall in section 2.7 that the inputs and outputs involving corporate governance and performance are varied. From the initial introduction of *DEA* being appropriate for use in public sectors and non-governmental organisations, recent research in *DEA* applications reveal that it is not only used to determine which organisations are more effective but aggregating endogenously related variables (Lehmann et al., 2004).

In corporate governance studies, in addition to the studies mentioned in section 2.7, Lauterbach and Vaninsky (1999) estimate technical efficiency through *DEA* by net income as output, and ratio of equity to net income, total firm asset, *CEO* pay, pays of four other top managers, and leverage (debt to equity ratio) as inputs; Sheu and Yang (2005) estimate technical efficiency through *SFA* by annual net sales deflated by wholesale price index as output, and labour (number of workers), capital (net fixed assets), and materials as inputs. In terms of productivity growth, Curcio (1994) estimated *TFP* growth by real value added by employee remuneration plus interest payment; Nickell et al. (1997)

use the change in logarithm of real sales, and; Galve-Górriz and Salas-Fumás (2005) use the ratio of assets to employees.

The choice of variables therefore depends on the researcher, data availability and whether the data will capture the phenomenon being investigated. Additionally, in publicly-listed or private firms, whether one imposes an input, output or combined orientation depends on market conditions. Individual firms trading in a non-monopolistic economy cannot by themselves alter volume of optimal outputs. It is therefore preferable to impose an input orientation to maximise technical efficiency as internal mechanisms can be controlled more than a world of uncertainty.

2.13 Chapter summary

We introduced the chapter with corporate governance mechanisms that exist in some European countries as well as how major corporate scandals in Europe and the *US* have led to the inactment of corporate governance codes and indices the world over. Governance indices are what are used when preparing new codes and these involve all important aspects of corporate governance. Since it is difficult to prepare such an index by an individual to use for a large cross-sample, we went on to explain the concepts of those aspects of the index that we will employ in this study, relating these to performance.

We have discussed both insider and outsider ownership concentration and the identities of the latter. We have also explained board size and board independence and their effect on performance, bearing in mind that the role of board outsiders is intricately linked to the size of the board. We then finished off the discussion on board characteristics by arguing whether *CEO*-board chairman duality or separation has the better influence on performance. The financial structure of a firm which is a significant aspect of a firm's governance mechanism has been treated. Investor protection which shapes how top management and the board relate to shareholders has been seen as an important ingredient for successful novel corporate governance introductions.

Variables that have been used in the literature in corporate governance studies and performance have been detailed out. We discussed market valuation as a performance measure that has been the most used in analysing listed firms. We have introduced and discussed the concept of data envelopment analysis and how it is used to analyse technical efficiency and productivity growth. Most of the studies on governance of listed firms have been done with market valuation and profitability and have witnessed conflicting results. We discussed the few studies that have used technical efficiency and how it would be useful as an added measure of firm performance. In the next chapter, we evolve the conceptual framework to develop our hypotheses based on our research questions and consequently begin an extensive statistical analysis in Chapter Four.

3. CONCEPTUAL FRAMEWORK

3.1 Introduction

The literature review of corporate governance reveals that the conceptual framework of analysis is positive agency theory. Recent literature however suggests that complementing this theoretical trend with institutional theory can mitigate the inconsistencies in results obtained via this approach in different institutional contexts. The stakeholder approach has also been applied. This chapter first gives an overview of trends in agency theory. Agency theory predicts that governance mechanisms (such as the ownership structure of the firm, the financial policies pursued by a firm, the composition and functions of the board of directors and even the competitive environment of firms, and legal protection rights of minority investors) are important issues that affect performance. The general validity of this theory can be better made on firms that have different corporate governance mechanisms.

The analysis of corporate governance mechanisms in the agency theory framework is reviewed here. Concepts like opportunism and self-interestedness are discussed. The limitations of agency theory are then given, and the hypotheses under this theory given. How positivist agency theory can be complemented by the institutional approach is discussed and the remaining hypotheses are derived under the institutional theory framework. Institutional theory is then detailed out. Earlier proponents of institutional theory posit that social reality is a human construction created through repeated interactions. Institutional theory considers conformity to institutions as well as conflicts and changes in social structure. The key developments and concepts like institutional change, deinstitutionalisation and neo-institutional theory are discussed in this chapter (and its text box A4[8]). The use of institutional theory in analysing corporate governance is also elucidated.

3.2 Agency theory

According to Fama and Jensen (1985), if there are fully competitive markets for products, labour and corporate control, there would be no costs of agency as self-interested managers will maximise their wealth by maximising shareholder value. In a more practical world, and especially in circumstances where there is very little market discipline and effective governmental policies, governance

[8] We provide an exhaustive write-up on institutional theory in the appendix. Here, we complement this theory with agency theory and discuss such terms as deinstitutionalisation and institutional change.

mechanisms serve to reduce conflicts between shareholders and managers, and controlling shareholders and minority investors.

The key assumptions (of self-interestedness, bounded rationality and risk aversion) and framework of agency theory have been given in Eisenhadt's (1989 and Wright et al., 2001) seminal work in defending the use of this approach and this is summarised in table 3.

Table 3: An overview of agency theory

Key idea	Principal-agent relationships should reflect efficient organisation of information and risk-bearing costs.
Unit of analysis	Contract between principal and agent.
Human assumptions	Self interest; bounded rationality; risk aversion.
Organisational assumptions	Partial goal conflict among participants; efficiency as effectiveness criterion; information asymmetry between principal and agent.
Information assumptions	Information as a purchasable commodity.
Contracting problems	Moral hazard and adverse selection; risk sharing.
Problem domain	Relationships in which the principal and agent have partly differing goals and risk preferences.

Source: Eisenhadt (1989: 59)

Agency theory predicts that, considering moral hazard and adverse selection problems, organisational exchanges should reflect information and risk-bearing costs if the organisation is to remain efficient. There are two forms of agency theory, the less stringent form of positivist agency theory mainly used in analysing corporate governance mechanisms, and the more general mathematically underpinned principal-agent approach which critically examines alternatives made under the positivist approach to make measured choices based on conceptualised reasoning.

Positive agency theory initially considered the conflicts and congruencies between external providers of capital (principal) and the manager of the firm (agent). It has now been extended to analyse the relation between large (both internal and external) and small capital providers. It argues that the agent has information that is privy and tends to use this to appropriate more of the surplus rents. Principals are however aware that agents do not make all information available to them and thus there is a conflict of interest where both relevant actors end up worse off than the outcome if they had shared all available information (social trap or moral hazard problem). This often leads to principals ending up with the adverse selection problem since they do not really know who the better agents are, as well as incurring the costs of agency.

Agency costs are the costs involved in writing and enforcing contracts to ensure congruence of the relevant actors (see figure 2) and has been the key issue in most existing studies on corporate governance and firm performance (Lee, 2004). Agency theory points to the fact of minimising this moral hazard problem between owners and managers by way of controls. But monitoring is costly so owners attempt to develop incentive contracts to align their interests with those of employee managers. Agency theory dwells on self-interest rather than blatant opportunism as has been argued by antagonists and these two concepts are examined below.

3.2.1 Opportunism versus self-interestedness

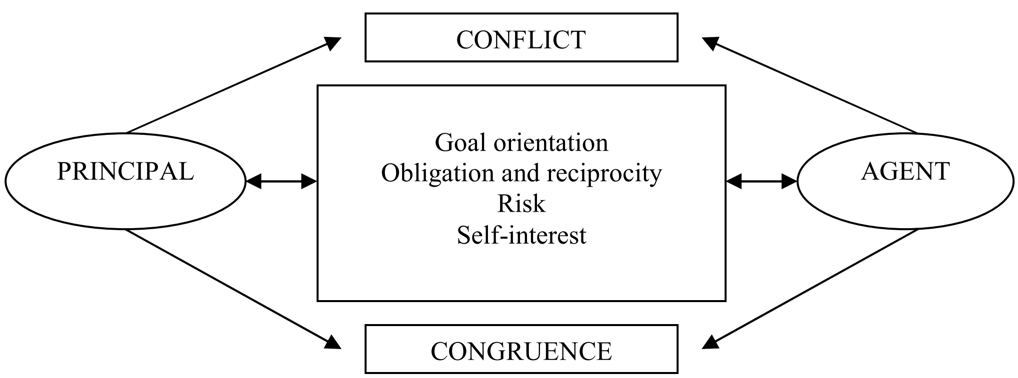
Popov and Simonova (2006) use various explanations of opportunism to characterise it into five categories: 1) that the relevant parties have incongruent interests; 2) that information is asymmetrical leading to the party with information having an unfair advantage that can be used to siphon more of the economic rents; 3) that asymmetric information can be manipulated so as to prevent the affected parties from disciplining the agent; 4) that the other parties might have the usefulness of the information reduced, and; 5) that operations may be premeditated and the necessary information on the operational process distorted in the process. They thus see opportunism as a deliberate hidden operation of the agent based on asymmetric information to achieve personal benefits at the detriment of the other relevant parties to the contract. Bruce et al. (2005) in their analysis about pay-performance sensitivity also concur with Popov and Simonova.

In a response to some criticisms by Bruce et al. (2005) about agency theory, Gomez-Meija et al. (2005) intervene in making more clearly, the assumptions under which agency theory is derived. They argue that agency theory is underpinned by the self-interestedness of organisational actors which does not necessarily reflect opportunism (and that it can manifest as opportunism under certain conditions). This theory does not consider the sensitivity of the resulting relationships that are modelled on it, and it does not explicitly recognise specific contextual factors, hence its generalisation and adaptation to the institutional context in which it is applied. Thus, for example, compensation to agents for objective performance may not be related depending on the institutional context (for instance Anglo-Saxon versus continental models of corporate governance, or civil law versus common law regimes as discussed under the section on investor protection).

Gomez-Meija et al. (2005: 1508) therefore define opportunism as “the adaptation of one’s actions to circumstances in order to further one’s immediate interests, without regard for basic principles or consequences." Opportunism is seen as non-rational behaviour in which the relevant agents heavily discount the future for immediate rewards. They argue that self-interest is rational and regards principles and consequences. Hence self-interest has a factor of compromise and tolerance. Self-interest can therefore lead to cooperation in the long-term if that is what optimises performance but opportunism does not mostly lead to cooperation.

Agency theory is therefore associated with finding a balance between conflict and congruence by addressing the issues of goal orientation, obligation and reciprocity, risk, and self-interest (Wright et al., 2001; see figure 2).[9] The larger a firm becomes, the more it gives rise to agency costs. This is probably why concentrating ownership leads to better performance. Looking inside the firm, the manager also faces agency costs from his subordinates, hence *ceteris paribus*, the bigger the firm, the more potential agency costs and the less productive will be the firm. Large firms however, command high market shares, scale and scope economies that may still make them perform better than smaller firms, hence empirical investigations of ownership concentration using different firm sizes may not necessarily support the hypothesis.

Figure 2: The principal-agent relationship



Source: Wright et al. (2001)

Managerial self-interest reduces the amount of resources that investors may wish to provide. Managers may engage in excessive perquisites and private benefits at the detriment of shareholders because they are privy to information they fail to share (Shleifer & Vishny, 1997). This cut-back on funds by investors is the agency costs of equity espoused in Jensen and Meckling (1976). The increased managerial ownership reduces non-beneficial projects since the manager has to bear some risks as a consequence of his actions. Managerial/controlling shareholder self-interest (investor

[9] See Wright et al. (2001) for an extensive discussion of these four issues.

expropriation or resource misallocation) reduces the value of the resource that (minority) investors are willing to put up for firm financing (Shleifer & Vishny, 1997). Investors therefore have to put some form of control in order to eschew ex-post misallocation or misappropriation of funds by managers. In doing so, they may stifle the independence of managers to be able to embark on efficient projects. Hence it is not only a one-sided issue of agents always the ones to blame for firm inefficiency or under-performance. Minority investors also look for protection from the legal environment or by good governance practices by the firm before making additional investments, unless the firm still performs well.

3.2.2 Limitations of agency theory

Agency theory has been criticised to exhibit a dyadic relationship overlooking diversities within the relevant actors and their interdependencies. Share owners are usually considered as monolithic in that their knowledge of managerial discretion and ability to monitor are about the same. Labour contracts are not exogenously determined as implied, and interfirm ownership and networks all make the dyadic reductionism inadequate (Aguilera & Jackson, 2003). In reacting to justification of agency theory, one needs to know the extent of sunk costs of the relevant stakeholders. Investments by shareholders are largely sunk (Shleifer & Vishny, 1997; La Porta et al., 2000) and they stand to be the most expropriated by management so the biggest agency costs and conflicts that lead to the decrease of firm value are expected to occur. Other stakeholders (like employees, community members and creditors) are in a better position to quit when they feel cheated.

3.3 Mechanisms of reducing agency costs

Mintz (2005) agrees with the fact that the agency problem between shareholders and management can not be perfectly solved but in practice, the compensation of management (in the form of stock issues option and long-term incentive packages) is often tied to the economic performance of the firm. Financial reporting (using independent auditors) and assessing internal controls (that serve to safeguard company assets) are measures that are taken to control managerial discretion although the board of directors have to be diligent in monitoring management to make this effective. The agency problem between controlling shareholders and minority investors, in practice, is reduced by investor protection laws. Firms operating in countries with high degrees of laws protecting investors generally perform better than firms in countries with low investor protection. This section considers the mechanisms of reducing agency costs in formulating the hypotheses.

3.3.1 Shareholding concentration

Empirical support for the effect of external block holdings on performance has been very mixed as this shareholding type has both benefits and costs that need to be considered but have an unspecified relationship within an agency theoretical framework. Adapting the review by Bøhren and Ødegaard (2004), the benefits are threefold: 1) that minority investors ride less freely (Shleifer & Vishny, 1986); 2) that there is a high takeover premium (Burkart, 1995), and; 3) that there is more effective monitoring of managers (Jensen & Meckling, 1976; Demsetz & Lehn, 1985; Shleifer & Vishny, 1986). The costs of large external blockholdings are fourfold: 1) there is reduced management initiative (Burkart et al., 1997); 2) firm's market liquidity is reduced (Brennan & Subrahmanyam, 1996; Holmstrom and Tirole, 1993; Chordia et al., 2001); 3) there are increased conflicts between the block and minority share owners (Shleifer & Vishny, 1997; Johnson et al., 2000) and; 4) there are lowered benefits of diversification (Demsetz & Lehn, 1985).

Friend and Hasbrouck (1988), and Friend and Lang (1988) suggest that insider shareholders are more concerned with the continued good performance of their firms because they have a greater non-diversifiable risk to debt than to outside shareholders and institutional investors who have a well-diversified portfolio. Higher insider ownership is therefore associated with minimum risks to capital structure (Bathala et al., 1994). The more the ownership stakes by insiders, the lesser the need for outside large owners to monitor managerial discretion. Block holding insiders have a convergence of interest with management and thus enhance performance.

In large firms, there are several owners and an agency perspective details that some of these owners will free-ride at the expense of others since they do not have the incentives to monitor management. Concentrating ownership is therefore hypothesised to have a positive relationship with firm performance as these large owners have the incentives to monitor managerial discretion.

H1: The performance of a firm increases with increasing ownership levels.

Monitoring and expropriation hypotheses

But as Mørck et al. (1988) put forward, block holding insiders most often become entrenched and expropriate outside owners and minority investors (the entrenchment and expropriation hypotheses). Demsetz and Lehn (1985) and Cho (1998) empirically find different points as to diminishing returns of insider blockholdings as tenure and charisma are all sources of insider power (Bøhren & Ødegaard, 2004). Bøhren and Ødegaard (2004) therefore suggest that the negative entrenchment effects of insider ownership decreases when the stakes are sufficiently large and therefore governance theory needs to specify and set restrictions on components' benefits and costs before any relationship to performance can be determined.

From the agency theoretical perspective, managers have interests that conflict with firm owners and that their self-interestedness conflict with outside owners. When managers have shares in a firm, their interests converge with that of other outside owners of the firm and firm value is supposed to increase. Significant ownership by insiders however has its costs as the non-diversifiable risk also increases. Although the literature suggests that the market for managers and other external disciplinary mechanisms does force managers to pursue value maximising objectives, when a manager owns significant shares and therefore voting power, he may satisfy other personal non-value maximising objectives that still secure his job and benefits.

Shleifer and Vishny (1997) also argue that concentrating ownership may allow large shareholders to connive with management to expropriate minority shareholders. The monitoring and expropriation hypotheses therefore suggest that concentrating ownership might have a non-linear effect on firm performance and is dependent on the institutional setting of a country. De Miguel et al. (2004) rely on theoretical arguments of non-linearity in the relationship between corporate ownership and value to derive optimal breakpoints in two empirical models. The first model exhibits a quadratic relationship between firm value and ownership concentration confirming monitoring and expropriation effects of highly concentrated ownership. The second model is of the relation between value and insider ownership, where they confirm the entrenchment and convergence-of-interest effects. They use instrumental variable estimator and generalised method of moments as their regression methods and find that Spanish insiders get entrenched at higher ownership levels than studies from the *UK* and *US* indicate.

In Drobetz et al. (2004a; see also Gugler, 2001; Yeh & Woidke, 2005), there is discussion about the positive effect of incentives with increasing cash flow rights of large shareholders. At the same time, entrenchment effect is negative as the voting rights of large shareholders increase. To this regard, mechanisms that enhance good corporate governance may not be in the interest of largest shareholders. Therefore according to Drobetz et al. (2004a), at low to intermediate levels of shareholdings, large shareholder entrenchment effect outweighs the incentive effect and the relationship is negative. At high shareholding concentration, the incentives to adopt good governance codes outweigh that for entrenchment and a positive relationship should hold. In addition to *H1*, we also test for a non-linear relationship where we hypothesise a convex relationship of ownership concentration with performance; based on the observation by Drobetz and colleagues.

As a final note to the ownership-performance dilemma, Cheng and Firth (2005) and Firth et al. (2006) suggest it is more difficult to monitor firms with growth opportunities and recommend that other measures such as performance-pay incentive schemes are appropriate when dealing with ownership and performance. Using data for *UK* property companies, Ooi (2000) shows that the divergence of shareholding and management increases with firm size, risk and growth rate and decreases with firm performance. Myers and Rajan (1998; and Pinkowitz et al., 2006) argue that among all firm assets, liquid assets can be converted to private benefits at lowest costs to managers with control rights or other controlling shareholders. So controlling owners from an agency perspective will over-invest in liquid assets. This has been confirmed with empirical investigations by Dittmar et al. (2003) and Kalcheva and Lins (2004). Liquid assets' is therefore an important variable in the relationship that concentrated ownership has on performance.

3.3.2 Identity of shareholders

Jensen and Meckling (1976) and Shleifer and Vishny (1997) argue that individual owners with direct shareholdings are thought to have more congruence with managers than those with indirect holdings through intermediaries – like other firms or the State. Pound (1988) argues that if negative incentives due to delegated monitoring do not offset the lower monitoring costs of institutions, institutional owners can outperform individual owners.

Foreign owners have also been argued to invest offshore so as to diversify their portfolio not doing much to improve the governance mechanisms in their target foreign firms (Brennan & Cao, 1997). Foreign owners have an informational disadvantage since their portfolio is biased toward domestic firms. Therefore increasing shares by foreign owners reduces monitoring of managers and lead to decreased economic performance (Bøhren & Ødegaard, 2004). De Jong et al. (2005) report a negative relationship of industrial shareholders on firm value. In section 2.4.2 we have already discussed the different types of ownership categories and their differing effects on performance as reported by prior empirical investigations. We hypothesise a general differing effect of different types of ownership categories (such as individuals/families, financial firms, publicly-listed firms, industrial companies and the State) on performance.

H2: The identity of a shareholder impacts on firm performance

3.3.3 Size of the board of directors

Board structure is instrumental in the monitoring efficiency of internal governance mechanisms. Empirical studies on board size reveal a link with performance (Anderson et al., 2004; see also issue number six in table A13, one of these studies report a non-monotonic increasing effect of board size with performance). The size of the board is often more than what is needed to operate effectively. The larger a group, the more conflicts of interest it is to arrive at a decision and empirical studies have shown that there is an ideal board size, beyond which firm value is decreased (Jensen, 1993; Lipton & Lorsch, 1992). Anderson et al. (2004) also show that the cost of debt is lower for larger boards and argue that banks presume that larger boards lead to effective monitoring of the firm's accounting processes. Brown and Caylor (2004) also propose that a board size of between six and fifteen members is the most ideal for improved firm performance. This is in line with agency theoretical predictions from the point of view of shareholders. The Conthe code of good governance of Spanish firms for instance recommends that board sizes be reduced and more non-executive directors be introduced.

Studies that find a negative relation between board size and performance include: Yermack (1996) with a valuation measure; Eisenberg et al. (1998) with profitability as a performance proxy in a Finnish *SME* study; Carline et al. (2002) with operating performance in the aftermath of *UK* company mergers, and; Mak and Yuanto (2002) with Tobin's *Q* as performance proxy for Singaporean and Malaysian firms. Dahya et al. (2008) find a positive relationship between board size and firm value. Aggarwal et al. (2007) find no support that board size affects board value. Renneboog (2000) does not find board size to have an effect on managerial disciplining when performance is poor. From the agency theory perspective however, larger board sizes should negatively affect firm performance.

H3: The size of the board of directors is negatively related to performance.

In addition to *H3*, we also test for non-linearities where we hypothesise a concave relationship with performance. That is to say that board sizes from five to fifteen members perform better than that with less than five and that with greater than fifteen members.

3.3.4 Board independence

Board outsiders are perceived to play a more monitoring role on the board than insiders because of their independence and reputation in the labour market for directors (Fama & Jensen, 1983). From an agency theoretical view point, a positive relationship is therefore expected in the effect of board independence on performance. Hossain et al. (2001) find a positive relationship between the proportion of outside directors and firm performance. Aggarwal et al. (2007) report higher firm value associated with firms that have an independent board. Higher non-executives on the board lead to a higher replacement of management when performance is poor (Renneboog, 2000). Dahya et al. (2008) find that board independence positively affects firm value although firm value does not seem to affect board independence. Issue number six in table A13 also reports some studies that find a positive relationship.

By contrast, Agrawal and Knoeber (1996) find board outsiders to significantly reduce firm value. Franks et al. (2001) find in their study of poorly-performing *UK* firms that boards dominated by outsiders obstruct disciplining under-performing managers. In a Dutch study of the effect of corporate governance recommendations and monitoring (The Peters Committee Monitoring Report), De Jong et al. (2005) report that the supervisory board made entirely of outsiders has a negative relation with firm value (significantly lower Tobin's *Q*). This, they attribute to the wider separation of ownership and control. These three studies point to a negative relationship between board independence and firm performance. These findings are contrary to empirical investigations that generally find outsiders to have more incentives to monitor the management board, since they are not entrenched.

Kang and Shivdasani (1995) are unable to detect any specific relationship between outside directors to performance in their Japanese study. Therefore, Dwivedi and Jain (2004), based on the contradicting evidences available, propose a monitoring and disinterestedness (due to being employed part-time and their other dedications) hypothesis where performance is influenced when the board independence is low and performance is decreased when the board independence is high.

We follow the generally accepted "monitoring hypothesis of board outsiders" and the resulting positive impact on performance.

H4: Board independence increases firm performance.

3.3.5 *CEO*/chairman separation

CEO – board separation also indicates how independent a board is, as a *CEO* who is also the chairman of the board of directors wields too much control that can promote entrenchment and subsequent abuse of power. The abuse of power however relates to the institutional set-up a firm finds itself. Agency theory predicts a negative relationship between *CEO*/board chairman duality and performance. Bozec and Dia (2007) find a negative relationship. In another stream of reasoning, a non-executive chairman has no superior knowledge of the firm's internal and environmental terrain than the firm's executive officers. Some researchers (for example Finklestein & D'Aveni, 1994) therefore argue that a unified leadership (duality) improves firm performance. Empirical studies have produced very mixed results (Dalton et al., 2004; Kang & Zardkoohi, 2005). Aggarwal et al. (2007), for example, find no effect of *CEO*/chairmanship (non-)duality on firm value. We hypothesise that duality negatively impacts on performance as seen in the development of corporate governance indices.

H5: CEO-board chairman separation positively impacts on performance.

3.3.6 Financial policy

Faulkender and Wang (2006) discuss how corporate financial policy affects the value shareholders place on cash. Key elements of financial policy include the choice of debt level, the maturity structure of debt, and the types of restrictive covenants in the indentures. Billet et al. (2007) remark that an important feature of the financial policy choice is that it is jointly determined as a function of firm characteristics and the contracting (or institutional) environment. Most studies control for the effect of corporate governance on performance with financial policies (see for example Cho, 1998; Demsetz & Lehn, 1985; McConnell & Servaes, 1990; Mørck et al., 1988). Bøhren and Ødegaard (2004) however argue and use the financial policy as part of a firm's corporate governance mechanisms. Financial policy can be used to limit managerial discretion over free cash flow when debt financing is encouraged by the board of directors. This leads to high dividend payouts which also force firms to issue new shares that may encourage further monitoring. In so doing, owners use high leverage and high dividend payouts to reduce agency costs (Easterbrook, 1984; Bøhren & Ødegaard, 2004).

Using Jensen's (1986) over-investment and Myers' (1977) under-investment arguments, Stulz (1990) also builds up a proposition that debt can have both positive and negative effects on firm value. Prior studies examining this relationship between debt and valuation with different opportunities for growth include McConnell and Servaes (1995), Jung et al. (1996), Barclay et al. (2003, 2006), Harvey et al. (2004), Alonso et al. (2005), and Aggarwal and Kyaw (2006). These studies argue that for high-growth firms, high leverage results in a decrease in firm value whereas it results in increased value for low-growth firms. Barclay et al. (2003) point out that higher debt results in lower firm value for firms with more growth opportunities and higher firm value for firms with greater assets; hence low-leveraged firms have the greater impact on valuation.

The literature has mostly tackled the value impact of debt/high-leverage in single countries. Aggarwal and Kyaw (2006) extend this to a cross-country influence with the sane argument that institutional and financial considerations affecting the types and levels of agency costs differ. They refer to the study of Japanese firms by Jo et al. (1994) where a positive relationship is observed between leverage and growth opportunities. Specifically, Aggarwal and Kyaw (2006) investigate the value impact of debt for high and low growth firms in twenty six countries for a fourteen year period, 1990-2003. They report debt to be value-decreasing in high growth firms and value-increasing in low-growth firms and that the relationship is stronger in countries with poor institutional and financial frameworks and their consequent high costs of agency.

Other studies that have observed a negative relationship between leverage and firm value moderated by high-growth opportunities (and positive relationship with low-growth opportunities) include Corby and Stohs (1998 for Ireland), Gul (1999 for Japan), Burton et al. (2000 for the *UK*), Harvey et al. (2004 for emerging markets), and Alonso et al. (2005 for Spain).

H6: High levels of debt to equity decreases firm performance

In other words, *H6* implies that in firms with high growth opportunities, high levels of debt result in a decrease in firm performance since debt can either have a positive or negative effect based on investment opportunities as espoused by Stulz (1990) and Aggarwal and Kyaw (2006).

3.4 Complementing agency theory with institutional theory

Inconsistent support for agency theoretical predictions on indicators of corporate governance effectiveness has necessitated an expansion of this orthodox approach to embrace other theories that serve to complement and expand the conceptual framework of analysis. Jensen (1993), for example, argues for the separation of board chairman and *CEO* functions. Such studies involving *CEO*/chairman duality has revealed inconsistencies when approached from an agency theoretical perspective (Coles & Hesterly, 2000; Conyon & Murphy, 2000; Kang & Zardkoohi, 2005). Kang and Zardkoohi's survey on related empirical articles supports this view. Young et al. (2000) use this expanded framework in studying the performance evaluation of *CEO*s by the board of directors. Lutbakin (2007) also makes valid arguments in this light supporting an earlier study (Lubatkin et al. 2005) as to how institutional embeddedness creates inconsistent agency theory predictions.

Gomez-Meija et al. (2005) and Aguilera and Jackson (2003) agree on the usefulness of institutional theory in extending models within an agency theoretical framework because of contextual influences so as to be able to develop and operationalise "key constructs" like the nature of self-interest and the oversight responsibilities available to principals. The organisational culture might impact on how the agency problem is constructed. A firm where trust can be developed among other elements reduces governance conflict issues. National cultures, institutional and regulatory frameworks all affect agency theory predictions.

Aguilera and Jackson (2003) relate institutions to agency theory by indicating that the former shapes how conflicts and coalitions evolve and are managed. A coalition between external shareholders and employees can force management to be more transparent or align the management's interests closely to the other stakeholders. In terms of liquidity and financial returns, insiders might also conflict with external minority shareholders, an issue that external members of the board are roped in to help control.

Thus through conformity to social norms as stipulated under institutional theory, self-interested individuals might prefer to cooperate rather than be opportunistic. The conformity of actors to basic principles and consequences serves to link agency theory with institutional theory. Viewed in this light, when agents try to conform to social norms (society) or personal values, they create some costs of agency in some other areas of the organisation. But streamlining self-interest to social expectations distinguishes it from blatant opportunism. When information asymmetry is high, agents have the incentive to be opportunistic since the principal or the society may not have the information to show concern. The contract between an agent and principal and the mechanisms of enforcement and their self-interests are normatively embedded and might not thus be the most economically rational.

Gomes (2000: 615) indicates that "in many countries the relevant corporate finance issue is not the traditional agency problem between management and shareholders, but rather the agency problem between controlling shareholders and minority shareholders" for two main reasons: 1) governance structure of public firms shields active large shareholders from hostile takeovers or monitoring, and 2) there is no provision in the legal framework for protection of minority investors. We now focus our extension to the conceptualisation of institutional theory.

3.5 Institutional theory

In addition to the neoclassical view that firms are constrained by information, finance and technology, institutional theory adds socially constructed limits like norms and rules – as obliged and justified by society – that affect economic choices (Oliver, 1991 & 1997a). Emphasis on institutional theory can be from the regulatory perspective (Williamson, 1975; North, 1990), normative perspective (Parsons, 1934/1990) or cultural-cognitive approach (Meyer & Rowan, 1977; DiMaggio & Powell, 1983 & 1991; Zucker, 1987; Scott, 2001). Institutional theory derives from path dependence of economic changes and Powell (1991) provide three factors that are part of events or influences that shape this process: interrelationships of strong technology; increasing returns to scale, and; investments in learning that take on a measure of irreversibility.

DiMaggio and Powell (1983) provide an explanation for processes that tend to make organisations more similar but with varying levels of firm efficiency. They settle on *isomorphism* which is defined as "a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions"(Ibid: 146 citing Hawley, 1968). The authors identify three types of isomorphism namely; coercive, mimetic and normative. Coercive pressures are typically made and enforced by the State and public authorities and firms are usually punished for non-conformance.

Mimetic pressures occur when an organisation mimics some practices that are acquired in its field due to environmental risks and uncertainties associated with some organisational decisions. Mimetic isomorphism in the words of Baretto and Baden-Muller (2006: 1560) is “a process by which, in ambiguous and uncertain situations, organisational changes are imitated in order to obtain legitimacy.” Normative pressures are usually done to acquire professionalism within an organisational segment. This is usually done for legitimacy and acceptance within a broader organisational field.

Scott (1987) also introduce four variants of institutional theory: institutionalisation as; a value-instilling process; a reality-creating process; a class of elements (usually cultural in nature, like symbols, cognitive elements, normative beliefs, and their sources), and; distinct societal spheres. These four variants bear some similar basic concepts and their explanations can be found in his write-up. By way of contextualising institutions, Oliver (1997a) suggests that they can occur at three levels. These are the individual, firm and inter-firm levels. The individual level deals with the decision-maker’s norms, habits and values. The firm level deals with organisational culture and politicking of institutional structures (which is where corporate governance and the conceptualisation of positivist agency theory fit). The inter-firm level deals with the norms within an industry as well as pressures from regulation and social expectations. It is at the inter-firm level that firms that are common to a specific industry exhibit similar activities, incentives and structures.

Institutionalised patterns are as a result of the process inter-relationships of all the three levels. In cross-country studies, firms in similar industries are therefore expected to conform more than those in other industries. Institutionalised patterns bring about firm heterogeneity as well, although some institutionalists (like DiMaggio, Scott, Powell, Meyer and Luckman) argue that conformity with external socially accepted norms leads to homogeneity and thus greater chances of firm survival. The institutionalist argument therefore considers that high performing firms are those that best conform to social pressures, and the more homogenous a firm becomes, the better its performance.

In text box A5, we have given an extensive detail of how the theories of institutions have evolved and when they can be used in conceptualising problems. Institutional change, deinstitutionalisation and neo-institutional theoretic frameworks are all covered.

3.5.1 Corporate governance in an institutional framework

Good corporate governance practices are being preached all over the world. Better legal environments adopt better governance mechanisms due to increased incentives in firms (Stulz et al., 2004). Countries have different governance codes that serve as templates for practice in the concerned countries. Countries have a concrete set of norms and rules governing the composition and role of the directors of the board, shareholding relations and accountability, auditing procedures and information to be disclosed, hiring, remunerating, and firing of directors and top management (Aguilera & Cuervo-Cazurra, 2004; *UNCTAD*, 2006). Although in some countries, the aspects of the governance codes are voluntary, most publicly-listed firms tend to satisfy all these conditions. This is attributable to market forces that coerce these into best practice codes and firms adopt them in an effort to gain legitimacy from society as expounded in the theory of institutions.

Based on the above, and in the light of institutional theory, Aguilera and Cuervo-Cazurra (2004) find that codes of good governance are more likely to be developed in countries with weak anti-director rights than in countries with strong anti-director rights, contrary to the observation by Stulz et al. (2004). In table A1, the names and number of codes developed in some Western countries together with their (revised) anti-director rights indices have been given. Such countries like the *UK* that has one of the highest revised anti-director rights index – five out of six (Djankov et al., 2008) has the most codes at twenty. Ireland with a similar index score however has only one, in line with the argument put forward by Aguilera and Cuervo-Cazurra (2004). In the case of Ireland however, the Irish Association of Investment Managers (Downes, 2002) point out that Irish companies have a good level of compliance with The Combined Code and this perhaps has prevented the preponderance of codes. The *US* however scores three on the index and has twelve codes. There is therefore the need for empirical verification of Aguilera and Cuervo-Cazurra's (2004) assertion.

From an institutional perspective, adoption of governance codes creates social legitimisation and enhanced performance. At the same time, development of a lot of codes may imply the inefficient development of previous codes which are expensive to implement in firms. However, the awareness and adoption of governance codes should lead to enhanced firm performance but too many of these put financial burdens on firms to keep adjusting their governance practices in line with new code introductions. We predict a negative effect on firm performance (refer to table A1 for the number of codes for 17 countries along with their investor protection indices).

H7: Firms in low-performing countries need to find the best governance codes to improve performance.

3.5.2 Investor protection in an institutional framework

Denis and McConnell (2003) discuss the second generation of international corporate governance as a comparison of governance mechanisms in differing legal/regulatory regimes. The second generation therefore considers the institutional framework as important as the traditional agency framework for analysing value-decreasing activities of management as large shareholders have both the incentive and ability to control management. This combined institutional and agency theoretical view has become necessary as studies on corporate governance in different countries have produced some dissimilarity in results. Even within the same legal regimes, there are differences in the governance results that have led some researchers to conclude that there is no single corporate governance blueprint that can explain the effect of governance on performance.

The degree of investor protection and their enforceability therefore leads to significant differences in the effect of corporate governance on firm value. North (1990, recall text box A5) has given us insights as to the role of enforcement in institutional theory. Good corporate governance, according to Durnev and Kim (2005; see also La Porta et al., 2002; Lins, 2003; Doidge et al., 2004a & 2004b; La Porta et al., 2006; Djankov et al., 2008), has more value in weaker legal and institutional regimes. Hence firms operating in countries with good investor protection laws need lesser good firm-level governance provisions for enhanced performance than firms in countries with less investor protection.

This is seen in La Porta et al.'s (2000: 6) argument that when a country's investor protection laws are good, it reduces expropriation of minority investors and insiders can only "overpay themselves, put relatives in management, undertake some wasteful projects", engage in expensive perquisites and embark on empire building. "After a point, it may be better just to pay dividends." They also add that when the diversion technology becomes less efficient, controlling shareholders reduce their expropriations and "their private benefits of control diminish". At the same time also, firms are then able to access external finance when investor protection is good.

Klapper and Love (2004) argue that firms in countries with weak anti-director rights and inefficient enforcements adopt good firm-level governance practices. When weak overall legal systems are considered, such firms on the average have lower governance ratings. La Porta et al. (2000) report that firms in countries with better investor protection have enhanced valuations. They see concentrated ownership as a response to counter weak investor protection laws. Concentrated ownership as discussed in section 3.3.1 however leads to agency conflicts between majority and minority investors. In this regard, the agency theory in an institutional framework can better analyse countries with weak investor protection as firms take it upon themselves to adopt investor protection practices.

H8: Investor protection is positively related to performance

3.6 Summary of theories, hypotheses and conceptual model

This chapter has reviewed the main conceptual framework –the agency theory- for analysing corporate governance. Positive agency theory initially considered the conflicts and congruencies between external providers of capital (principal) and the manager of the firm (agent). It has now been extended to analyse the relation between large (both internal and external) and small capital providers. A complementary framework –institutional theory- suitable for analysing cross-country studies has also been introduced. Institutional theory posits that conformity with external socially accepted norms leads to homogeneity and thus greater chances of firm survival. Table 4 summarises the hypotheses, the theoretical lenses in which the hypotheses are developed and the directions of the hypothesised signs.

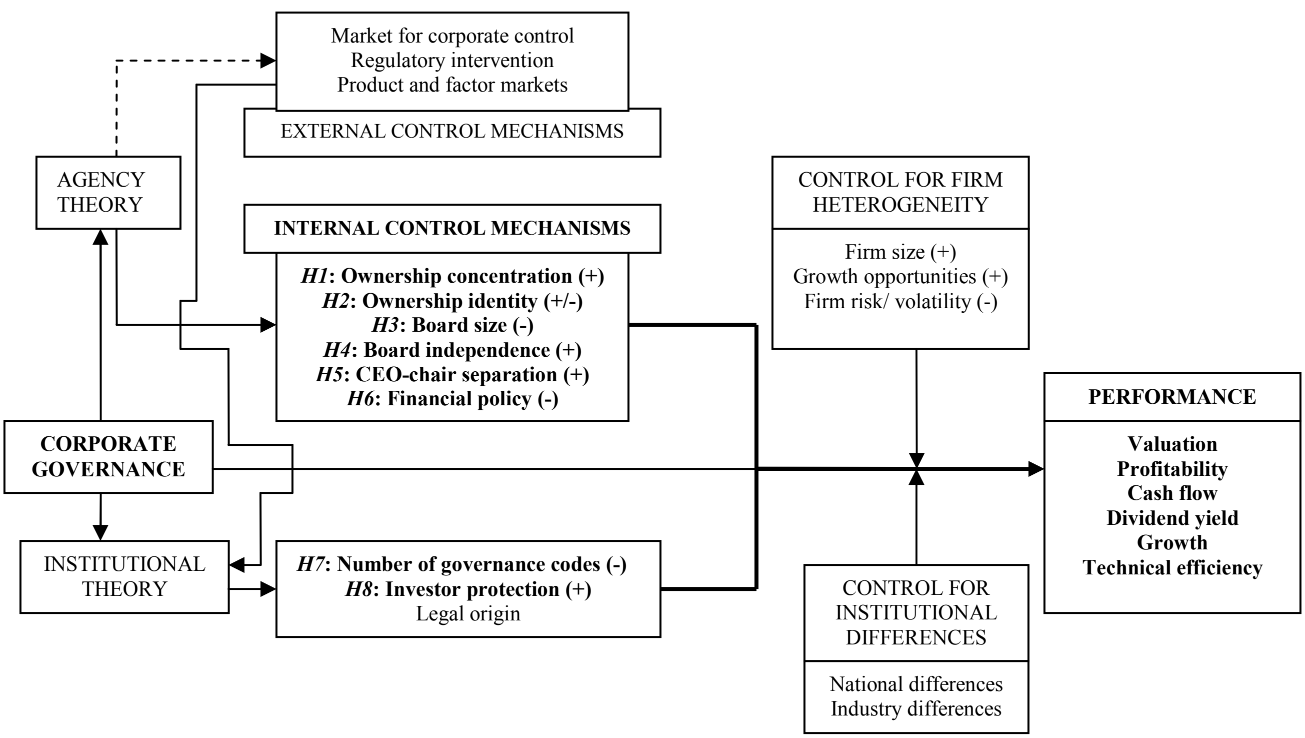
Table 4: Summary of hypotheses

THEORETICAL FRAMEWORK	HYPOTHESES	DIRECTION OF HYPOTHESISED SIGN
Agency	*H1*: The performance of a firm increases with increasing ownership levels.	+
Agency	*H2*: The identity of a shareholder impacts on firm performance	+ and -
Agency	*H3*: The size of the board of directors is negatively related to performance.	-
Agency	*H4*: Board independence increases firm performance.	+
Agency	*H5*: *CEO*-board chairman separation positively impacts on performance.	+
Agency	*H6*: High levels of debt to equity decreases firm performance.	-
Institutional	*H7*: Firms in low-performing countries need to find the best governance codes to improve performance.	-
Institutional	*H8*: Investor protection is positively related to performance	+

The institutionalist argument therefore considers that high performing firms are those that best conform to social pressures, and the more homogenous a firm becomes, the better its performance. Through conformity to social norms as stipulated under institutional theory, self-interested individuals might prefer to cooperate rather than be opportunistic. The conformity of actors to basic principles and consequences serves to link agency theory with institutional theory. Institutional differences between countries result in varying degrees of protection for investors through conformity and enforcement.

These two theories complement in broadening the scope of the effect of corporate governance on performance. The applications of the individual theories in previous empirical studies have led to mixed evidence. In figure 3, we present this complementary framework of internal control mechanisms and institutional adjustments together with moderating factors and how they collectively impact on firm performance. Governance indices are constructed based on firm control mechanisms and the institutional setting and this is perceived to impact on performance. Our variables of interest have been highlighted in the annotation.

Figure 3: Conceptual framework of governance and performance



4. METHODOLOGY AND RESULTS

4.1 Introduction

We have now discussed all the aspects of governance and performance that will enable us carry out an empirical investigation. We are performing a multi-country study with firms in the manufacturing sector. The relevance of involving several countries will help us establish a global relationship or identify differences in the governance and performance relationship. This is as a result of the conflicting reports in single country studies. To this level we have already discussed how linking institutional theory with agency theory will help us control country differences and know the exact relationship between governance and performance. One very important variable in governance studies is the effect of insider ownership on performance. We are unable to include this due to unavailability of data. To be more specific, only a few firms in the sample have insiders as largest shareholders, in line with the observation by Demsetz and Lehn (1985). We do not anticipate this to have a marked influence on our results as other studies separate insider and outsider ownerships by estimating different model specifications. Bøhren and Ødegaard (2004) also concur that governance variables need not be analysed together to provide consistent estimates.

In what follows, we introduce the variables and how they have been measured in prior research and how we intend to measure these within the limitations of our data set. We then deal with influential observations, give descriptive statistics, and detailed analyses. The chapter is in two main parts. The first part is with the derivation of technical efficiency and the components of total factor productivity applying the Malmquist index. After analysing technical efficiency, technical change and productivity change across industries, countries, legal origins and periods, we input the results of this analysis into the second part of the chapter.

The second part begins with a univariate analysis of ownership and board variables, and then we apply bivariate techniques by way of correlations and simple regressions to check for signs and strength of relationships, if any. We extend the analysis to a multivariate yet cross-sectional level. We then begin our discussion on panel models and the advantages and difficulties of their applications. Difficulties of endogeneity, panel heteroskedasticity and serial correlation are discussed and mitigated. We use several statistical models to analyse the data and check for evidence of non-linearities and non-monotocities. The consequent results are also discussed and compared to previous empirical investigations.

4.2 Data and measures

We use archival data covering seventeen *OECD* countries listed in table 5 and seventeen industries listed in table 6.

Table 5: *OECD* countries involved in the study

Country			
Austria	Germany	Norway	*UK*
Belgium	Greece	Portugal	*USA*
Denmark	Ireland	Spain	
Finland	Italy	Sweden	
France	Netherlands	Switzerland	

Table 6: The industrial sectors involved in the study

NAICS 2002	Type of Industry
	12 Countries without USA, UK, Germany, Sweden and France
312	Beverage and Tobacco Product Manufacturing
314	Textile Product Mills
322	Paper Manufacturing
3259	Other Chemical Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
	Spain and Portugal
2362	Non-residential Building Construction
	17 OECD Countries (Total Number of Countries in Sample)
3254	Pharmaceutical and Medicine Manufacturing
3332	Industrial Machinery Manufacturing
3342	Communications Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Medical, and Control Instruments Manufacturing
	16 European Countries
311	Food Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Non-metallic Mineral Product Manufacturing
335	Electrical Equipment, Appliance and Component Manufacturing
336	Transportation Equipment Manufacturing

These data are obtained from Bureau van Dijk's OSIRIS database. The industries used in *DEA* results are of four digit classification (*NAICS* 2002 core codes) and are: 3254, 3332, 3342, 3344 and 3345. The total unrefined sample is from all seventeen *OECD* countries. Subsequent refinements drastically decrease the sample as we eliminate some firms with incomplete information on required inputs and output, as well as outliers' deletion. Because the *USA* has several firms when all the seventeen countries are considered, subsequent firm additions (from other manufacturing sectors) to increase the sample size are deliberately made to increase firms in countries with less representation. In this light, we have also included seventeen firms from the construction industry in Spain and Portugal. Table 7 gives the variables we employ in the study.

Table 7: Variables and measures

Variable	Measure	Operationalisation
Anti-director rights index	Investor protection	Revised anti-director rights index developed by Djankov et al. (2008), see text box A3 and table A16 in the appendix.
Asset growth	Growth	Difference in total assets between two consecutive years.
Beta	Firm risk	Provided as current beta of the firm in OSIRIS. Only used in preliminary analysis.
Bias-corrected technical efficiency	Technical efficiency	Inputs: Cost of materials + other expenses, Number of employees, Tangible fixed assets + Intangible fixed assets. Output: Operating revenue/ turnover. Monetary values are corrected with purchasing power parity and exchange rate.
Board independence	Governance	The ratio of board outsiders to the size of the board. Taken from company websites.
Board size	Governance	The number of directors of the company's board. Taken from company websites.
Cash flow	Financial liquidity	Taken as cash flow per share from OSIRIS
CEO-chair separation	Governance	The *CEO* is not the chairman of the board. This is measured as a dummy variable. Taken from company websites.
Corporate governance codes	Investor protection	Number of corporate governance codes obtained from the *ECGI* compilation in table A1 in appendix.
Dividend yield	Investor ratio	Taken as dividends per share from OSIRIS. Dividends payout not used because there is no information on a significant number of firms. Dividend yield proxies for the cost of capital.
Legal origin	Investor protection	Common or civil law origin (or extension of civil to French, German and Scandinavian origins). La Porta et al. (1998).
Leverage	Financial policy	Natural logarithm of total debt to total assets. Ratio provided by OSIRIS.
Liquidity	Financial policy	Working capital to total assets. Ratio provided by OSIRIS. Used in preliminary analysis.
Market-to-book value	Hybrid market valuation	Natural logarithm of *MBV*. Provided by OSIRIS
Operating revenue/ turnover growth	Growth	Difference in operating revenue/ turnover between two consecutive years.
Ownership concentration	Corporate control and governance	Ratio of largest direct shares or its natural logarithm. Natural logarithm of ratio of 5 largest direct shareholders. Natural logarithm of ratio of total (direct and indirect) shares of largest owner.
Ownership identity	Major shareholder influence on governance	5 dummy variables: Individual or family; Financial company; Publicly-listed company; Industrial company; State, and; Others (reference category) (see table 8 for list).
ROA	Profitability	Ratio taken directly from OSIRIS
ROE	Profitability	Ratio taken directly from OSIRIS
Sales	Firm size	Natural logarithm of total firm sales in thousand of USA dollars.
Sales growth	Growth opportunities	Average of five-year sales growth
Standard deviation of *ROE*	Firm volatility proxied for risk	Natural logarithm of standard deviation of four-year return on equity
Tobin's *Q*	Market valuation	Use of book values of total assets and total equity: *Q* = Market capitalisation + (Total assets – Equity) ÷ Total assets. Natural log is used in most specifications.
Total factor productivity growth	Productivity growth	Inputs: Cost of materials + other expenses, Number of employees, Tangible fixed assets + Intangible fixed assets. Output: Operating revenue/ turnover. Monetary values are deflated with producer price index and corrected for purchasing power parity and exchange rate.

Firm age and age since *IPO*, *R&D* expenses, advertising expenses, market concentration factors, insider ownership and dividend payout are not used as only few firms report these or are not available in the database. Sales growth over five years is our preferred proxy for growth opportunities than firm investments although the latter is employed in the preliminary analyses as well. Past year firm betas are not available in the database thereby excluding its use in the robust regression estimations.

The measures are taken from the OSIRIS database. For technical efficiency, total factor productivity, asset growth, operating revenue/ turnover growth, Tobin's *Q*, standard deviation of return on equity and sales growth, we perform calculations based on information from the OSIRIS database. Board independence is the ratio of outsiders on the board.

Ownership variables

Tables 8 and 9 give details of ownership identity and concentration as existing in the OSIRIS database. Ownership type can be individual or families, financial services, public company, industrial company, the State or other types collectively grouped as "others".

Table 8: Types of largest shareholders

Number	Large shareholding type
1	Individual/ Family; Self-owned
2	Banks; Financial Institutions, Mutual & Pension Fund/Trust/Nominee; Insurance Company
3	Public Company
4	Industrial Company
5	State or Public/Government agency
6	Other Unnamed Shareholding Aggregates; Foundations and Research Institutions; Private investor

Number 6 is the reference category. Number 2 aggregates all financial companies. Public company means a company that is publicly traded.

We present how OSIRIS denotes control (largest direct shareholdings) through what they call the *BvDEP* independence indicator given in table 9. We employ this measure in the preliminary regressions. Since this measure gives similar results to the other ownership concentration variables, we do not comment on the results in the relevant section but on the more preferred continuous variable operationalisation, i.e the actual percentage of shareholdings.

Table 9: *BvDEP* independence indicator

1	A^+	No shareholder with more than 25% direct or total ownership (="Independent companies")
2	A	
3	A^-	
4	B^+	No shareholder recorded with more than 50% direct, indirect or total ownership One or more shareholders recorded with more than 25% direct or total ownership
5	B	
6	B^-	
7	C^+	No shareholder recorded with more than 50% direct ownership
8	C	One shareholder recorded with more than 50% total ownership (= indirectly majority owned)
9	D	One shareholder recorded with more than 50% direct ownership (= directly majority owned)
10	U	Unknown

Source : Bureau van Dijk's OSIRIS database

The largest shareholder is, in some cases, the ultimate firm owner. Bureau van Dijk has adopted some measures in classifying an ultimate owner. A shareholder is an ultimate owner if it is the only one having more than 24.9% shares of the company. In case this is another company, no shareholder must have more than 24.9% in its shareholding structure; in other words, it should be independent.

Board variables

Information on the three board characteristics of size, independence and chairman/*CEO* duality are taken primarily from all 2,339 firms' websites. Only one year of data information is obtained. While some firms have information for several years, some have analysable information for only a few years (mostly one year). Other company websites have no information on corporate governance practices.

Information on the board of directors (or the supervisory board) is also taken from 2004 annual reports and definitive proxy statements (*SEC* filings for *US* firm listings). When there is no firm information for that year, 2005 values are used. In the absence of information on these two years, the current information as at mid-2006 is utilised. In a few cases, board information is taken earlier than 2004 or from the information given in the OSIRIS database. This is a limitation to the study but we do not anticipate that these will have a marked influence in the analysis as changes in board governance characteristics are relatively stable within a short period. Values for a year are also fraught with board changes all the time and annual reports are made available at different times of the year. Most of the firms without governance data in year 2004 however do not have data for most of the other variables and are effectively eliminated during the multivariate analyses. We therefore use constant-value board characteristics in our three-year longitudinal analysis.

The difficulty encountered is with knowing which non-executive directors are independent as not all firms clearly spell out their criteria. In a few cases, non-executive large shareholder representatives have been tagged as independent directors based on the corporate governance reports. For Greek firms that do not have an English website translation, no information is retrieved. The criteria for independence also differ in some respect across countries. Some companies see directors who do no work or consulting for them as independent irrespective of whether they have significant shares.

It is interesting to note that some of the listed firms do not have any corporate governance information on their websites. Dual *CEO*/board chairman firms (especially in the *USA*) also have less corporate information on their websites. These are usually the smaller sized firms. The fast dynamics of the data especially that of biotechnology, electronics and other high technology sectors is interesting to note in terms of entries, acquisitions, mergers and exits.

Most Italian and Spanish firms have direct information on the number of independent non-executive directors on their websites or annual reports. Irish and British firms usually have the non-executive category listed and less often independent non-executives. Non-executive board chairmen are not considered entirely independent by the revised Combined Code of 2003. Board details in some Belgian firms are obtained from company prospectuses. Information on Finnish firms is obtained from the insiders' register. German firms list their codetermination of the supervisory board status but do not separate directors representing shareholders from independent directors. The Dutch system allows for a 'joint board' (involving management and supervisory board members). Where this board is provided, information is taken from this, otherwise the supervisory board prevails. Some French firms also have an additional supervisory board while some countries such as Italy have a separate audit board. Most Swedish, Danish and Norwegian firms do not indicate the number of independent board members in the sample of firms reviewed.

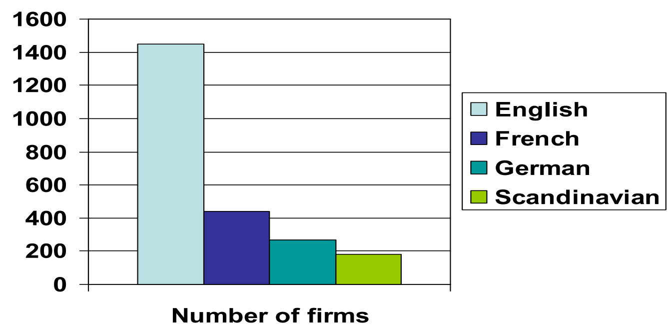
The determination of board independence in this study is sometimes a bit vigorous for European firms than for *US* firms that are not listed on the *NYSE*. In this study, board members with significant (direct and indirect – of between 7 % and 10%) shareholdings in European firms are not considered independent. *NASDAQ* and *AMEX* independence requirements allow board membership for non-executive proprietary ownership (board members with significant shares, and even retired company founders).

Another casual observation is that board changes in Ireland, the *UK* and the *USA* are more frequent within a fiscal year than for other countries and it is interesting in the future to study if the Common Law origins play a part in this.

Legal origin and investor protection

Two measures of legal origin, a measure of investor protection, are used in the study following their use by La Porta and colleagues in several of their cross-country studies. The first is the common code versus civil code originating from the British and French. The second is a breakdown of the civil code into French, German and Scandinavian. The countries that appear in the extended legal origin are as follows: English legal origin – Ireland, *UK* and *USA* (61.99%); French legal origin- Belgium, France, Greece, Italy, Netherlands, Portugal, and Spain (18.85%); German legal origin- Austria, Germany and Switzerland (11.42%), and; Scandinavian legal origin: Denmark, Finland, Norway and Sweden (7.74%). These are represented in Graph 1 below.

Graph 1: Study's sample of firms by legal origin



As expected with listed firms, the common code origin dominates due to the large number of *US*-listed firms in the manufacturing sector. The countries are:
•English: Ireland, *UK*, *USA*.
•French: Belgium, France, Greece, Italy, Netherlands, Portugal, Spain
•German: Austria, Germany, Switzerland
•Scandinavian: Denmark, Finland, Norway, Sweden

The percentages show an unequal distribution with almost two-thirds representing English legal origin. We therefore prefer to use the common versus civil legal origin classification to present a representative analysis in the regressions but use the extended legal origin type for the efficiency and productivity analyses. The figures and percentages shown are that for the whole sample and change after deleting influential observations (which reduces the sub-sample size of firms with an English legal origin, as most of the small listed firms are incorporated in the *US*) and whether the remaining observations have all the variables required in the non-parametric and parametric estimations. In this study, the data and indices (revised anti-director rights index and investor protection index) for seventeen countries included in Djankov et al. (2008) are used as two of the measures of investor protection. The other measure is the number of corporate governance codes developed by a country.

Dependent variables

All dependent variables used are screened for outliers using the formula: *Median* ± (3 * *Interquartile Range*). Although 2.5 multiplied by the interquartile range is the norm, we decide on 3.0 to obtain a larger sample size. The presence of a lot of missing values for some variables also prompted the choice. In the case where these variables are not in ratio form as in the variables used in *DEA*, the output is divided by the three inputs to get three ratios of single factor productivity. The ratio forms are then used to remove extreme observations. We also apply the method proposed by Wilson (1995) to make certain all the extreme observations used in the *DEA* methodology have been identified.

The other variables we use have been operationalised from Chapter Two. In the subsequent analysis, we first consider the non-parametric methodology of measuring technical efficiency and total factor productivity.

4.3 Non-parametric analysis and results

In this section, we use *DEA* to provide efficiency and productivity estimates and discuss the results. We begin by reporting on the variables used in the estimation under technical efficiency. These variables are used for both two types of analyses.

4.3.1 Technical efficiency

The choice of outputs and inputs in *DEA* studies is not definite as discussed in section 2.12 of the study. Our choice is based on the premise that we should be able to compare the industry-mean efficiency estimates achieved with firms having a similar production function to other industry-mean efficiency estimates insofar as they are all manufacturers. We are examining internal governance control mechanisms and their impact on efficiency and since the firm has control over what it can use in minimising inputs than maximising outputs, the latter which depend on the market structure in terms of competition and customer dynamics, an input orientation is desired. Additionally, in the kind of industries we consider, the stock of intangible assets which drives innovations is an important factor. We decide on using as inputs: the number of employees; a combination of the cost of materials and other operating expenses, and; a combination of tangible and intangible assets.

These industries are high-technology or knowledge intensive where intangibles are a vital input into firm survival. Most firms however do not report for intangible fixed assets and this implies having to deal with a markedly reduced sample size. The choice of the number of employees indicates labour as an important factor of production. The choice of materials (material costs and other operating expenses) is because it is a vital input in the production process of manufacturers. For the output, we select the operating revenue/turnover as this is less likely to be manipulated through earnings management. Because our sample involves sixteen countries (Portugal is not included in the *DEA* estimations because of very few firms with complete data), we use the purchasing power parity to correct for the variables. Since the purchasing power parity has been provided in the local currencies of the concerned countries and the data is in *USA* dollars, we first change the purchasing power parity to *USA* dollar terms by factoring in the exchange rate. The five industries are:

- Communications Equipment Manufacturing ($N = 287$)
- Industrial Machinery Manufacturing ($N = 120$)
- Navigational, Measuring, Medical, and Control Instruments Manufacturing ($N = 315$)
- Pharmaceutical and Medicine Manufacturing ($N = 570$)
- Semiconductor and Other Electronic Component Manufacturing ($N = 384$)

The total number of firms in each industry is that provided above. These numbers drop significantly after cleaning the data. We report the descriptive statistics of the inputs and output using all six years of data before (table 10) and after (table 11, simplified in graph 2) removing extreme observations. There are several methods available to detect the presence of outliers such as Rousseeuw and Leroy (1987), Wilson (1993 & 1995), Seaver and Triantis (1995), Ondrich and Ruggiero (2002), Simar (2003) and Fox et al. (2004). Our data cleaning process is as follows:

- Elimination of observations with missing data;
- Elimination of negative numbers because we are dealing with financial data of competitive firms. In this context, input and output variables have to be non-negative;
- Removal of observations with zeros as this is unlikely to be used as a production factor by a *DMU* without using one of the basic inputs (the same applies for the output).
- Division of the output with each of the three inputs to get ratios, and;
- Application of the formula *Median ± 3 * Interquartile Range* to the resulting ratios to remove observations outside these boundaries.

This procedure not only serves as detecting the presence of outliers but also makes it possible for performing regression analysis in the second stage. We cross-check our extreme observations from the above formula with the procedure proposed by Wilson (1995) before removing them from the sample. We report these summary statistics and observe the significant differences between means and medians of the industries.

Table 10: Descriptive statistics of unrefined *DEA* variables

Statistic	Mean	Standard deviation	Minimum	1^{st} Quartile	Median	3^{rd} Quartile	Maximum
Communications Equipment Manufacturing (*N* = 287)							
Revenues	751714	3703774	0	9890	44357	162342	40800000
Employees	2589	10862	1	69	198	685	147000
Costs	656946	3197872	-766	13098	45791	160521	34300000
Assets	254940	1152838	0	3734	14912	69507	23000000
Industrial Machinery Manufacturing (*N* = 120)							
Revenues	521810	1098135	0	34361	121574	376407	9564412
Employees	2722	5375	3	247	663	1991	30242
Costs	466232	936739	8	34056	125518	344855	6415389
Assets	176423	349998	0	8235	34565	136413	2080147
Navigational, Measuring, Medical, and Control Instruments Manufacturing (*N* = 315)							
Revenues	441431	1685506	0	6236	30575	162362	19000000
Employees	2457	10124	1	42	186	878	124500
Costs	361156	1436429	-327400	8080	29686	128770	17200000
Assets	317809	1321571	0	3505	14017	93997	15800000
Pharmaceutical and Medicine Manufacturing (*N* = 570)							
Revenues	1053201	4745949	-21796	1282	10415	67691	50500000
Employees	3220	14156	1	28	90	308	166900
Costs	755610	3377066	-1896	9327	25453	77641	39300000
Assets	1043720	5159185	-425	3329	15340	114725	91900000
Semiconductor and Other Electronic Component Manufacturing (*N* = 384)							
Revenues	578533	2253584	-29035	22223	97045	285624	38800000
Employees	2978	8615	1	138	515	1572	99900
Costs	502942	1782219	-128400	25494	96558	270125	26600000
Assets	365468	1540897	1	10725	44269	173773	23200000

Summary statistics of the six years of data in thousands of *US* dollars. Output: Revenues = Operating revenues/ turnover. Inputs: Employees = Number of employees; Costs = Material costs and other operating expenses, and; Assets = Tangible fixed assets and Intangible fixed assets.

The refined data in table 11 is just an indication of how the distribution is far from central tendency. The final sample sizes as given in tables A19 to A23 are different from the initial sample (as given above). There are *SME*s and very large multinational corporations in the sample as can be seen from the differences in mean, median, minimum and maximum values. The industrial manufacturing industry has the least range of data values while the pharmaceutical and medicine manufacturing industry has the widest range of values.

We use an input orientation with a variable return to scale technology and 2000 replications to correct for the technical efficiency bias. The choice of orientation is because firms in the manufacturing industry often operate in competitive environments where output is restricted by customer demand. We are interested in how firms are able to maintain the same outputs reducing any or all of their inputs. The choice of technology is because of size differences in firms where some are either too small (increasing scale returns) or too big (decreasing scale returns).

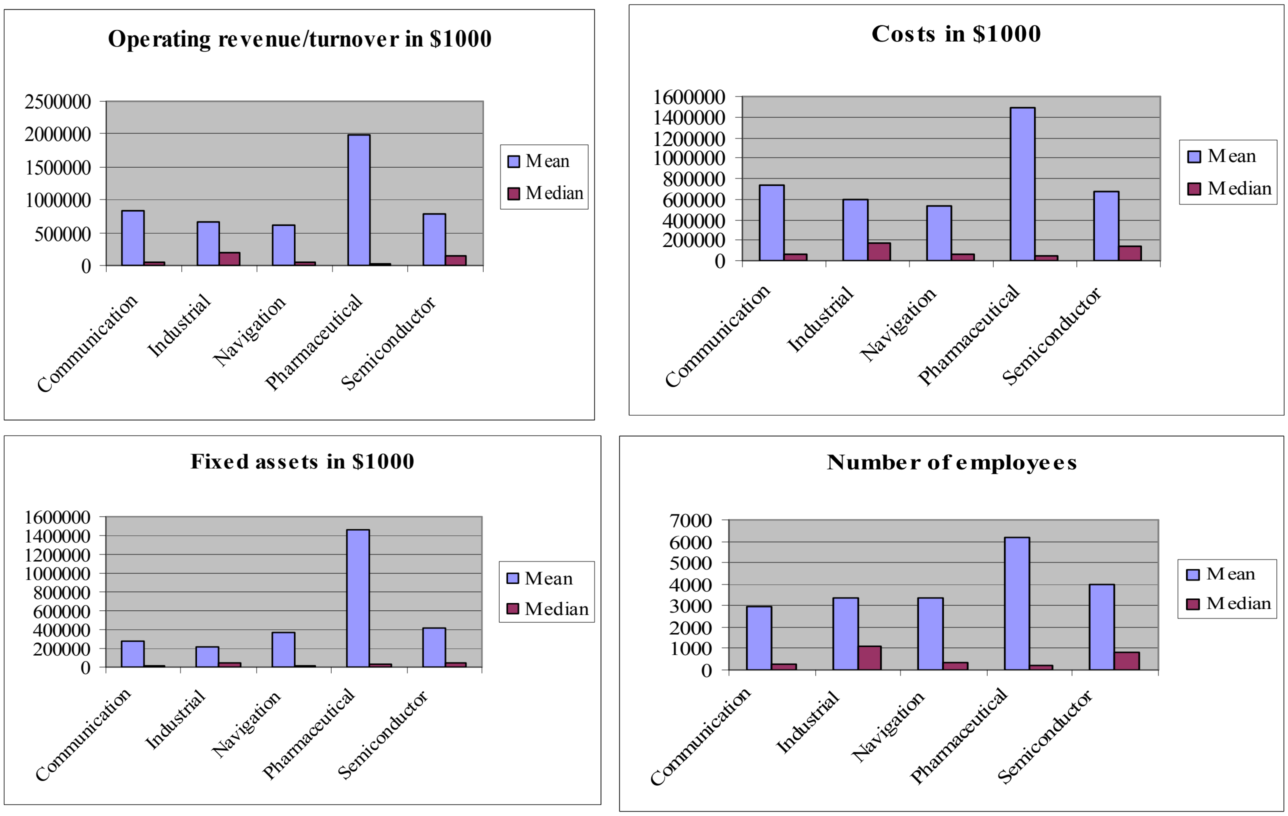
The firm-level results of the analyses are not reported but we report and compare yearly averages for all the five industries in tables A19 to A23 which includes a write-up in text box A6. The summary statistics include the mean, median, minimum, maximum, and first and third quartiles for *VRS* efficiency and their bias correction, the standard deviation, and the upper and lower limits of 95% interval of confidence. The advantage of the bias-correction is that it separates the technically efficient firms as the uncorrected values are all the same (technical efficiency is equal to unity).

Table 11: Summary statistics of refined inputs and output

Statistic	Mean	Standard deviation	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Communications Equipment Manufacturing							
Revenues	831242	3817036	12	17190	58625	227161	49066699
Employees	2948	10065	1	103	277	1107	101553
Costs	734593	3230987	572	20781	62957	238715	41344513
Assets	272768	1201126	89	4823	19851	76782	23008500
Industrial Machinery Manufacturing							
Revenues	662372	1214758	2833	66716	188203	484685	9564412
Employees	3333	5898	32	360	1089	2364	30242
Costs	593268	1055408	2996	60810	176522	446406	6415389
Assets	211830	379272	325	15979	46173	192053	2240564
Navigational, Measuring, Medical, and Control Instruments Manufacturing							
Revenues	617294	2023374	3	11093	57717	305673	19038000
Employees	3386	11981	1	91	329	1582	124500
Costs	526033	1751846	240	15148	56664	2616123	17168000
Assets	361883	1419801	36	4643	22279	122650	15772000
Pharmaceutical and Medicine Manufacturing							
Revenues	1995923	6745508	1	4652	32224	304534	50514000
Employees	6165	19477	1	64	211	1168	166900
Costs	1484699	4891055	238	16264	46761	268110	39303000
Assets	1466190	6403623	8	5933	28619	211648	105000000
Semiconductor and Other Electronic Component Manufacturing							
Revenues	785862	2749397	87	51261	150298	395531	38826000
Employees	3992	10129	2	272	819	2397	99900
Costs	679148	2157751	159	52913	141117	387845	26610000
Assets	416264	1657678	32	17025	53048	203162	23248000

Summary statistics of six years of data deflated with producer price index for manufacturing (base year 2000) in thousands of *US* dollars. Output: Revenues = Operating revenues/ turnover. Inputs: Employees = Number of employees; Costs = Material costs and other operating expenses, and; Assets = Tangible fixed assets and Intangible fixed assets. Outliers have been removed with the *Median ± 3 * Interquartile Range* after dividing the output with each of the three inputs and verified with the method proposed by Wilson (1995).

Graph 2: Means and medians of *DEA* data inputs and output by industry



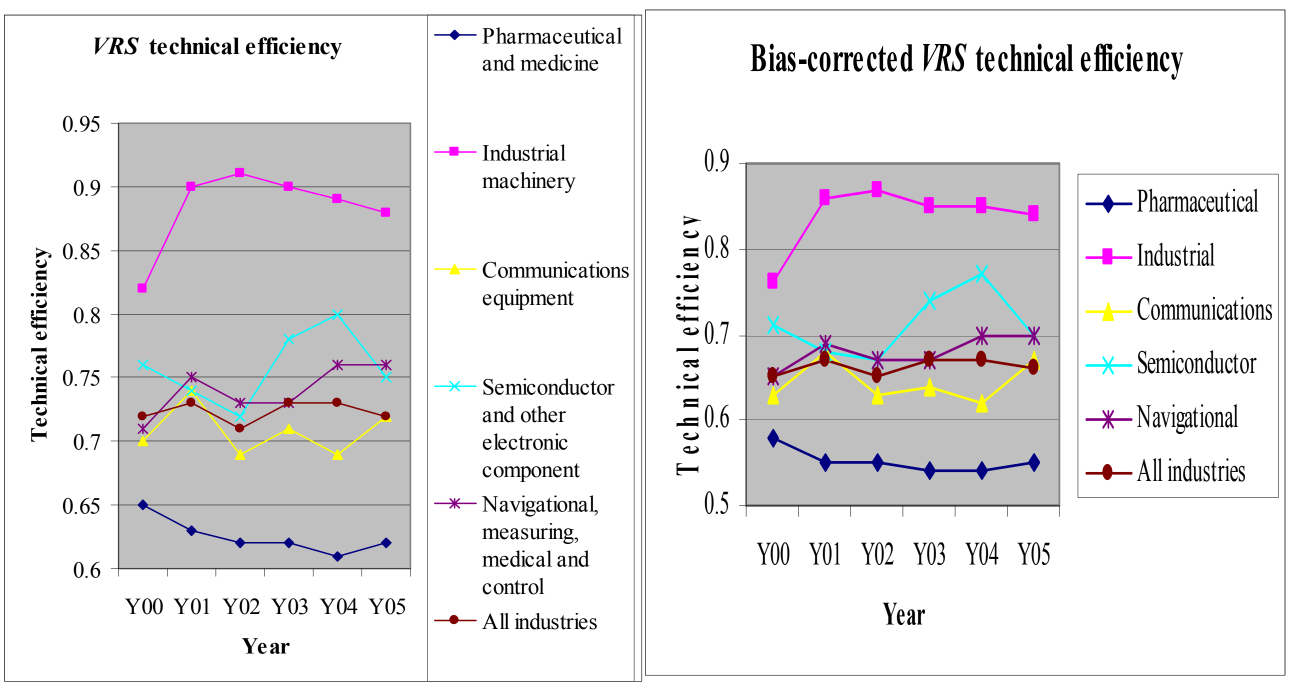
We use an extreme point method in deriving the efficiency estimates. As such the sensitivity of influential outliers is important. The result of the *DEA* empirics is subsequently fed into the second stage of the study where a pooled regression methodology is applied. We follow the method described by (Simar and Wilson, 2007) to correct for biases in technical efficiency and use the *FEAR* (Frontier Efficiency Analysis with *R* [Wilson, 2008]) software.

We specify a separate technology for each year and industry. Graph 3, also detailed out in table A24, discusses the technical efficiency differences between industries. In what follows, we introduce the bias-corrected estimates. We will start with the overall sample for the entire six-year period. The average sample efficiency over the entire period is 72% (66% when corrected for bias). The yearly fluctuation of the sample is between 71% and 73% or (65% to 67% when bias-corrected). Therefore, the overall sample efficiency is relatively stable over time.

For the year 2000, industrial machinery has the highest efficiency at 76%, the only year it reports a level under 80% (its average for the whole period is 84%). As a matter of fact for all the years, this industry's technical efficiency average is more than all the others. The 2000 average of all firms in the industries is 65%.

The pharmaceutical and medicine manufacturing industry reports the lowest efficiency scores at 58% and also for the entire duration of the study. Interestingly enough, the 58% score for this industry is its best during the period as its overall period average is 55%. We have indicated that industrial machinery places first (and pharmaceutical and medicine manufacturing places last) for all the years so we discuss which of the other three industries perform second best. Semiconductor and other electronic component (71%), navigational, measuring, medical and control (65%) and communications equipment (63%) industries place second, third and fourth respectively. We make yearly comparisons of the industries and then consider the whole period using the bias-corrected measure (when we refer to technical efficiency).

Graph 3: Technical efficiency by industries



For year 2001, navigational, measuring, medical and control manufacturing is 1% technically efficient than the other two. It performs similarly to semiconductors in 2002. For the communications equipment industry, tying in third place with semiconductors in 2002 is its best position (and also its best efficiency score at 68%) as it only performs better than pharmaceutical firms for the other years. Semiconductor and other electronic component ties with navigational, measuring, medical and control in year 2003 but outperforms the latter in years 2004 and 2005. It has an average efficiency of 71% for the entire period while navigational, measuring, medical and control manufacturing has 68%.

We further discuss simplified results of the above for more clarity. Pharmaceutical and medicine manufacturing industry is, on average, 45% inefficient after correction for biases in technical efficiency estimations. This is an industry that has a lot of very new and small firms competing with large and well-established multinationals. The large firms are, on the average, more efficient than the small firms. In year 2000, this industry records its highest mean efficiency score of 58%, dropping by three percentage points the following year. It records its lowest efficiency score in years 2003 and 2004 at 54%. We can say that on the average, its level of inefficiency over the study period is relatively stable with a difference of only 4% in the six years considered.

On the other hand, the industrial machinery manufacturing industry is the most efficient posting less than half of the inefficiency in pharmaceuticals at 21%. This industry has its least efficiency at the beginning of the study period at 76% which improves by 10% in the next period. It experiences a further increase in 2002 but decreases in efficiency at the end of the study period. It therefore experiences a consistent improvement in technical efficiency for the first five years while the pharmaceutical industry records consistent reductions in technical efficiency for the same period.

Firms in the semiconductor and other electronic components manufacturing industry have the second best efficiency after industrial machinery at 71%. In 2000, they are on average 71% inefficient. In the next two years it becomes more inefficient. Subsequently, it starts improving on its efficiency until the final year when it declines to the comparable level at the initial year. In six years, the range of its efficiency is 10% with the maximum being 77%.

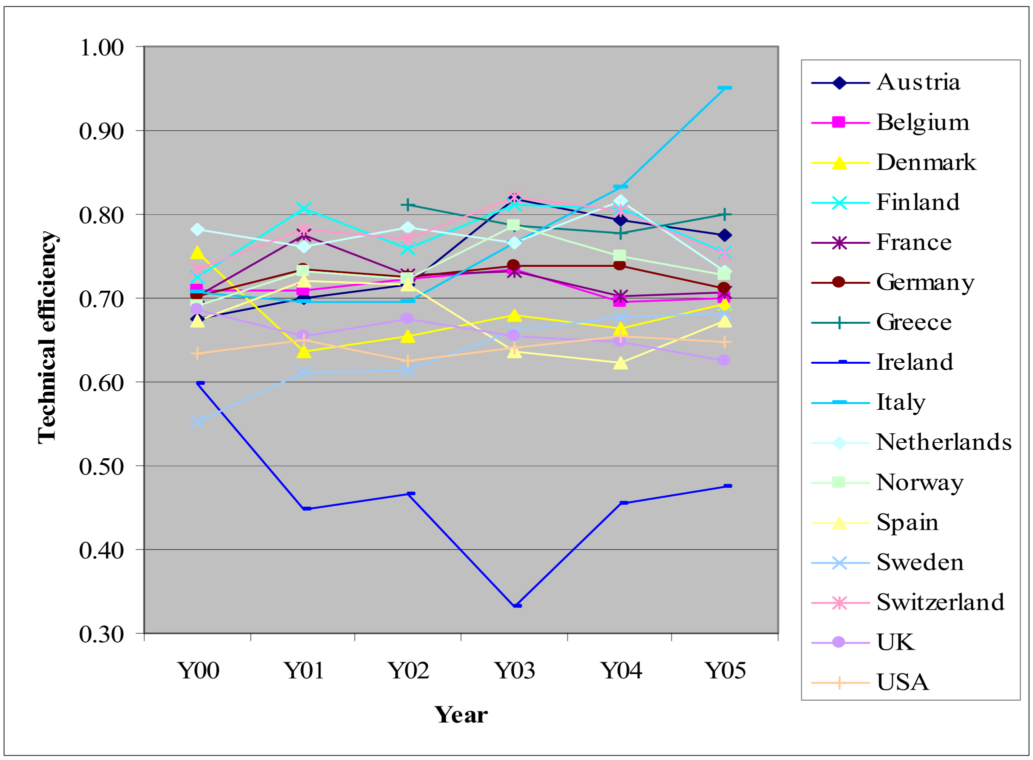
Navigational, measuring, medical and control manufacturing industry are the third most efficient firms in this five-industry comparison. On average, they are 68% efficient, ranging from 65% in year 2000 to 70% in years 2003 and 2004. This industry is followed by communications equipment manufacturing with 64% efficiency. The most remarkable increase in efficiency for this latter industry is from 2004 to 2005 at 5%. In 2001, it posts its best efficiency at 68%.

In summary then, Industrials perform best followed by Semiconductors, Navigationals and then Communications respectively. Pharmaceuticals are the worst performers. Firms in this industry are 9% less efficient than those in fourth-placed Communications and 24% less efficient than first-placed Industrials. For all firms the average technical inefficiency is 34% (pharmaceutical and medicine manufacturing firms being the most populous).

Technical efficiency estimates by country

Graph 4, also detailed out in table A25, show technical efficiency results for the sixteen countries under investigation and their aggregation into legal origins; which is provided in graph 5 (see also table A25).

Graph 4: Bias-corected *VRS* technical efficiency by country using 2000 bootstrapped replications



In table 12 also, we present the results of yearly averages for the whole period based on which we rank the countries in terms of the average technical efficiency over the whole six-year period from best to worst respectively as:

Greece > Finland = Switzerland > Netherlands > Austria = Italy > Germany = Norway > France > Belgium > Denmark > Spain > *UK* > Sweden = *USA* > Ireland.

Graph 5: Bias-corrected *VRS* technical efficiency by legal origin using 2000 bootstrapped replications

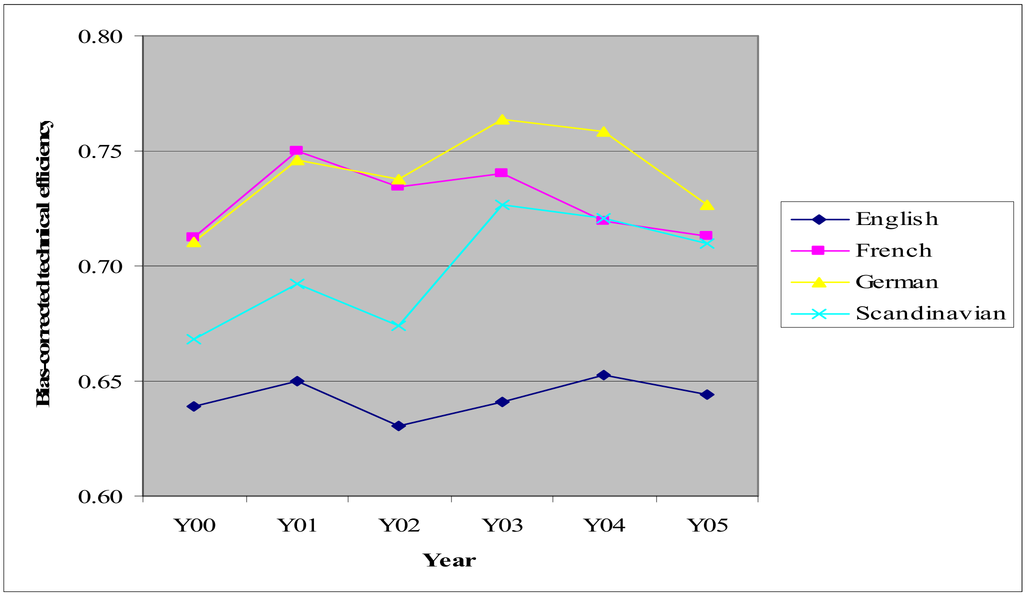


Table 12: Average country technical efficiency for the period 2000-2005

Country	*VRS* efficiency	Bias-corrected *VRS* efficiency	5% Bound efficiency	95% Bound efficiency
Austria	0.82	0.74	0.68	0.81
Belgium	0.77	0.71	0.66	0.76
Denmark	0.73	0.68	0.64	0.72
Finland	0.82	0.78	0.73	0.82
France	0.79	0.72	0.67	0.78
Germany	0.78	0.73	0.68	0.77
Greece	0.87	0.79	0.74	0.86
Ireland	0.53	0.47	0.43	0.52
Italy	0.79	0.74	0.70	0.78
Netherlands	0.85	0.77	0.71	0.84
Norway	0.82	0.73	0.67	0.81
Spain	0.72	0.67	0.64	0.71
Sweden	0.71	0.64	0.59	0.70
Switzerland	0.85	0.78	0.72	0.84
UK	0.71	0.65	0.61	0.70
USA	0.70	0.64	0.59	0.69
		Legal origins and all countries		
English	0.70	0.64	0.60	0.69
French	0.79	0.73	0.68	0.78
German	0.80	0.74	0.69	0.79
Scandinavian	0.76	0.70	0.65	0.75
All countries	0.72	0.66	0.62	0.72

The technical efficiency average is for six years.

Austria takes fifth position, same as Italy, while Greece takes the first position. The bottom placed countries are Denmark, Spain, Sweden, *USA*, *UK* and Ireland. Statistically speaking, Greece which occupies the first position in the overall ranking is only significantly more efficient than Denmark, Ireland, Spain, Sweden, *UK* and *USA*. It is not significantly different from the nine other countries of Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Norway and Switzerland.

In terms of legal origin for the six-year period, Geman origin countries perform best followed by French and then Scandinavian countries but these rankings are not systematically different. The lower limit of confidence for German firms is the same as the upper limit of confidence (95%) for English firms indicating that even though on average German firms are 10% more efficient than English firms, 5% of both origins are likely to have the same efficiency in the population. At this level of confidence, German legal origin firms are more efficient than their English counterparts.

Finally, for the entire study period, the average efficiency of all firms is 66%. The technical efficiency can therefore be improved by reducing any or all of the inputs (i.e. labour, materials, other expenses, tangible fixed assets and intangible fixed assets) to produce the same output (operating revenue/turnover).

4.3.2 Technical change and total factor productivity

We use the same inputs-output specifications as in the contemporaneous frontier analysis. In addition to correction with purchasing power parity, the producer price index for the manufacturing industry is also applied to deflate values for variables measured in dollars for all periods in constant dollar terms. We have provided the *TFP*, pure technical efficiency, pure technical and scale efficiency changes for the 2000-2003, 2003-2005 and 2000-2005 periods in table 13. The arithmetic mean of *TFP* change for the 2003-2005 period is 2%. The arithmetic mean *TFP* growth for all industries in the 2000-2005 period is 4% broken down into 5% pure technical efficiency change, 0.3% pure technical change and 0.5% scale efficiency change. Median *TFP* for 2000 to 2003 is 1%, 2003-2005 is -3% and 2000-2005 is -1%. Although our main period of analysis is from years 2000 to 2005, we have provided estimates for years 2000 to 2003 and 2003 to 2005 in order to confirm why a longer period is necessary for dynamic analysis.

We apply the algorithm proposed by Simar and Wilson (2007) to give estimates at the 95% level of confidence using *FEAR* (Frontier Efficiency Analysis with *R*) software. We use an input orientation and report *VRS* results in addition to the main *CRS* results. The result returned is the Malmquist index and its components' breakdown averages with confidence intervals.

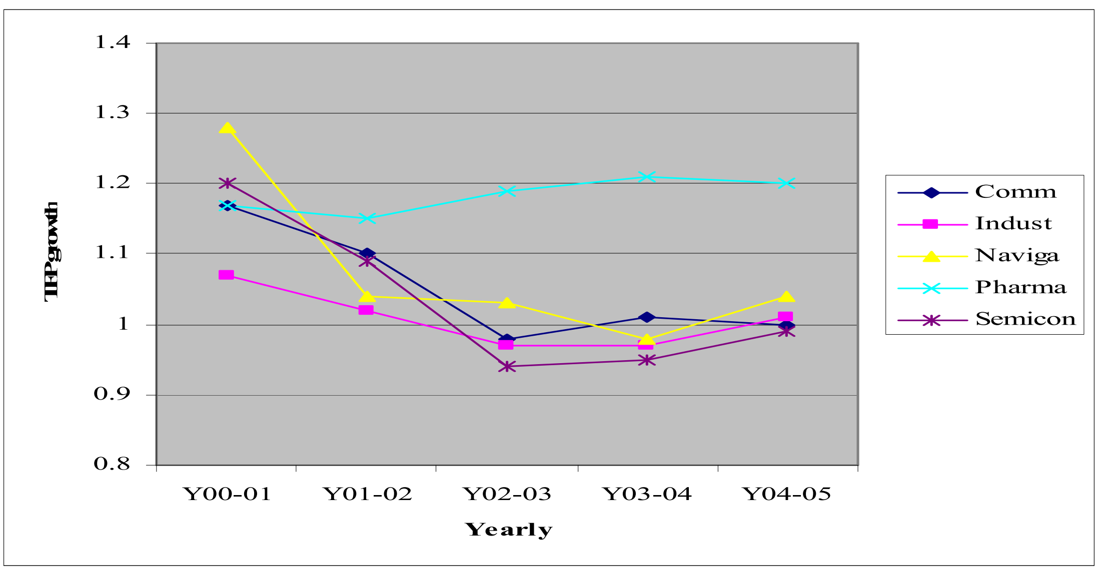
Table 13: Descriptive statistics of productivity and components

Variable	*N*	Mean	Std. Deviation	Minimum	Maximum
Malmquist (*TFP*) index*: 2000-2003	587	1.15	0.32	0.49	6.22
Malmquist (*TFP*) index*: 2003-2005	672	1.02	0.41	0.50	5.34
Malmquist (*TFP*) index*: 2000-2005	521	1.04	0.39	0.50	4.62
Pure technical efficiency change (2000-2005)*	520	1.05	0.34	0.51	4.23
Pure technology change (2000-2005)*	510	1.003	0.13	0.60	1.92
Scale efficiency change (2000-2005)*	517	1.005	0.15	0.52	2.74

Data years are 2000, 2003 and 2005. Median *TFP* for 2000-2003 is 1.01, 2003-2005 is 0.97 and 2000-2005 is 0.99. The statistics refer to the combined sample of all industries.

Year to year firm level productivity changes (*TFP*, pure efficiency change, pure technical change, scale efficiency change, scale of technology change and technical change) are reported for the five industries and compared in tables A26 to A30 and text box A7. The yearly *TFP* changes are shown in graph 6 below.

Graph 6: Yearly total factor productivity change by industry using 200 bootstrapped replications



The confidence intervals are obtained with 200 bootstrapped replications. The ideal situation is increasing the number of replications (like the 2000 in the static estimations) to achieve more robust confidence intervals but the time taken for increased replications is very long with the current *FEAR* software and we are performing the analysis for forty different year/industry combinations. The confidence intervals are therefore wide. Our primary concern is with productivity change and technical change. Table 14 is a summarised version of tables A31 and A32 indicating the averages of the variables. The latter tables contain extended statistics like the minimum, median, maximum, first and third quartiles. We therefore discuss the mean values of *TFP* and its component of technical change.

Technical change for the industries

Table 14 reports both values of pure technical change and technical change. In this section, we limit our discussion to technical change. The technical change considered is only from years 2000 to 2005, i.e. a five-year period. We do not comment on the period from 2000 to 2003 and 2003 to 2005 as its results are argued to be less consistent from an aggregation argument which gives credence to why technical change and productivity growth should be measured over a longer horizon (i.e. five years and preferably more) so as to be able to better analyse the results. The results over the five-year measure turn out to be reliable than that for the lesser periods.

If we discard the limits of confidence for a moment and look at the industry arithmetic means (note: this is not individual firms' means obtained through the bootstrapping method; hence we are not disputing the method's efficiency, neither are the estimates been bias-corrected), communications equipment manufacturing (Communications) and semiconductor and other electronic components manufacturing (Semiconductors) both report a 7% growth in technology over the five-year period.

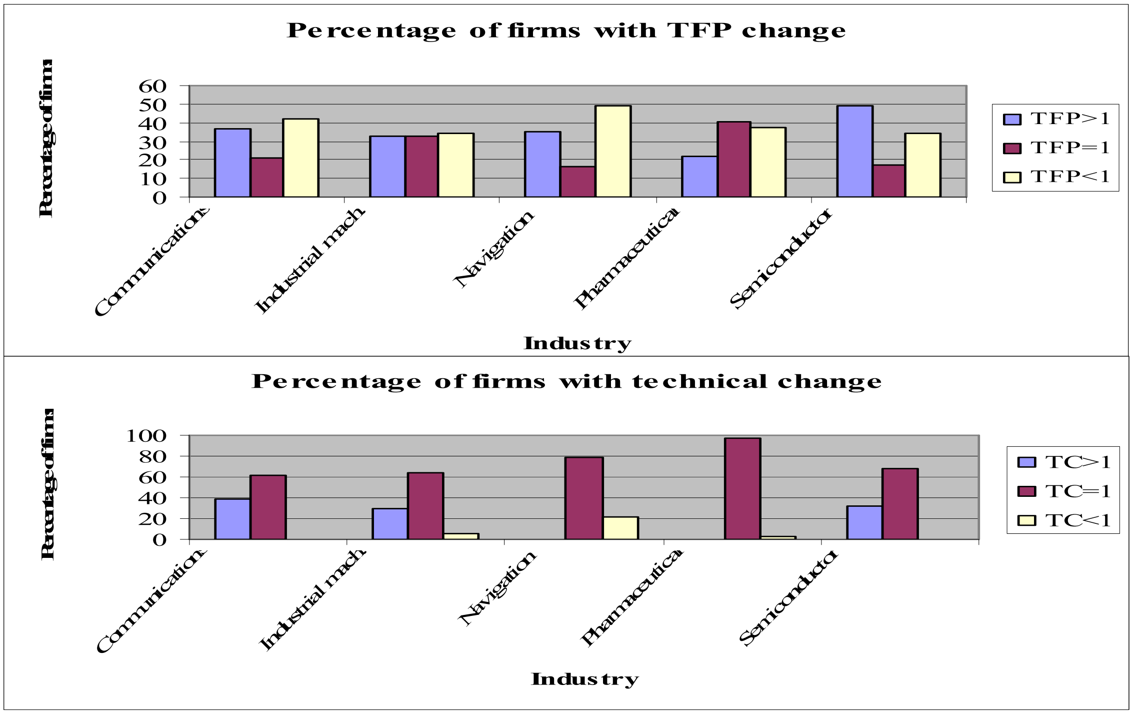
Industrial machinery manufacturing (Industrials) has a technical progress of 4%. However, navigational, measuring, medical and control instruments manufacturing (Navigationals) and pharmaceutical and medicine manufacturing (Pharmaceuticals) report negative technical changes. Navigationals report 7% while Pharmaceuticals report a whopping 12% regress. In terms of pure technical change, the figure is 4% for Navigationals but Pharmaceuticals remain the same.

Still with the five-year period, if we consider the limits of the confidence interval for technical change, none of the means of the industries has at least 1.0 for lower level of confidence. No industry also has 1.0 or less as a figure for the upper limit of confidence. This will suggest that no statistically significant technical change took place over the five-year period. We record the number of firms in each industry that experience technical regress, constant technology or technical progress as reported in graph 7 (table A33).

Table 14: Summary statistics of productivity and technical change for the five industries

Statistic	Communications Equipment Manufacturing	Industrial Machinery Manufacturing	Navigational, Measuring, Medical, and Control Instruments Manufacturing	Pharmaceutical and Medicine Manufacturing	Semiconductor and Other Electronic Component Manufacturing
Years 2000-2003					
Malmquist index	1.10	1.06	1.13	1.24	1.17
Technical change	1.03	1.04	0.92	0.88	1.17
Years 2003-2005					
Malmquist index	0.95	0.98	1.00	1.20	0.95
Malmquist index Lower bound 5%	0.92	0.96	0.96	1.12	0.93
Malmquist index Upper bound 95%	1.00	0.99	1.03	1.29	0.97
Pure technical change	0.93	1.00	1.00	1.04	0.92
Pure technical change 5% lower bound	0.86	0.92	0.90	0.81	0.86
Pure technical change 95% upper bound	1.09	1.06	1.15	1.47	1.00
Technical change	0.95	0.96	1.03	1.04	0.93
Technical change 5% lower bound	0.80	0.85	0.84	0.66	0.82
Technical change 95% upper bound	1.25	1.09	1.33	1.96	1.07
Firm total	111	63	155	158	185
Years 2000-2005					
Malmquist index	1.02	1.01	1.03	1.08	1.05
Malmquist index Lower bound 5%	0.98	0.99	0.98	0.98	1.02
Malmquist index Upper bound 95%	1.07	1.05	1.08	1.21	1.09
Pure technical change	1.01	1.05	0.96	0.88	1.09
Pure technical change 5% lower bound	0.96	1.00	0.87	0.63	1.02
Pure technical change 95% upper bound	1.18	1.14	1.11	1.17	1.20
Technical change	1.07	1.04	0.93	0.88	1.07
Technical change 5% lower bound	0.93	0.94	0.73	0.53	0.95
Technical change 95% upper bound	1.36	1.19	1.16	1.59	1.27
Firm total	98	52	118	103	150

Graph 7: Percentage of firms with *TFP* and technical changes from years 2000 to 2005



No firm in Communications has a technical change less than 1.0 but 62% of them report no statistically significant technical change while the remaining 38% indicate statistically significant technical progress. The dynamics in Semiconductors is basically the same as in Communications. No firm indicate technical regress, 68% indicate no significant change while 32% show technical progress.

We now consider Industrials. 6% in this industry report statistically significant regress while 30% indicate progress. 64% indicate no significant technical change; therefore 96% of firms indicate a constant technology or technical progress. Navigationals, as we recall from earlier, indicate technical regress. Only 21% of firms show statistically significant regress, while no firm indicates technical progress. 79% of this industry shows no statistically significant technical change. Although Pharmaceuticals also show a similar pattern, only 3% of firms show significant technical regress whiles the remaining 97% reflect no change.

Total factor productivity for the industries

We can say with a level of confidence of 95% that for the 2000-2005 period, all the industries experience between 1% (industrial machinery) to 8% (pharmaceutical and medicine manufacturing) total factor productivity growth which have been broken down to their components. Semiconductor and other electronic component manufacturing score the second highest productivity growth at 5% followed by navigational, measuring, medical and control manufacturing. Communications equipment manufacturing only performs better than industrial machinery at 2%.

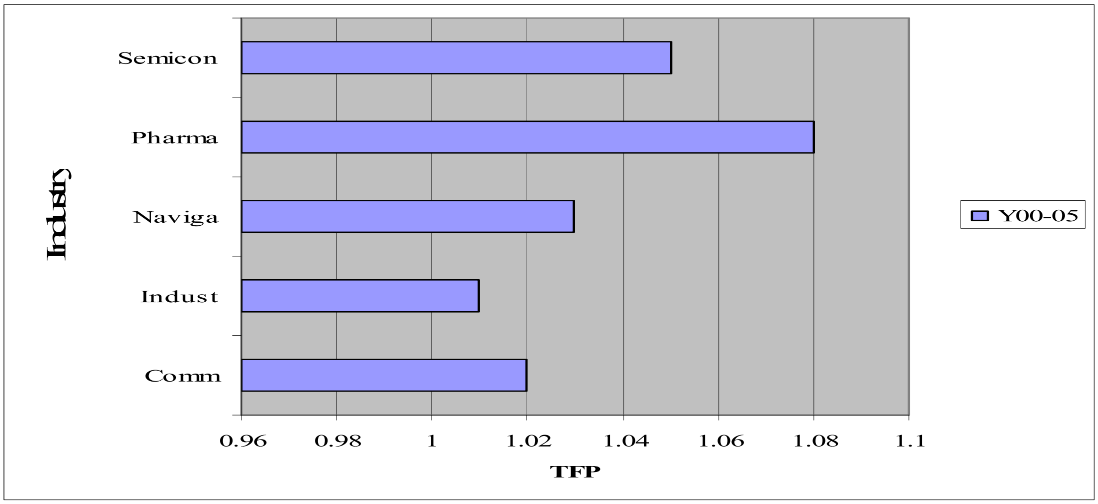
The pharmaceutical and medicine manufacturing industry therefore puts more emphasis on improving technical efficiency because it is easier for relatively inefficient industries to do so. Even though there is a drop of 12% in pure technical change (indicating the best performers – benchmarkers- have become less efficient in 2005), pure technical efficiency change which is derived from the inefficient firms in year 2000 increases by 20% in 2005 catapulting the total factor productivity growth to 8%. It is undeniable that there is more research and development in the pharmaceutical industry than in the industrial machinery sector (evidenced by the values of its firms' intangible assets). This is coupled with the fact that it is difficult for (almost) technically efficient industries to increase their efficiency.

The *TFP* scores for period 2000-2003 indicate significant growth for all the five industries ranging from 6% for Industrials to 24% for Pharmaceuticals. The *TFP* scores for the two-year period of 2003-2005 do not show growth for three of the five industries. It is only the pharmaceutical industry which again experiences a 20% growth because of a 4% technical progress and a 5% technical efficiency increment considered with the other components. The navigational, measuring, medical and control manufacturing industry does not record any statistically significant *TFP* (no change). The components breakdown reveal that 4% gains in pure technical efficiency and scale of technology are offset by a 3% loss of scale while pure technology remains unchanged (refer to tables A31 and A32).

We now discuss results for the 2000-2005 periods. All industries record productivity growth with the highest being Pharmaceuticals at 8%; followed by Semiconductors at 5%; Navigationals at 3%; Communications at 2%, and; Industrials at 1%. However, only Semiconductors indicate a statistically significant growth as its lower confidence interval at 5% indicates a positive value of 2%. The lower interval of Industrials indicates a 1% productivity loss while the other three industries have lower limits of 2% losses.

We investigate these results further by looking at the percentage of firms in each industry with productivity gains, losses or no changes as shown in graph 7 above (table A33). 42% of firms in

Graph 8: Five-year *TFP* change from years 2000 to 2005



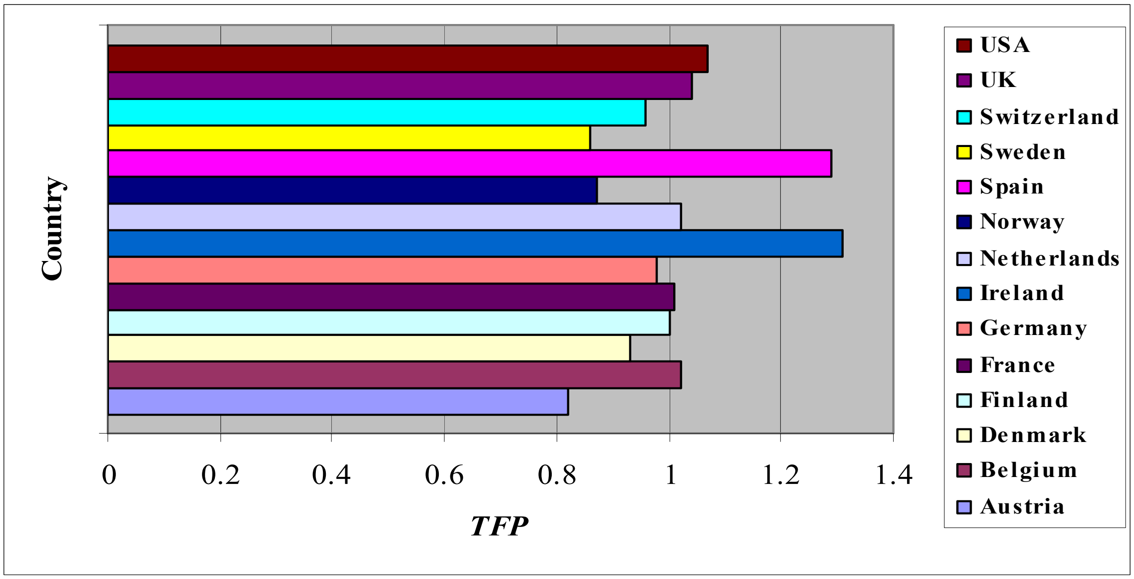
Communications experience productivity losses whiles 36% indicate gains. The remaining 21% indicate no significant changes. In Industrials, nearly a third falls into each of the three categories while the percentage of firms with productivity losses in Navigationals is almost the same as those that experience gains or no significant changes. For Pharmaceuticals, although we have an average of 8% growth, only 22% of firms actually experience productivity gains while 40% show no significant changes and 38% show significant losses. It is only for semiconductors that almost half (49%) indicate productivity growth while 17% show no change. Even in this industry, 34% still indicate productivity losses. However, this industry's productivity growth is statistically significant at the 5% level. We have thus confirmed why a longer period is necessary for meaningful dynamic analysis. Graph 8 indicates arithmetic mean industry *TFP* growths.

Technical change and TFP estimates at country level

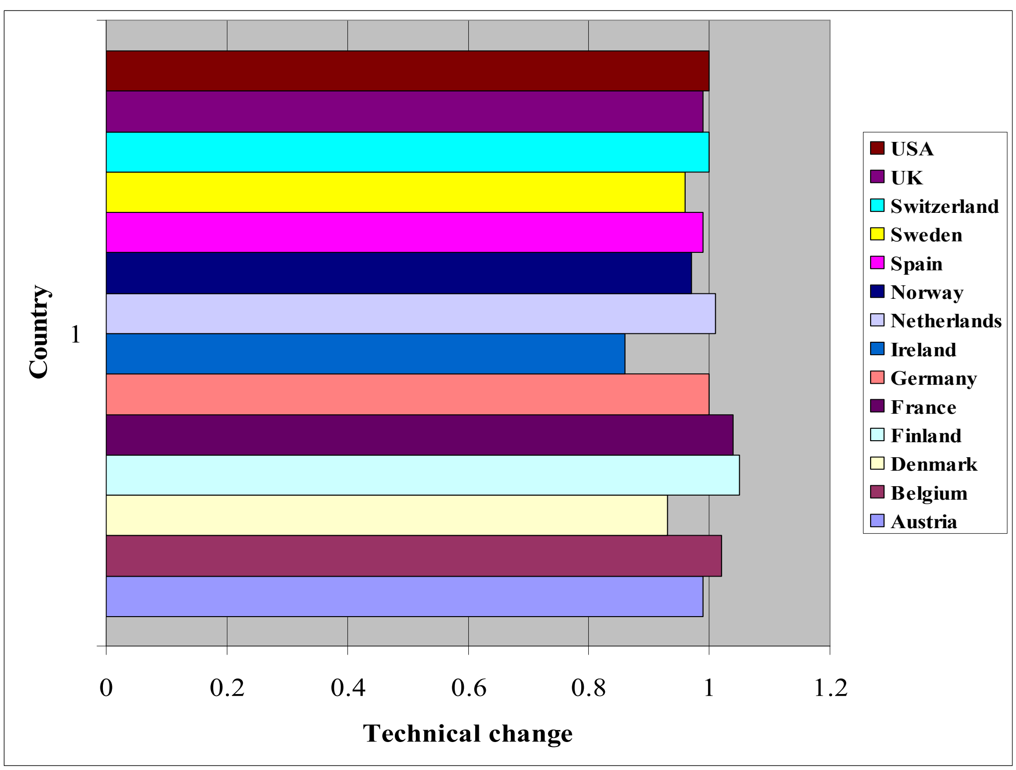
Graphs 9 and 10 (table A34) respectively show total factor productivity growth and technical change estimates at the relevant confidence levels for the 16 countries under investigation.

It has been noted earlier that Portugal is excluded as it has very few firms left in the sample after the choice of inputs and outputs, and subsequent outlier detection test. The number of firms for Austria, Ireland, Norway and Spain are below the median country value. *USA* has a disproportionately high number of firms in the sample (over 50% for the dynamic frontier estimation). Please refer to the table for a more detailed report of the components of productivity like scale change, scale of technology change, pure technical change and pure technical efficiency change. We are interested in technical change and total factor productivity growth.

Graph 9: ***TFP*** **change by country from years 2000 to 2005**



Graph 10: Technical change by country from years 2000 to 2005



We must first indicate that the means of technical change at the country level are all not statistically significant from each other at 5% (see table A34). What we mean is that there is no country that shows statistically significant technical progress or regress. Having said this, we still endeavour to rank the technical changes of the sixteen countries based on the sub-sample arithmetic means. We will discuss technical changes from years 2000 to 2005; although we will say in passing that during the sub-period of say 2003-2005, Austria, Denmark, Italy and Norway show decreases in productivity.

Ireland and Greece are the only countries that show technical progresses of 10% and 7% respectively. All other countries indicate statistically insignificant regresses of between 1% and 8%. Austria which is one of the most technically efficient countries posts an 8% technical regress taking the last position. On the other hand, Denmark, Spain, Sweden and the *USA* show 1% regress. France and the *UK* both regress in technology by 2%. Belgium, Germany and Switzerland observe regresses of 3% each while Italy, Netherlands and Norway record 4% regresses. Finland records a 6% technical regress, being only worse than Austria to this extent. As we have already emphasised, all these results are not statistically significant at 5%. We now discuss technical changes by legal origin. All legal origins indicate technical regresses of between 1% and 3% but none of this is statistically significant.

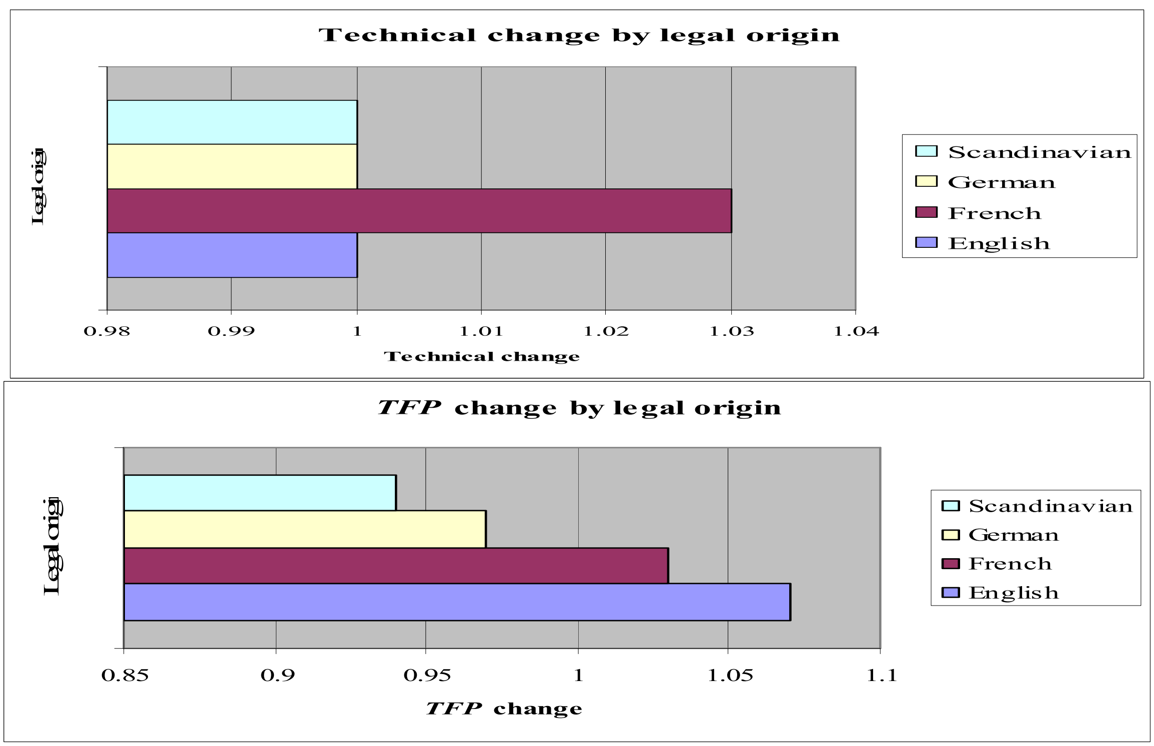
Unlike technical changes that are all not statistically different between countries, there are some differences in total factor productivity changes. Countries like Greece, Ireland and the *USA* show statistically significant total factor productivity growth. Ireland again shows the highest productivity growth of 13% funnelled by foreign direct investments during that period. Incidentally, it is one of the countries that have been severely affected by the 2008 global recession crunch. As it is the least technically efficient country, it makes significant technical efficiency improvements. Greece also records a total factor productivity growth of 11%, with credit going to a 12% gain in pure technical efficiency change. The *USA* is third with a 4% productivity growth.

We will now discuss countries with no statistically significant changes in productivity. Spain records a 7% insignificant productivity growth followed by Sweden at 5%, Belgium at 3% and France at 1% respectively. Switzerland records no productivity change. Finland and Netherlands both record insignificant productivity losses of 1%. Germany and the *UK* also record statistically insignificant losses of 2%.

We will now discuss the three countries with significant productivity losses. Denmark shows a *TFP* loss of 6% followed by Austria at 5% and Norway at 2%. These results only apply to the five manufacturing industries in every country we have selected. It does not in any way imply that all industries (and by extension, all firms) in these countries recorded productivity losses. In the case of Italy (like Portugal), we are unable to report any *TFP* change as most of the firms in the sample do not have complete information for year 2000 to get a useful analysis.

Now what about technical change and productivity at the analytical level of legal origin? Graph 11 indicates technical change for the period 2000 to 2005. Apart from the French that reports a 3% statistically insignificant technical progress, the other three legal origins show no change at all at the 5% significance level. In terms of *TFP* for the 2000 to 2005 period, the English post a statistically significant growth of 7% while the French's growth of 3% is insignificant. Both Germans and Scandinavians report insignificant regresses of 3% and 6% respectively.

Graph 11: Technical and *TFP* changes by legal origin



We have only provided efficiency and productivity estimates for the industries, countries and legal origins. We have not tackled the estimates for the different corporate governance explanatory variables of interest as we utilise these estimates as part of our dependent variables in the second stage regression analyses which considers these relationships.

4.4 Parametric methodology and empirical analyses

This section examines some econometric approaches used in our study of corporate governance and performance. We introduce some robust measurements suitable for the data. These methods are used in other disciplines of the Social Sciences to handle panel data estimations. Before we carry on, we give some descriptive statistics of the data in table 15 and some further methods to deal with influential outliers that distort the coefficient estimates. The data is for three years (2003-2005). However, average five-year sales growth is measured from 1998 to 2005 (i.e. five years each for the three data years) and standard deviation of *ROE* is measured from 1999 to 2005 (i.e. four years each for the three data years).

It has already been pointed out that our board and ownership variables are for one year. La Porta et al. (1999), Thomsen and Pedersen (2000) and Bauer et al. (2004) point out that governance variables tend to be relatively stable for a short period of time. This is the main reason why our panel is for three years as using time invariant governance variables for a longer period may lead to inconsistent estimates.

Dealing with influential observations

In regression analysis, transforming the dependent and independent variables improve data normality. We make several transformations of the dependent variables, to see which of the resulting transformations show the best normal distribution, using Ladder-of-Powers Histograms technique. This technique draws out transformations of the identity variable to their squares, cubes, inverses of these squares and cubes, inverse of the identity variable and logarithmic transformations. The logarithmic transformations are the most normally distributed. Dependent variables with non-negative values are thus logarithmically transformed. *ROA*, *ROE*, cash flow, asset growth and operating revenue/turnover growth are not transformed since they have lots of negative values.

Table 15: Summary statistics of the relevant variables pooled over three years

Variable	*N*	*n*	Mean	Std. Dev.	Minimum	Maximum
Tobin's Q^{o}	5006	1669	1.79	1.02	0.07	5.66
MBV^{o}	4923	1641	2.13	1.78	-4.50	8.39
ROA^{o}	5605	1868	-4.74	23.21	-92.98	83.10
ROE^{o}	5202	1734	-1.62	35.61	-140.54	137.38
Cash flow^{o}	4616	1539	0.45	1.50	-4.92	5.81
Dividend yield^{o}	1614	538	0.57	0.62	0	3.27
VRS technical efficiency^{o}	2538	846	0.73	0.21	0.11	1
Corrected tech. efficiency^{o}	2538	846	0.67	0.19	0.10	0.98
TFP^{o}	2151	717	1.04	0.48	0.50	8.01
Asset growth^{o}	5292	1764	0.08	0.29	-0.95	1.10
Revenue growth^{o}	5043	1681	0.10	0.31	-0.96	1.13
Largest shares	5037	1679	0.30	0.23	0.01	1
5 largest shares	3150	1050	0.50	0.22	0.05	1
Board size	6618	2206	7.08	2.81	1	26
Board independence	4923	1641	0.56	0.24	0	1
Leverage	6128	2043	2.17	62.28	-359.5	4564.58
Sales	5815	1938	1446954	7324163	3	193000000
5-yr. sales growth	4222	1407	1.13	27.43	-0.54	1025.22
Std. dev. 4-yr. *ROE*	3908	1303	13.2	12.36	0.22	85.98
Unrefined values of eight dependent variables (without data cleaning and outlier deletion)						
Tobin's *Q*	5399	1800	12.38	338.46	0.07	22874.77
MBV	5364	1788	3.58	80.94	-977.21	5539.35
ROA	6068	2023	3510.72	275093.01	-966.44	21429000
ROE	5583	1861	2657.69	200001.68	-929.65	14944000
Cash flow	5316	1772	-38688.49	2022274.59	-119722661	100942
Dividend yield	5076	1692	5748.09	409454.25	0	29172000
Asset growth	5776	1925	5.71	206.04	-1	11308
Revenue growth	5564	1855	0.72	8.42	-20.24	267.67

^{o} = Outliers have been removed (from dependent variables) by a measure of *"median ± 3 x interquartile range"*. The raw data for eight dependent variables of Tobin's *Q*, *MBV*, *ROA*, *ROE*, Cash flow, Dividend yield, Asset growth and Revenue growth have also been given for central tendency comparison. Technical efficiency and *TFP* are already corrected from the non-parametric analysis. Variables measured in currency are in thousands of *US* dollars.

4.4.1 Univariate analysis of ownership and board variables

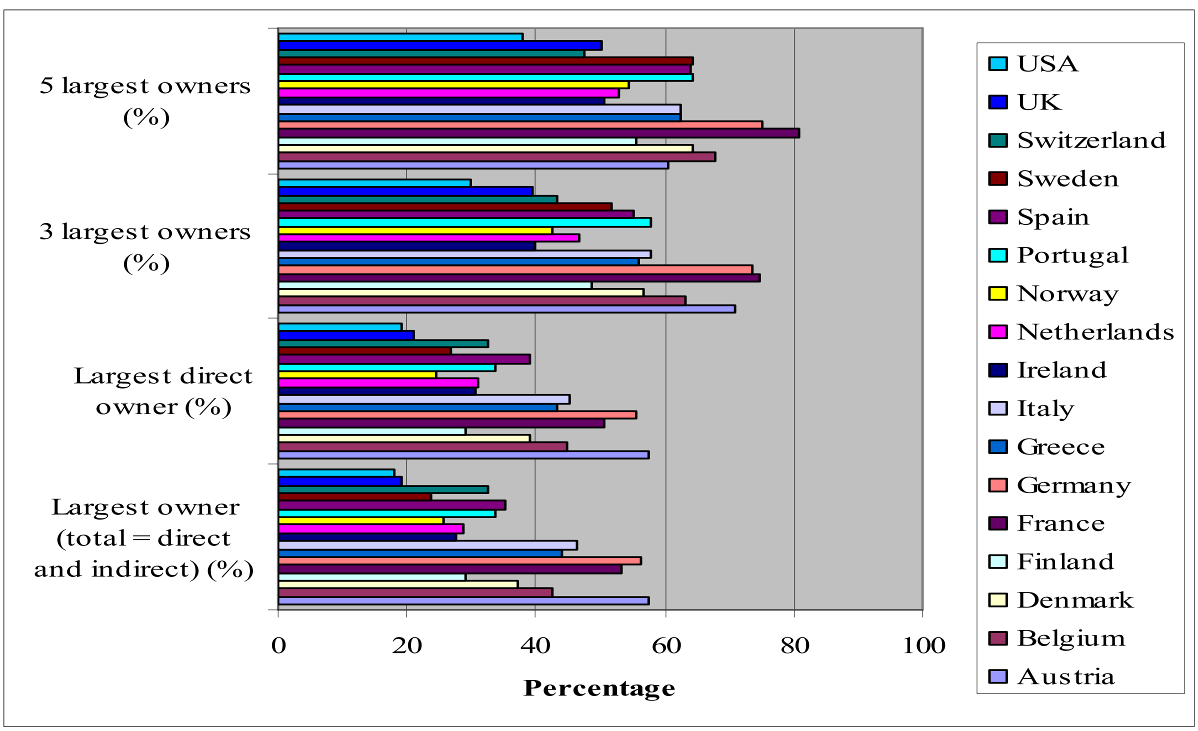
We report on univariate analysis of ownership and board characteristics in this section in order to make comparisons with prior empirical studies. Ownership and board variables have given more contradictory empirical results than that of the other explanatory and dependent variables. These other variables are all important but will take up too much space if compared to previous studies.

Shareholding percentage across countries and ownership types are given. The distribution of the size and independence of the board and *CEO*-chairman separation are also indicated across countries. We will start with shareholding percentage. Here, we have the largest total (direct and indirect) shares, the largest direct shares, the three largest direct shares and the five largest direct shares. Graph 12 (detailed in table A35) looks at the means of the shareholding percentages across countries.

Ownership concentration

Austria, Germany and France show the most concentrated ownership (greater than 50% for the single largest owner) which is in line with what the literature review has revealed. The *USA* has the least shareholdings for a single owner at less than 20%. The values for the *UK* and Ireland are also low indicating their Anglo-Saxon leanings. Scandinavian countries also show lower ownership concentrations than countries with a French origin. Among the Scandinavian countries, Denmark reports the highest concentrated ownership while Finland has the lowest. The ownership concentration however vary within these countries depending on whether the largest, three largest or five largest is considered. In terms of countries with a French legal origin, Greece and Italy have higher ownership concentrations than Spain and Portugal[10]. The concentration in the Netherlands is comparable to the Scandinavian countries while Belgium has ownership concentration comparable to that of Italy and Greece.

Graph 12: Percentage of share ownership by countries

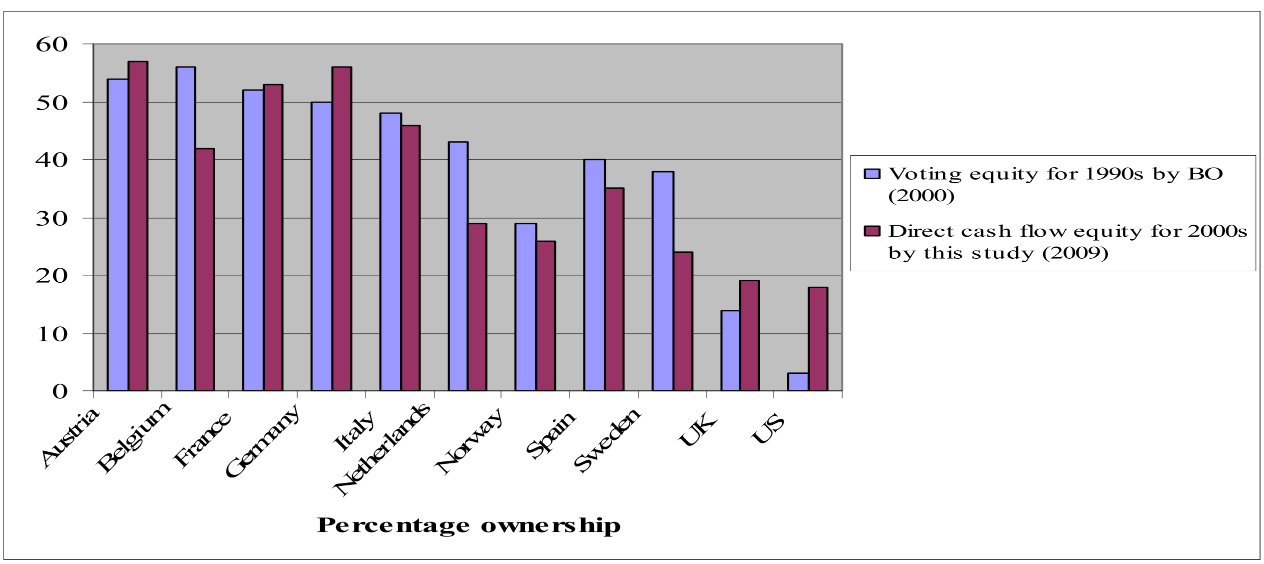


[10] Whereas Portugal is not used in the non-parametric estimations of efficiency and productivity growth, it is used in the regression estimations of the other eight dependent variables.

With the exception of the *USA* (38%) and Switzerland (47%), all other countries including English legal origin countries (*UK* (50.2%) and Ireland (50.4%)) have more than 50% ownership for the five largest direct shareholders. This supports the thesis that even in publicly traded firms, ownership is still highly concentrated and that these European common origin countries share more in common with the continental model.

We compare our results of the distribution of ownership across countries with that of Bøhren and Ødegaard (*BO*, 2000). They employ voting equity as their measure of ownership concentration while we employ cash flow ownership. These results are not strictly comparable because of the apparent wedge between voting and cash flow ownerships for some countries and the different time periods. These same authors indicate that the wedge does not seem to matter in altering firm performance. Austria has very high ownership concentrations in each study at 54% and 57% as indicated in graph 13 (table A36). While the latter value is the highest in our study, it is the second highest in *BO*'s study. We only have manufacturing industries in our sample while *BO*'s study is representative of the various industrial sectors. Germany has an average cash flow ownership of 56% in our study and 50% of mean voting equity in *BO*'s study making these two German speaking countries with highly concentrated ownership.

Graph 13: Percentage of shares of largest owner by country



Belgium has the highest ownership concentration in *BO*'s at 56% while we have 42% in our study. Sweden has 38% in *BO*'s study while we arrive at 24%. Netherlands has 43% in *BO*'s study while we have only 29%. These may be due to improvements in corporate governance and investor protection laws, the effect of pyramidal controls that lead to more voting equity than cash flow equity or the industries considered. All other countries (i.e. Austria, Germany, France, Italy, Norway, Spain and the *UK*) have approximately the same levels of ownership concentration in both studies. The only conflicting country is the *USA*. While *BO*'s review point to only 3% voting equity, we report 18% cash flow ownership indicating the concentration of ownership, although investor protection in the *USA* has supposedly improved over the period. Other studies will also point to the fact that the *USA* does not have very low dispersed ownership as has been reported by yet other studies (for example Demsetz & Lehn, 1985; Demsetz and Villalonga, 2001).

Ownership identity of largest shareholders

We now report on the descriptive statistics of the sample and sub-samples of *USA* and Western European firms. Table 16 reveals the proportion of largest direct shareholdings and five largest shareholdings held by different types of shareholders.

For the five largest shareholders, we use the identity of the largest shareholder (while the other four shareholders may have different identities). As regards the total sample, individuals or families on the average hold 29% and 54% of largest direct shares and five largest shares respectively. Public companies come highest in both categories at 45% and 79% respectively. Industrial companies on the average hold more shares than individuals/families/self-owned at 44% and 59% respectively. The State has on the average 27% shares for largest shares and 55% for five largest shares. Financial companies command the least shareholding concentration at only 18% for the largest shares and 40% for the five largest shares. We do not comment on the aggregated category referred as “Others” as we use this as our reference category in creating our categorical dummy variables for our subsequent regression analyses.

We now discuss the results obtained by splitting the sample into firms in the *USA* or Western European countries. Firms incorporated in the *USA* have lower means of all the shareholding concentration of the different ownership categories except the category labelled “State” referring to the Government, public institutions, municipal authorities, etc where they edge out the Europeans by three percentage points at 29% for largest direct owner. However, not many firms in the *USA* have this category in their ownership structure while in some European countries, this category forms a substantial part of the ownership structure.

Table 16: Ownership ratios among different categories in *US* and non-*US* firms

	Total sample			
	Mean	Standard error	Mean	Standard error
Shareholder type	*Largest direct shareholdings N = 1676*		*5 largest direct shareholdings N = 1048*	
Individual/ Family	0.29	0.01	0.54	0.01
Banks, Financial Institutions, Mutuals, Pension funds	0.18	0.01	0.40	0.01
Public company	0.45	0.02	0.79	0.02
Industrial Company	0.44	0.01	0.59	0.01
State/ Public agency	0.27	0.03	0.55	0.07
Others	0.36	0.02	0.66	0.03
	Sample divided into US vs. Non-US firms			
Largest direct shareholdings	*Non-US*		*US*	
Individual/ Family	0.33	0.01	0.23	0.01
Banks; Financial Institutions	0.25	0.01	0.13	0.01
Public Company	0.50	0.02	0.28	0.03
Industrial Company	0.47	0.01	0.31	0.02
State	0.26	0.04	0.29	0.05
Others	0.38	0.02	0.28	0.05
Total largest shareholdings	0.38	0.01	0.19	0.01
5 largest direct shareholdings	0.61	0.01	0.38	0.01

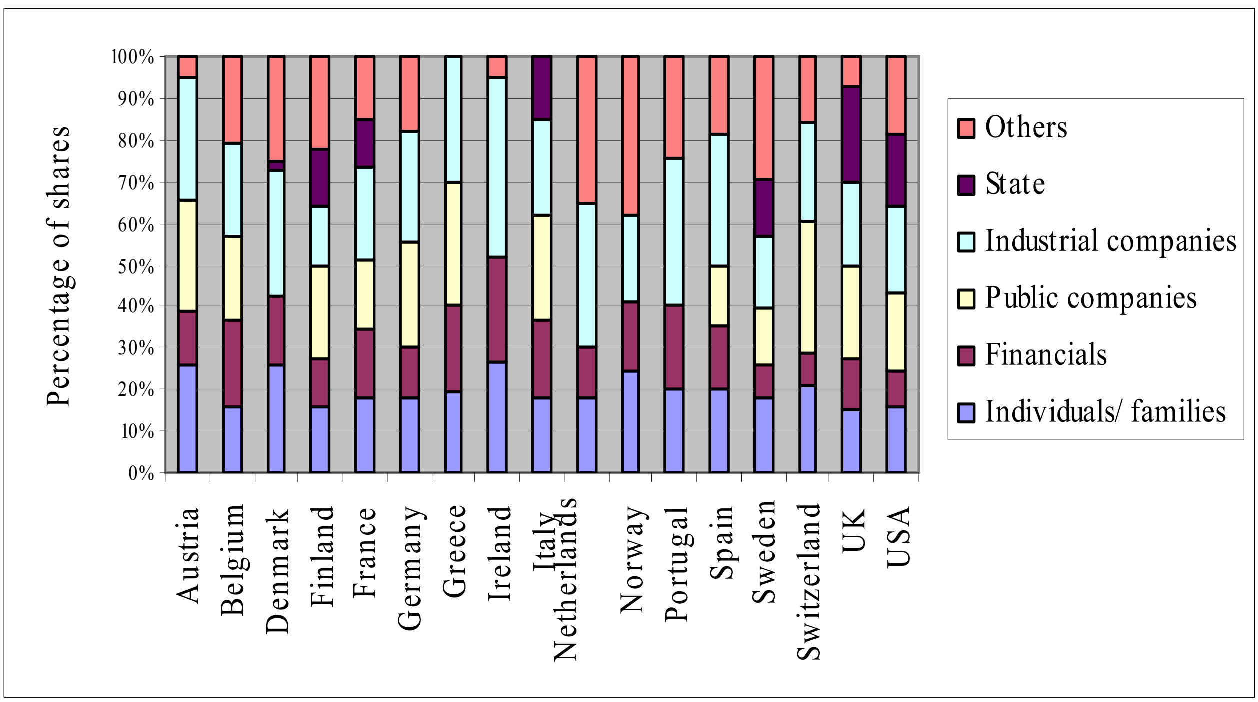
The means and standard errors of largest direct shareholdings and total (direct and indirect) largest shareholdings are approximately the same. We report values for the former. The identity of the largest shareholder in the five largest shareholders is reported as the identity of the five largest shareholders.

In table A37, we report the cash flow equity (in percentages – second column of each category) of the different category of owners for the seventeen countries. Individuals/families and industrial companies have substantial shares across all countries. For example in Austria, there are 25 firms in this category from the manufacturing industries. Only one firm has an individual/family as the largest shareholder with 60% shares. Industrial companies in this country have on average 68% of the shares. The State has no participation at this level of ownership. The average shareholding of the largest direct shareholder when this is a public company is 62% of the total. Financial companies on average own less than half of the shares of the other three categories but better than most countries except Belgium, France, Greece and Italy. They are comparable to that of Germany which is expected. In Belgium, financial, public and industrial companies all have 40-45% ownership while individuals/families have a third of total shares when they are the largest shareholder. There is no State participation for our 44 firms in the sample with data.

In our sample containing 46 Finnish firms, only one has the identity of the largest shareholder as a public company (60% of direct shares). The State has a major role in firm ownership in this country just like individuals/family, industrial companies and financials. Most firms have their largest owner being a financial company followed by industrial companies and individuals/families having about equal representation.

France has a high ownership concentration across all categories. On the average, families and individuals hold more than 50% controlling stakes and industrial companies control almost two-thirds of firms they represent. Only Austria and Germany have industrial companies with more shares than France. In firms where they are represented, the French government has almost a third of the stakes while financial and public firms have just under half of the total shares.

Graph 14: Percentage of largest shareholdings among ownership categories by country



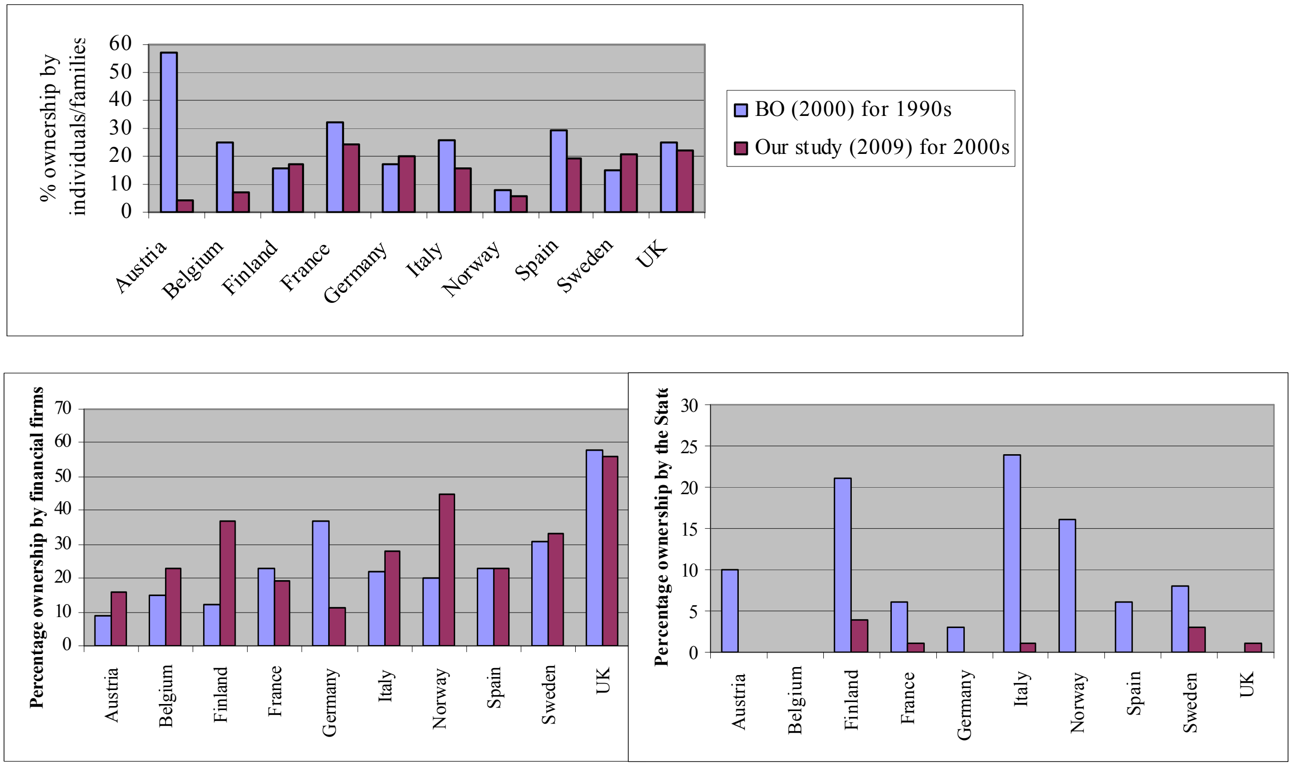
One obvious inference from graph 14 (detailed in table A37) is about the role of public companies in Germany. There are 166 firms from Germany and 41 of these are public companies with 62% average ownership when they are the largest shareholders. This is only exceeded by industrial companies with an average of 67% for the 66 firms represented. There is no State representation but we find that financial companies which include banks have the lowest ownership for 17 German firms at just above 20%. Greece has a similar ownership pattern with Germany although the ownership levels are lower except for financials where it is almost 10% higher. Industrial companies in the Netherlands have majority control but all other categories have less than a third with no State participation. Other categories also have majority control (same as in Norway) but the five remaining categories all have less than a third of total shares. Individuals/families, industrials and financials in this order have between 32% and 22% of total shares while there is no public or State participation in the observed sample. Denmark has higher ownership levels than Norway (no majority-controlled firms) but with little State participation.

Spain and Portugal have industrial companies as their main largest shareholders and this category has the largest number of shares. The State has little participation in these industries while individuals/families and financial companies also have more than 20% shares. In the case of Switzerland, the public and industrial companies also have concentrated ownership and so are individuals/families. Ownership by financial companies is low at 12%. The State has little participation in this country too. Ownership concentration of Swedish firms is rather low for the five categories. Other categories of ownership however have almost 45% of ownership. Again, the trend in Sweden for the five categories is similar to that of Switzerland except for State participation.

Ireland has more concentrated ownership than the *UK* or *USA* considering its legal origin. Apart from industrial companies and individuals/families (and other categories) that have a higher concentration of ownership than *UK*, albeit not too marked, all other categories have lower ownership levels even for the few State representation. For financials, largest shareholdings are substantially less than 20%. The public and industrial companies in the *USA* and *UK* have less than a third of total shares and represent the categories with the most shares. The shares of individuals/ family are more concentrated than financials but less than public and industrial companies.

We will now compare the percentages of firms in each ownership category of ten countries with that of Bøhren and Ødegaard (*BO*, 2000) for the 1990s. The comparison is shown in table A38. Our results are presented in table A39 and summarised in graph 15. For Austria, only 4% of our firms have the largest owner being an individual/family compared with 57% for *BO*'s. We do not have many Austrian firms in our sample and our choice of industries may have fewer individuals as largest owners. Although we report no State participation, the State has an average of 10% participation in Austria for *BO*'s study. Our sample reports a substantially important contribution of financial companies at 16% while that for *BO*'s study is less than 10%.

Graph 15: Comparison of identity of largest shareholder with Bøhren and Ødegaard's study



Percentage of ownership by individuals/family (top); percentage of ownership by financial firms (bottom left), and; percentage of ownership by the State (bottom right).

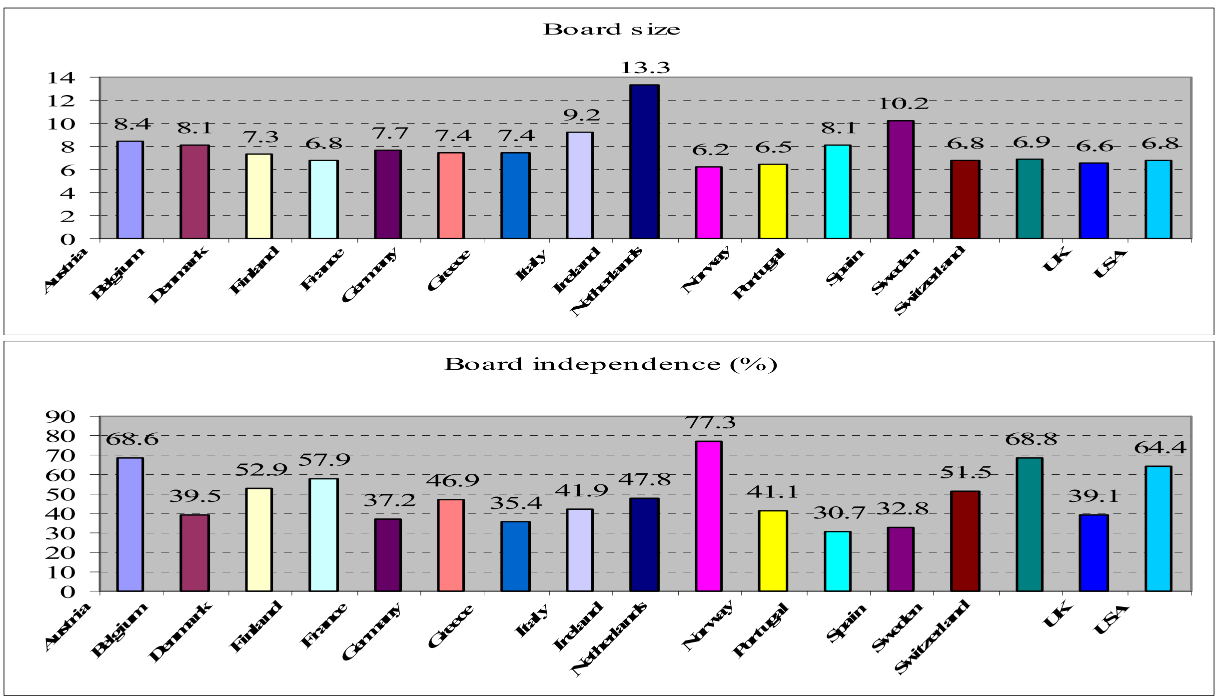
For Belgium, our study reports individuals/families contributing to 7% of ownership while the other study has it at 25%. Our financial category is 8% higher than the other study at 16%. We must say here that the participation of the State in our study is very low, in fact none in several countries. The result for ownership categories in Spain is consistent for both studies although we observe no State participation. This can be a result of the further privatisation drive in Spain. We report a lower State participation in Sweden than *BO* but about the same influence of financial firms. Whilst our individual/family participation is 6%, the other study is 21%. *BO* report a 16% average ownership participation for the State in Norway while we do not have any in our industries surveyed.

Our ownership level for financials in Norway is more than twice their study but about the same for individuals/families. In both studies, the financial firms in the *UK* participate a lot (more than 55% of all firms). Irish firms are just a little lower and *US* firms are at 59% in our study. The other study does not cover these countries. Family ownership is fairly consistent across the two studies. The results from both studies are also fairly consistent for Italy but the State has a 24% participation rate in the comparative study. Both studies involving the French report similar distribution. We also observe in our study that in Greece, 58% of firms have individuals/families as largest shareholders.

Board size

Board size in Ireland is the highest although we must infer with caution as the number of Irish firms in the sample is limited because of their relatively small number of listed manufacturing firms that are incorporated in Ireland. Most firms in Ireland are subsidiaries of multinationals or other countries and these are not included. Both the mean and median board size for the whole sample is seven. This means that Irish firms with thirteen members have almost as twice the number of board of directors as other countries. This is against the backdrop that Ireland is the least technically efficient country in the analysis from the previous section. The upper part of graph 16 gives the distribution of average size of the board of directors in the seventeen countries under consideration.

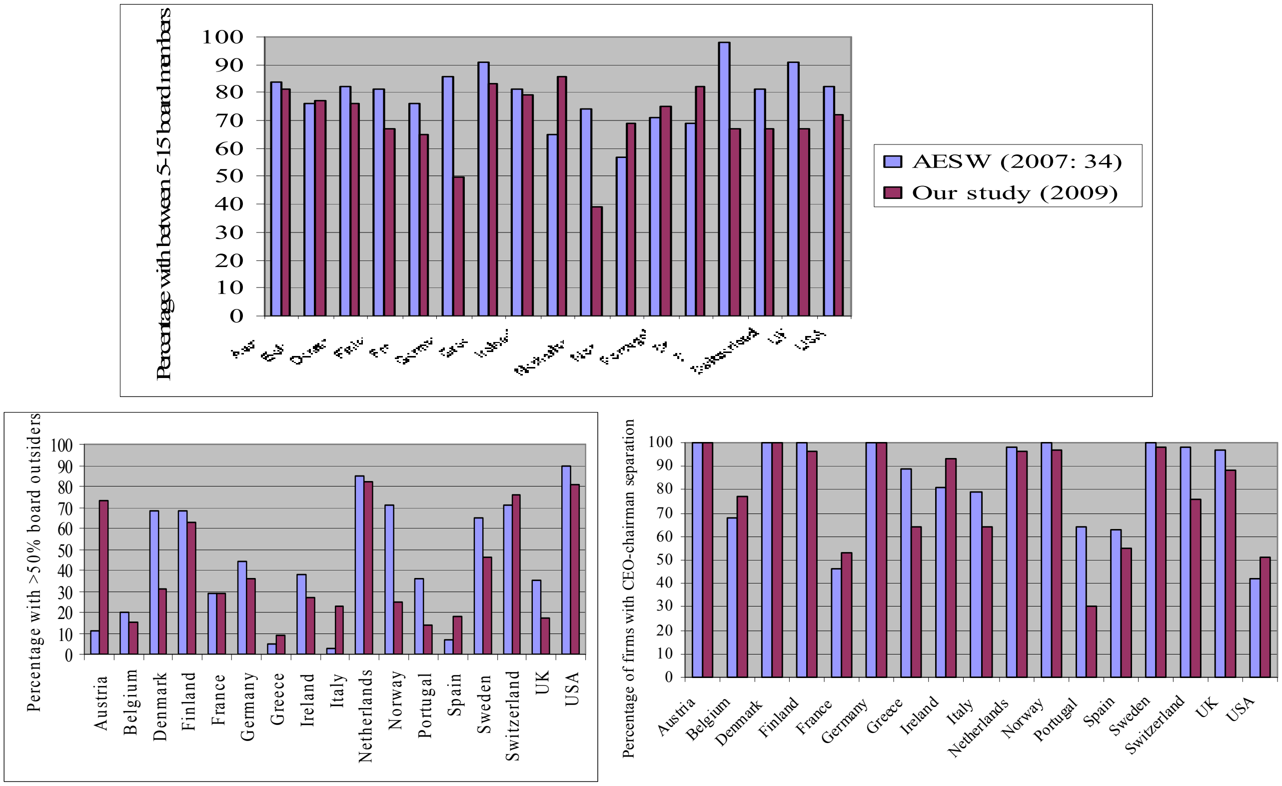
Graph 16: Average sample board size and board independence by country



Most Irish firms have adopted the Combined Code of *UK* which recommends smaller boards. Netherlands has on the average, six members on the board. This is followed by Norway with an average of 6.5 board members. Denmark, Finland, Germany, Greece, Sweden, Switzerland, *UK* and *USA* have an average board size of seven, although statistically speaking; the *UK* closely follows Norway. Countries like Austria, Belgium, France and Portugal have on average a board size of eight members. Italy has an average size of nine and Spain follows with an average size of ten. In effect, only Ireland has a bigger board size than Spain.

We continue our discussion on board characteristics by considering univariate relationships with the countries in our study and comparing them to the study by Aggarwal et al. –*AESW*- (2007) as reported in graph 17 (table A40).

Graph 17: Comparison of ideal board characteristics with Aggarwal et al.'s study



Percentage of firms with board members between 5 and 15 members (top); percentage of firms with more than 50% board outsiders (bottom left), and; percentage of firms with *CEO*-chairman separation (bottom right).

Four out of five Austrian firms in both studies have the ideal board size of between 5 and 15 members which is in line with empirical predictions of good performing firms. Three-quarters of Belgian firms have the right board size in both studies. As regards to Denmark, our study reports 76% while *AESW*'s study is at 82% indicating a majority of firms have the right board sizes. In both studies, other countries like Finland, France, Greece, Ireland, Italy, Portugal, Spain, Sweden, Switzerland, *UK* and *USA* all have at least two-thirds of their firms with the ideal board sizes.

There are three countries worth considering here. While in our study, only half of German firms have the right board size, *AESW* report a value of 82%. The average board size in our study is 8.4 but our observation is that large sized firms in Germany tend to have higher board sizes due to their process of codetermination (or equal representation) by shareholders and employees; and these are the firms likely to be listed. The next country is the Netherlands. We report that only 40% of firms have the ideal firm sizes of between five and fifteen members while the other study reports three-quarters. Our average board size of the 49 Dutch firms is however low at only 6.2 with minimum of 3.0 and a maximum of 18. The explanation we can give is that our study covers only manufacturing industries and that in the Netherlands, manufacturing industries may have lower board sizes of less than six members. In fact, 29 of the 49 Dutch firms have a board size of three, four or five members. The third country is Norway. We report a higher number of firms at 69% to *AESW*'s 57%. We have a substantial number of firms with less than six members and no firm with more than the ideal size range.

Board independence

The average number of outsiders on the board of directors for the entire sample is 56%. This means that most boards are independent. We now consider the distribution across countries. For the Netherlands, 77% of the board are outsiders followed by Switzerland at 68.8% and Austria at 68.6%. *USA* comes fourth at 64%. Denmark, Finland and Sweden are the other countries with more than 50% board outsiders. Portugal has the least percentage of outsiders (less than a third) followed by Spain (also less than a third) and Greece at 35%. France and the *UK* also have less than 40% outsider representation. The *UK*'s value is for independent non-executive board members. Belgium and Italy have just over two-fifth outsiders on the board while Germany and Ireland have almost half (i.e. less than 50%) of board outsiders. The lower part of graph 16 gives the distribution of average number of outside directors of the board in the seventeen countries under consideration.

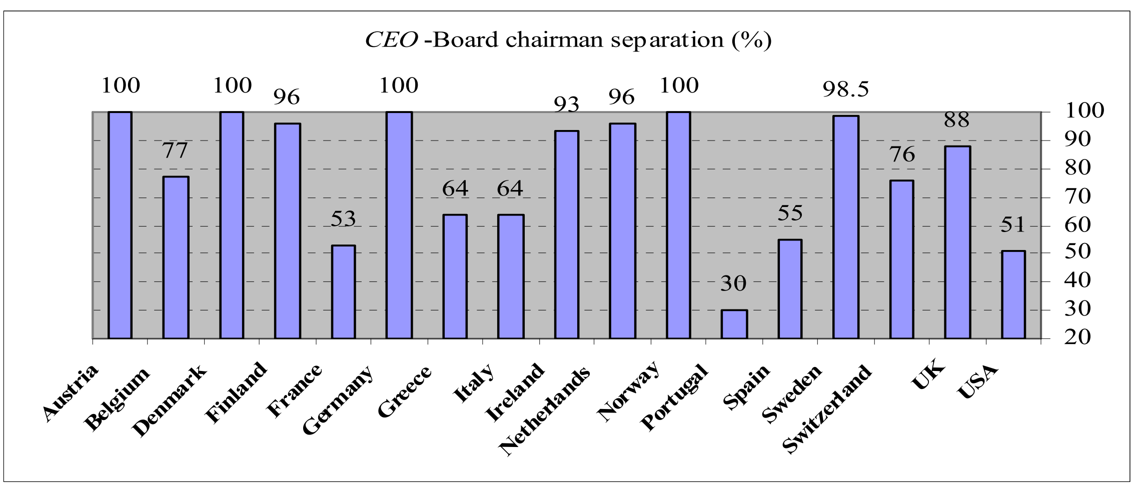
We compare our results of board independence across countries with that of *AESW* in graph 17. The only countries with similar percentages in both studies are Finland, France, Germany, Greece, Ireland, Netherlands, Switzerland and the *USA*. Countries like the *USA* and Netherlands have very high board outsiders of more than 80%. Italy, Spain, Ireland, *UK*, Portugal, Belgium, France, Germany and Greece have less than 50% outsiders. In fact Greece, Italy and Spain have very low board outsiders. We find contradictory evidence for Austria, Denmark, Norway and Sweden. Like German firms, it is not possible to easily deduce the number of outsiders from annual reports and board information on the respective websites of Austrian firms. For Danish firms we report 31% while the comparative study reports 68%. In a similar vein, we have a low of 25% for Norwegian firms while the other study has a high of 71%.

The difference between Swedish firms in the study is relatively close enough. We report 46% while *AESW* report 65%. We attribute these discrepancies to the difficulty of determining board outsiders from annual reports. We use shareholding information on board members to make our choice. This means that directors with substantial company shareholdings are deemed to be insiders. This is not the case for *US* firms but the definitive proxy statements filed with *SEC* makes the differences clear. Directors with substantial shares in *US* firms have been found to be classified as board outsiders. We therefore acknowledge that our decision on classifying some directors of European firms with shareholdings as insiders appears to be stricter than their *US* counterparts, especially for those firms who left the decision for us to make.

CEO-board chairman separation

By virtue of the governance policy of a country, some countries have a two-tier system as already discussed in Chapter Two. Firms in our sample from Austria, Denmark, Germany and Norway have a complete separation of the *CEO* from the board chairman. Finland, Ireland, Netherlands and Sweden have almost complete separation (greater than 92%). The *UK* has 88% separation followed by Belgium and Switzerland, all with more than three-quarters of separation. Greece and Italy have almost two-thirds of separation while countries such as France, Spain and the *USA* have at least 51% separation. 70% of Portuguese firms have the *CEO* as the chairman of the board and are thus the country with the least separation. These results are presented in graph 18 (detailed in table A40).

Graph 18: Average sample *CEO*-board chairman separation by country



Countries like Austria, Denmark, Germany and Netherlands, by law, have a two-tier system and hence a 100% separation (see table 2). Other countries with (almost) *CEO*-chairman separation are Finland, Norway and Sweden. The *UK* and Ireland have very high *CEO*-chairman separations of at least 80% in both studies. The *USA* on the other hand has a 42% separation in Aggarwal et al. and a 51% separation in our study, and is the country with the least separation in *AESW*'s. France is only better than the *USA* in *AESW*'s study but better than Portugal in our study. Portugal has a 30% separation in our study while it has 64% in *AESW*'s study. All other countries have more than 50% *CEO*-chairman separation.

4.4.2 Bivariate analysis

We have been dealing with univariate analysis in the previous section. We now turn to simple bivariate analysis such as correlation, *ANOVA* and bivariate *OLS* regressions to examine the relationship of the variables to be used in the multivariate analysis. We report correlation results in table 17. These are not all the variables that we have selected as proxies for our investigation, but the relevant ones that do not have too many missing observations or high correlations with the independent variables have been reported. The highest correlation between two predictor variables is board size and sales at 0.41. The sales variable is a measure of firm size.

It is realistic to infer that the larger the firm, the larger the size of the board. As a matter of fact, the proxies for firm size that we have in the data like total assets, operating revenue/turnover, market capitalisation, total equity and number of employees all have correlations with board size higher than 0.41. It is important to control for firm size in our sample as we have very large and very small firms so we maintain the proxy for size. The second highest correlation is with ownership concentration and board independence at -0.28. This is deemed low enough to avoid collinearity issues. The third highest correlation between predictor variables is board independence and board size at 0.13. This is a low correlation figure.

The next two steps are *ANOVA* and bivariate regression analysis which we report and comment in table A41 and text box A8. Included are results of bivariate *OLS* regressions of eleven dependent variables of valuation, profitability, growth and efficiency with ownership concentration, board characteristics, financial policy, investor protection and several measures of firm size, learning processes, risk and opportunities for growth. Ownership concentration (measured by either largest total owner, largest direct owner, two, three, four or five largest direct owners) has a negative effect on valuation, a positive effect on profitability, a negative effect on growth and a positive effect on efficiency. Board size (its natural logarithm) has a positive effect on all measures (*Q*, *MBV*, *ROE*, *ROA*, profit margin, asset growth, turnover growth and technical efficiency) except *EPS* and *TFP* where insignificant negative effects are observed. The positive effect is significant with *MBV*, *ROA*, profit margin and technical efficiency.

Table 17: Pairwise correlation of relevant continuous variables

	Asset growth	Op. rev./ turnover growth	Cash flow	Dividend yield	Tobin's *Q*	*MBV*	*ROA*	Board size
Operating revenue/ turnover growth	0.38***							
Cash flow	0.20***	0.17***						
Dividend	-0.05**	-0.10***	0.64***					
Tobin's *Q*	0.05***	0.08***	-0.13***	-0.10***				
MBV	0.16***	0.12***	0.02	-0.07***	0.71***			
ROA	0.22***	0.21***	0.56***	0.05**	-0.08***	0.04***		
Board size	0.06***	0.03**	0.21***	0.15***	-0.01	0.10***	0.12***	
Leverage	-0.01	0.00	-0.01	0.02	0.00	0.14***	0.01	0.00
Largest shares	0.02	-0.02	0.20***	0.21***	-0.24***	-0.17***	0.16***	-0.02
Board indepen-dence	-0.03*	0.03	-0.08***	0.11***	0.14***	0.15***	-0.11**	0.13***
Bias corr. Technical efficiency	0.11***	0.16***	0.46***	0.05	-0.03	0.05**	0.67***	0.04**
TFP	0.01	-0.39***	-0.13***	0.03	0.04*	0.01	-0.21***	-0.03
Sales	0.01	0.00	0.26***	0.21***	-0.02	0.02	0.10***	0.41***
ROE	0.21***	0.21***	0.58***	0.10***	-0.01	0.03**	0.92***	0.14***
Std. dev. *ROE*	-0.07***	-0.07***	-0.32***	-0.10***	0.11***	0.11***	-0.34***	-0.12***
Sales growth	0.01	0.00	-0.07***	-0.08***	-0.02	-0.02	0.01	-0.04***
	Leverage	Largest shares	Board independence	Bias corr tech. eff.	*TFP*	Sales	*ROE*	Std dev *ROE*
Largest shares	-0.01							
Board indepen-dence	0.01	-0.28***						
Bias-corr. Technical efficiency	0.01	0.13***	-0.01					
TFP	-0.01	-0.05*	-0.05**	-0.30***				
Sales	0.00	0.00	0.04***	0.13***	-0.03			
ROE	0.13***	0.17***	-0.14***	0.62***	-0.22***	0.11***		
Std. dev. *ROE*	0.07***	-0.10***	0.07***	-0.19***	0.05*	-0.08***	-0.37***	
Sales growth	0.00	0.04**	0.00	-0.09***	0.11***	-0.01	0.01	-0.01

***|**|* = significant at 1%|5%|10% levels. This excludes variables on investor protection proxies which are given in table 27.

Board independence has a positive effect on valuation but a negative effect on profitability, mixed effects on growth and a positive but insignificant effect on efficiency. Financial policy has a very mixed effect depending on the measures used. A similar observation can be made about investor protection. Apart from Tobin's *Q*, *EPS* and *TFP* where negative values are observed, total assets (as a proxy for firm size) has a positive effect on all measures of firm performance. On the other hand, when we use market capitalisation to proxy for size, only *EPS* and *TFP* return a negative relationship, albeit insignificant in the latter. Other bivariate relationships with control variables can be seen in table A42. These are preliminary bivariate relationships we observe with the data.

4.5 The cross-sectional linear model

Having mentioned the bivariate relationships, we now move to a preliminary cross-sectional multivariate relationship (see table A42 and text box A9) where we use the literature review to select our variables. We specify all corporate governance variables (ownership concentration and identity, board size and independence, *CEO*-chair separation, financial policy), investor protection (anti-director rights index) and control variables (where legal origin is for country differences, operating revenue by assets is for firm size and beta for firm risk). We keep both country and industry controls in the light of institutional theory in the statistical analysis we carry out. How we go about justifying the use of industry and country control variables is detailed out in text box A10.

Besides *MBV* (which satisfies collinearity and homoskedasticity) where ownership concentration has a 5% level of significance in its negative relationship, there is virtually no observed relationship with the other performance variables. After trying with several combinations and proxies of the independent and control variables (as gathered from the literature review), we arrive at our linear model in equation (A4.5.1). We consequently report yearly *OLS* regression estimates of our governance-valuation model with basic *OLS* corrections for normality, heteroskedasticity, collinearity and omitted variables bias. We will not compare these results with other studies; we do comparisons of our results only after applying more robust analytical tools.

Text box A11 gives more details about the results we obtain with the cross-sectional linear models before and after controlling for heteroskedasticity. To summarise the results given in tables A43 and A44, ownership concentration has a negative relationship with firm valuation and is statistically significant in two of the three years. Board size has a positive but insignificant relationship in all the three years while board independence has a positive relationship significant for only one year. Although *CEO*-chairman separation has a negative effect on valuation, this is not statistically significant for all the three years. In terms of ownership categorisation, State ownership impacts negatively on value but this is not significant for all the years. Public firms have an insignificantly positive relationship with value while individuals/families followed by financials and then industrials (in that order) have significantly positive effects for all years. These results offer support that ownership identity matters for corporate performance – *H2*. Leverage, our proxy for financial policy is significantly negative for all the three years supporting the hypothesis that equity (internal and then external) is a preferred method of financing than debt (pecking order hypothesis) – *H6*.

Firm size as measured by total sales has a positive impact on firm value in all three years. Firm risk has a positive but insignificant effect on valuation. Growth opportunities has a positive effect on firm value and this relationship is significant in two of the three years.

4.6 The pooled and cross-sectional time series linear models

In the Social Sciences and for that matter the study of corporate governance, the cross-sectional variation between firms and their impact on performance is generally much greater than the variation over time within a firm. Applicable explanatory variables do change at a much slower pace in economic analyses embedded in an institutional context (Kittel 2001: 233). We utilise this basis to apply the same values for observations for three years (i.e. time-invariant variables).

Board size, board independence and shareholding concentration, three of our main predictor variables are assumed to have globally insignificant changes across a short period of time for the same observation than for different observations within different institutional contexts. This is in addition to what some literature (for example La Porta et al., 1999; Bauer et al. 2004) have suggested about ownership data, for instance, which is argued to vary insignificantly up to five years.

We begin with preliminary analysis of pooling the three years of data of ownership concentration and three specifications of control variables on the ten measures of performance given in text box A12 and table A45. The first specification controls for firm fixed effects, industry, country and year. The results are mixed which may be due to the fact that creating separate intercepts for each firm already controls for all unobservable firm heterogeneity.

We are therefore interested in the other two specifications; the first of which has only fixed effects. Ownership concentration has a significantly negative effect on Tobin's *Q*, *MBV* and *ROA*. The effect is not significant with dividend yield, asset growth, turnover growth and technical efficiency. It has a positive and statistically significant effect with *ROE* and cash flow and insignificant with *TFP*. The other specification is the one with control for risk, financial policy, size and growth opportunities (for firm effects), industry, country and year controls when industry, country or year are jointly significant. The results obtained when Tobin's *Q* is the dependent variable are similar to the cross-sectional results discussed above. The results when *MBV* is the dependent variable are similar to that for Tobin's *Q* with the exception of risk and financial policy which are not statistically significant.

The effect of ownership concentration on profitability in the third specification is negative but not significant whereas sales measure as expected has a positive effect on both measures of profitability. Risk and leverage have negative effects and growth opportunities has a positive effect but not significant with *ROA*; and weakly significant with *ROE* (i.e. at 10%). For dividend yield, ownership is positive but insignificant; the positive effect is however significant for asset and turnover growths, and technical efficiency. Ownership has an insignificantly negative effect on *TFP*. Financial policy, risk, size and growth opportunities have mixed effects depending on the performance variables used.

While it is possible to use ordinary multiple regression techniques on panel data, they may not be optimal. The estimates of coefficients derived from regressions may be subject to omitted variable bias – a problem that arises when there is an unknown variable (or variables) that cannot be controlled that affect the dependent variable. With panel data, it is possible to control for some types of omitted variables even without observing them, by observing changes in the dependent variable over time. This controls for omitted variables that differ between cases but are constant over time. It is also possible to use panel data to control for omitted variables that vary over time but are constant between cases.

A pooled regression model assumes common coefficients across the cross-sectional units. Simple panel analysis can be done by pooling the data together and just running it or using fixed, between or random effects. The between effect is seldom used. The generally accepted way of choosing between fixed and random effects is running a Hausman test. The Hausman test checks a more efficient model against a less efficient but consistent model. Hausman's essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero. Statistically, fixed effect is preferred with panel data as it gives consistent results but it may not be the most efficient model to run and cannot be run on time-invariant variables. Random effect is a less consistent but efficient estimator.

A pooled regression model [equation (4.6.1)] takes the form below where y is the dependent variable, β is the coefficient of the independent variables x_1 to x_k, and ε is the error term. Additionally, i and t are the observation/unit (*DMU*) and time period under consideration respectively. This model assumes that there is no systematic individual influence and that individual differences are treated as error. β_0 here has a control for omitted variable-bias.

$Y_{it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_k x_{kit} + \varepsilon_{it}$ Pooled regression model (4.6.1)

$y_{it} = \beta_0 + \beta_1 x_{1i\,t} + \beta_2 x_{2it} + \beta_k x_{kit} + \varepsilon_{it} + v_i$ Random effects model (4.6.2)

$y_{it} = \gamma_i + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_k x_{kit} + \varepsilon_{it}$ Fixed effects model (4.6.3)

Equation (4.6.2) is a random effects specification. The random error v_i is heterogeneity specific to a cross-sectional unit. The random error ε_{it} is specific to a particular observation. V_i is well specified when it is orthogonal to the individual effects. Because of this intrapanel variation, the random effects model can allow time-invariant predictor variables. The fixed effects models are however sensitive to time-invariant variables and cannot be used when such variables prevail. There are several types of fixed effect models and a model can be specified by acknowledging that the intercept β_0 is not constant for all units (denoted as γ_i) as in the basic pooled regression model to allow for different intercepts for unit and/or time dummies as indicated in equation (4.6.3).

For our sample, a Breusch-Pagan (1980) Lagrangian multiplier test for random effects does not accept the null hypothesis of the one-way random group effect model that variances of groups are zero. A pooled *OLS* regression is therefore unfavourable. STATA drops dummies from fixed effects models and the Hausman test indicates that a fixed effect be used. As we are interested in the ownership identities that are categorical variables as well as our other time invariant independent variables, we opt for the random effects model; and introduce unit dummies when we are interested in a fixed effects model, acknowledging the latter may not be an efficient nor consistent estimator.

Because most variables of the data set are longitudinal, accurate and consistent estimates is achieved depending on the degree to which we account for heterogeneity across firms and time periods. Inter-firm variation can be accounted for when a fixed effects methodology is applied. Some statistical software packages like STATA (used in these analyses) do not make provision for analysing time-invariant variables which will require of us to use other data-pooling estimation techniques not particularly the most consistent. Fixed effects methodology assumes that differences across firms are systematic manifestations of unobserved firm-specific characteristics. In fixed effects estimation, the time-invariant variables are perfectly collinear with individual fixed effects. Some degree of imprecision therefore obtains when we employ fixed effects estimation in our analysis. It however contributes to the correction of unobserved heterogeneity.

In determining the usefulness of including country, legal origin or industry controls in line with institutional theory predictions, we run a series of analyses which we have reported in text box A10.

Our results allow us to use both industry and country dummies to control for the relationships. We have also provided a preliminary analysis of the pooled regression estimations; in building up the appropriate methodology for analysing our data to ensure the best predictions. The inconclusive results require as having a second look at pooled data in terms of endogeneity, autocorrelation and panel heteroskedasticity. Pooling data has been recognised to improve predictions in data analysis but it also has its drawbacks which have to be corrected to have consistent predictive estimates. We employ the linear model from equation (A4.5.1) and adjust with cross-section and time series corrections. The model to be estimated is given in equation (4.6.4) where ψ_t, η_i and ε_{it} denote time effects, unobserved heterogeneity and the error term respectively.

D is the dependent variable taking values of Tobin's Q, MBV, ROA, ROE, cash flow (CF), dividend yield (DIV), technical efficiency (TE – its biased correction or upper confident limit equivalent), TFP (or its upper confident limit equivalent), operating revenue/turnover growth ($ORTG$), and asset growth (AG) respectively. Equation (4.6.4) denotes a random effects model which is particularly suitable for our analysis as we have time-invariant variables in our specifications.

$$
\begin{aligned}
&D(Q, MBV, ROA, ROE, CF, DIV, TE, TFP, ORTG, \& AG)_{it} = \\
&\beta_0 + \beta_1 LOG\_OWNERSHIP\_CONCENTRATION_i + \beta_2 LOG\_BOARD\_SIZE_i + \\
&\beta_3 BOARD\_INDEPENDENCE_i + \beta_4 CEO\_CHAIRMAN\_SEPARATION_i + \\
&\sum_{h=1}^{h=6} \beta_h OWNERSHIP\_IDENTITY_{hi} + \beta_6 LOG\_SALES_{it} + \beta_7 SALES\_GROWTH_{it} + \\
&\beta_8 LOG\_STANDARD\_DEVIATION\_4\_YEAR\_ROE_{it} + \beta_9 LOG\_LEVERAGE_{it} + \\
&\sum_{j=1}^{j=17} \beta_j INDUSTRY_{ji} + \sum_{k=1}^{k=17} \beta_k COUNTRY_{ki} + \psi_t + \eta_i + \varepsilon_{it}
\end{aligned}
\qquad (4.6.4)
$$

As theory and empirical evidence suggest, we use this model to examine the relationship between corporate governance and firm value controlling for firm specific effects, country and industry differences. We use the largest direct owner (cash flow equity), largest total (direct and indirect – voing equity) owner, and five largest direct owners to denote ownership concentration.

4.6.1 Multicollinearity

A high level of correlation among regressors is quite common in panel estimation techniques. However, collinearity among the model's independent variables inflates standard errors and results in overfitting, potentially over-estimating the effects of some collinear variables and underestimating the effects of others. There are few formal tests for multicollinearity, and the applicability of existing ones (such as variable inflation factor – *VIF*) to panel data is not entirely clear. Albeit, regressing one of the collinear variables on another (and controlling for fixed effects in panel data) is adequate to determine how severe it is.

There have been some techniques such as principal components analysis that are argued to produce consistent estimates in the presence of multicollinearity but these have usually not been generalised to pooling. Medvedev (2006) suggests that in case of collinearity, it is appropriate to drop the problematic variable or, if the theory demands its inclusion, to estimate the model as it is and note that standard errors are likely to be inflated and coefficients unstable. The dummy variables we utilise for industry and country controls is recognised to create multicollinearity problems which can be improved by pooling the data.

4.6.2 Endogeneity

Endogeneity (omitted variable bias, simultaneity bias, and measurement error) presents problems not only for inference but also for estimation, since the right hand side variable or variables is/are potentially correlated with the variation in the dependent variable that is relegated to the error term violating some basic assumptions of covariances of the predictor variables jointly set to zero. Consistent estimation requires obtaining instruments that are uncorrelated with the error term. The Durbin-Wu-Hausman and the difference-in-Sargan statistic tests for endogeneity rely on comparing regression results before and after applying the instruments. Text box A13 gives details about how endogeneity is curtailed in *2SLS/GMM* estimations and table A46 reports the results we obtain after an application to our study.

In summary, the first stage of the analysis relates ownership concentration with financial policy (+), opportunities for growth (-), firm size (-) and volatility (-). The second stage of the analysis relates firm value with ownership concentration (-), financial policy (-) and opportunities for growth (+).

4.6.3 Panel heteroskedasticity and autocorrelation

The disadvantages of pooled regression methods lie in terms of their error structure and global relationship assumptions between variables. It has been argued that the relationship that holds in time may not hold across space hence pooled models are suggested to give an average of these two time and spatial effects. The result of pooled models may in some cases end up being different from both the space and time dimensions considered alone. In fact, compared with pooled-*OLS*, the bias due to measurement errors may be exacerbated by using first differenced or fixed effect estimators. But pooled-*OLS* suffers from bias due to unobserved heterogeneity which is more dominant than within estimators. Theory however subscribes that in general the bias due to pooling dominates.

In pooled analysis with different firm sizes, autocorrelation obtains within panels from varying periods. Dynamic panel residual autocorrelation is handled with a Prais-Winsten or Cochrane-Orcutt transformation that is a first partial difference that eliminates autocorrelation bias. In this light, Arellano, Bond and Bover's one and two step *GMM* estimators have been generally utilised – a branch of statistics known as growth models (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998). *GMM* is usually robust to deviations of the underlying data generation process –*DGP*- to withstand heteroskedasticity and normality violations because they are asymptotically normal, but they are not efficient in their estimations.

Most panel studies rely on the Huber-White sandwich method to calculate robust standard errors, which represent consistent estimates of the variance-covariance matrix in the presence of heteroskedasticity. The consequences of autocorrelation are similar to heteroskedasticity, but the problems caused by the latter are usually more severe. *OLS* coefficient estimates remain consistent and unbiased in the presence of autocorrelation, but they are no longer best linear unbiased estimators (*BLUE*) or asymptotically efficient. Despite the numerous advantages of pooled regressions, there are some methodological setbacks. The basic assumptions underlying *OLS* regressions may not be adhered in the error term of pooled models bringing the estimation reliability to question. Pooled regressions require the error term to be standardised (mean should be zero; homoskedastic) with a constant variance (no cross-sectional correlation) in all firms while time-specific error terms are not correlated (no autocorrelation).

Autocorrelation can make standard errors biased. Corrections for autocorrelation are with *OLS* estimation with Newey-West standard errors, or Prais-Winsten and Cochrane-Orcutt *FGLS* transformations. Medvedev (2006) argues that the Prais-Winsten and the Cochrane-Orcutt methods cannot be compared to *OLS*-based approaches because the differences in the regression coefficients are not the same. The properties of these *FGLS* estimators are only known asymptotically (i.e. hypothesis testing is based on the z rather than t statistics). In addition, if both heteroskedasticity and autocorrelation are present in the data, a three-step *FGLS* approach is required, further complicating comparisons with *OLS/LSDV*-type models (Beck & Katz, 1995 & 1996; Kittel, 2001; Medvedev, 2006). Text box A14 gives a very comprehensive review about panel heteroskedasticity and autocorrelation as we have applied to our study.

Panel-corrected standard errors

In text box A15 and table A47 we deal with the *FGLS* method and the results we have obtained with its application to our study. The results generally support the relationships observed so far. The (three-stage) *FGLS* method has some pitfalls which Beck and Katz have identified as the: estimates of the coefficients being more inefficient than *OLS*, and; estimates of the variances of the coefficients from the last stage *GLS* being biased downwards. So they recommend the use of *OLS* to estimate coefficients, but to correct the estimates of the standard errors of the coefficients with panel corrected standard errors *PSCE*. If there is autocorrelation, then we use the Prais-Winsten *GLS* estimator to first correct this.

PCSE is then calculated from the regression residuals using *OLS* estimation. The *PCSE* is a White-Huber sandwich robust estimator. The choice to estimate statistical models on *CSTS* data introduces some additional threats to the validity of inferences drawn from the analysis. Estimates of coefficient standard errors from *OLS* regression can be unreliable when using *CSTS* data (Beck & Katz, 1995). Despite these dangers, *OLS* coefficients remain consistent, or unbiased. However, the standard errors of the coefficients are inefficient when the panel error assumptions are violated leading to misleading statistical inferences.

We apply the Prais-Winsten *GLS* and observe that our data follows a first-order, auto-regressive process (*AR*1). This technique applies a transformation to the data to correct for the serial correlation before estimation of the model. The correction of the standard errors for heteroskedasticity follows Beck and Katz (1995) in correcting the residuals for constant variance in the error term. This method produces unbiased coefficients and efficient *PSCEs* (Beck & Katz 1995; 1996) even when the sample size is small and the time period is longer, otherwise correcting for heteroskedasticity across dyads is enough when the sample size is far larger than the time period. This is the method we use in almost all the rest of our regression analyses. Beck and Katz suggest that we should assume the *AR* coefficient to be the same for all firms and estimate a common coefficient. Estimating the *AR(1)* separately for each firm must be avoided as this creates a larger uncertainty about the estimated coefficients.

Application to the study

In tables 18 to 21, we present regression results (1 to 24) indicating the relationship between Tobin's *Q*, *MBV*, *ROA*, *ROE*, cash flow, dividend yield, asset growth and revenue growth to corporate governance. The second and fifth columns of each table represent pooled *OLS* regression results with correction for heteroskedasticity. The third and sixth columns represent pooled *OLS* regression results with control for firm fixed effects. The fourth and seventh columns of the table represent Prais-Winsten regression results for *PCSE*s and correction for *AR*(1). We are interested here in comparing the results from the Prais-Winsten regressions with the results when there is no control for autocorrelation and panel heteroskedasticity as results from the latter provide inconsistent estimates.

MBV and Tobin's Q

We start with analysing results from columns 2 (robust pooled *OLS*); 3 (fixed effects pooled *OLS*), and; 4 (Prais Winsten regression) of table 18. In all results, ownership concentration is negatively related to *MBV*. The fixed effects specification has bigger coefficients than the other two although it suffers from serial correlation and panel heteroskedasticity. Columns 3 and 4 have similar results but theory indicates that results from column 4 are the most robust. For example board size has a negative effect on *MBV* but this effect becomes insignificant when corrected for panel heteroskedasticity.

The positive effect of board independence becomes significant when controlled for heteroskedasticity and the coefficient increases with correction for autocorrelation. The negative effect of *CEO*-chairman separation becomes insignificant when corrected for serial correlation and panel heteroskedasticity. In the fixed effects specification[11], ownership identity has a negative effect on *MBV* but this is reversed with the results of the other statistical methods. Firms with public corporations as their largest shareholder tend to have a better effect on *MBV* than financials and individuals/family respectively. This is followed by industrial companies. The effect of State ownership is negative but insignificant. Leverage has an insignificant effect on *MBV*.

[11] Note: we remind readers that our fixed effects estimation is derived by creating separate intercepts for all firms making the estimations rather weak as we cannot apply the conventional estimators due to time-invariant restrictions. Focus is therefore given to the Prais-Winsten estimations.

Table 18: Regression results of corporate governance and market value

	1[a]	2[b]	3[o]	4[a]	5[b]	6[o]
	Log Market-to-Book Value			**Log Tobins's *Q***		
Variables	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)
Log largest owner	-0.088*** (0.025)	-0.329*** (0.050)	-0.091*** (0.030)	-0.054*** (0.017)	-0.170*** (0.034)	-0.056*** (0.020)
Log board size	0.029 (0.071)	-0.579*** (0.204)	0.045 (0.087)	0.038 (0.046)	-0.143 (0.092)	0.051 (0.055)
Board independence	0.276*** (0.083)	0.430 (0.362)	0.282*** (0.101)	0.119** (0.057)	-0.235 (0.179)	0.124* (0.066)
CEO is not chairman	-0.058* (0.034)	-1.469*** (0.189)	-0.062 (0.042)	-0.048** (0.025)	-0.890*** (0.143)	-0.046 (0.030)
Individual/ family	0.318*** (0.093)	-1.604*** (0.303)	0.302*** (0.107)	0.251*** (0.052)	-0.609*** (0.210)	0.240*** (0.064)
Financials	0.319*** (0.089)	-2.007*** (0.344)	0.310*** (0.101)	0.214*** (0.049)	-1.145*** (0.234)	0.206*** (0.059)
Public company	0.386*** (0.119)	-1.380*** (0.321)	0.369*** (0.135)	0.134* (0.070)	-0.529*** (0.199)	0.129 (0.086)
Industrial company	0.269*** (0.088)	-0.681** (0.326)	0.251** (0.099)	0.193*** (0.048)	-0.284 (0.215)	0.177*** (0.059)
State	-0.027 (0.125)	-2.930*** (0.472)	-0.030 (0.154)	-0.049 (0.074)	-0.427* (0.258)	-0.055 (0.100)
Log sales	0.078*** (0.011)	0.023 (0.033)	0.068*** (0.013)	0.052*** (0.008)	-0.014 (0.021)	0.044*** (0.010)
Sales growth	0.046*** (0.018)	0.000 (0.019)	0.027 (0.020)	0.048*** (0.014)	0.038*** (0.012)	0.047*** (0.012)
Log std. dev. *ROE*	0.011 (0.018)	0.080*** (0.021)	0.026 (0.018)	0.021* (0.012)	0.054*** (0.013)	0.028** (0.012)
Log leverage	-0.020 (0.021)	0.200*** (0.030)	0.029 (0.025)	-0.085*** (0.015)	0.056*** (0.019)	-0.052*** (0.016)
Constant	-1.261*** (0.266)	2.825*** (0.421)	-1.182*** (0.308)	-0.770*** (0.145)	1.714*** (0.267)	-0.701*** (0.171)
Rho			0.532			0.553
R^2	0.222***	0.834***	0.181***	0.239***	0.855***	0.220***
Adjusted R^2		0.751***			0.782***	
Wald chi^2			404.7***			554.2***
Pooled *N* (3 years)		1593			1620	

[a] = Year dummies for White heteroskedasticity-corrected robust standard errors not significant and excluded. [b] = Categorical dummies for firm fixed effects without industry and country dummies. [o] = Prais-Winsten regression with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation. ***|**|* = significant at 1%|5%|10% levels. The different types of standard errors are in parentheses.

A positive relation obtains for firm size and that for growth opportunities is positive but not statistically significant. The positive relationship of firm risk on *MBV* in the fixed effects specification becomes insignificant in the robust measures.

In columns 5 to 7 where firm value is measured by Tobin's *Q*, we discuss the results of ownership concentration and other governance variables. Ownership concentration has a negative relationship with firm value in all models. Board size has no statistically significant relationship while board independence increases firm value. The negative relationship between *CEO*-chairman separation and valuation becomes insignificant when corrected for panel heteroskedasticity and first order autocorrelation. With this correction, public corporations do not seem to exhibit a statistically positive relationship with value whereas individuals have the most profound positive effect followed by financial and industrial companies' respectively. The negative effect of the State is not statistically significant in the robust corrections. Leverage has a negative and significant effect on valuation but firm size, investment opportunities and risk have statistically significant effects on valuation.

ROA and ROE (profitability)

We use the same set of controls for all performance measures so as to make comparisons. It is important to mention that most of the controls are used primarily with valuation although some studies use these control for the other performance measures. The relationship between corporate governance and profitability is reported in columns two to seven of table 19.

The proxies of profitability are not logarithm transformed because of observations with negative values. Regressions 7, 8 and 9 are results for *ROA* while 10, 11 and 12 are results for *ROE*. It can be seen that corporate governance has a better relationship with valuation than with profitability. In both measures of profitability, ownership concentration has no significant effect (except for the fixed effects specification of *ROA*). Board size seems to have a negative effect but this is not robust across all econometric models, although this is significant when *ROE* is the dependent measure.

Board independence has a positive effect in the fixed effects model but becomes insignificant in the more robust regressions. There seem to be no statistically significant relationship between separating the duties of the *CEO* from the board chairman. Individuals/families generally have a positive effect on profitability whereas the State has a negative effect. The results of the rest of the ownership categories are mixed and generally insignificant. Leverage has a negative effect on profitability but this is not globally significant when *ROE* is the dependent measure. Risk has a negative effect on profitability while opportunities for growth has a positive but insignificant effect. Firm size has a positive effect on profitability in all regressions.

Table 19: Regression results of corporate governance and profitability

	7	8[b]	9[o]	10	11[b]	12[o]
	Return on assets			Return on equity		
Variables	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)
Log largest owner	0.205 (0.340)	9.273*** (1.317)	0.167 (0.427)	-0.044 (0.607)	-0.956 (2.004)	-0.170 (0.744)
Log board size	-1.197 (0.905)	-21.62*** (2.590)	-2.096* (1.075)	0.120 (1.597)	-58.102*** (6.891)	-1.517 (1.964)
Board independence	-1.487 (1.055)	12.149*** (4.423)	-1.553 (1.305)	-2.734 (2.029)	37.937*** (6.893)	-2.890 (2.525)
CEO is not chairman	-0.342 (0.474)	-28.560*** (3.969)	-0.260 (0.588)	-0.848 (0.789)	-6.580 (5.465)	-0.797 (0.984)
Individual/ family	1.863** (0.883)	-9.054*** (3.405)	2.133** (1.076)	4.012** (1.799)	51.636*** (8.489)	4.136* (2.313)
Financials	1.156 (0.848)	17.860*** (3.934)	1.107 (1.027)	1.680 (1.711)	-16.473** (6.835)	1.154 (2.170)
Public company	-1.652 (1.227)	-2.818 (4.433)	-1.503 (1.530)	-2.733 (2.693)	8.050 (8.527)	-2.791 (3.396)
Industrial company	0.771 (0.883)	4.607 (3.369)	0.774 (1.043)	0.926 (1.787)	-3.469 (6.301)	0.526 (2.225)
State	-3.039** (1.279)	-24.170*** (5.025)	-3.193** (1.570)	-4.594* (2.599)	-57.932*** (9.044)	-5.260 (3.473)
Log sales	1.319** (0.175)	8.066*** (0.751)	1.582*** (0.214)	2.123*** (0.316)	14.356*** (1.293)	2.669*** (0.382)
Sales growth	0.529 (0.781)	0.127 (0.745)	0.467 (0.748)	1.162 (1.351)	2.552* (1.362)	1.499 (1.432)
Log std. dev. *ROE*	-1.134*** (0.238)	0.192 (0.315)	-1.044*** (0.252)	-2.674*** (0.447)	0.641 (0.596)	-2.223*** (0.473)
Log leverage	-2.325*** (0.289)	-3.269*** (0.487)	-2.413*** (0.321)	-0.390 (0.496)	-3.399*** (0.943)	-0.858 (0.564)
Constant	-3.331 (2.610)	-31.140 (6.757)***	-3.773 (3.031)	-4.296 (4.878)	-83.194*** (13.172)	-5.899 (5.786)
Rho			0.451			0.440
R^2	0.184***	0.759***	0.111***	0.228***	0.760***	0.142***
Adjusted R^2		0.638***			0.638***	
Wald chi^2			255.7***			380.16***
Pooled *N* (3 years)		1497			1521	

[b] = Categorical dummies for firm fixed effects without industry and country dummies. [o] = Prais-Winsten regression with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation. ***|**|* = significant at 1%|5%|10% levels. Robust standard errors, standard errors of firm fixed effects and heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry, country and year dummies are not reported. Column 2 is robust pooled *OLS*, 3 is fixed effects pooled *OLS*, and 4 is Prais Winsten regression.

Cash flow and dividend yield

The dependent variable cash flow is not logarithm-transformed because several observations have negative values. Dividend yield is logarithm-transformed as only a few observations have zero values. In table 20, the second to fourth columns (13 to 15) represent the effect of corporate governance and control variables on cash flow.

Table 20: Regression results of corporate governance with cash flow and dividend yield

	13	14[b]	15[o]	16	17[b]	18[o]
	Cash flow			Log dividend yied		
Variables	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)
Log largest owner	0.072* (0.042)	-0.387** (0.156)	0.076 (0.054)	0.222*** (0.070)	-0.304 (0.202)	0.224*** (0.086)
Log board size	-0.053 (0.099)	-1.919*** (0.341)	-0.120 (0.122)	0.209 (0.197)	-0.447 (0.287)	0.052 (0.221)
Board independence	-0.242 (0.156)	1.114*** (0.318)	-0.280 (0.193)	-0.422** (0.197)	-1.052*** (0.361)	-0.445* (0.247)
CEO is not chairman	-0.053 (0.054)	-1.084*** (0.265)	-0.048 (0.070)	-0.098 (0.105)	0.758*** (0.231)	-0.087 (0.139)
Individual/ family	-0.306** (0.152)	-0.116 (0.379)	-0.298* (0.176)	0.529*** (0.194)	-2.731*** (0.854)	0.589** (0.242)
Financials	-0.429** (0.152)	-0.790** (0.377)	-0.461*** (0.174)	0.422*** (0.161)	0.343 (0.289)	0.438** (0.192)
Public company	-0.858** (0.376)	2.200*** (0.466)	-0.733 (0.531)	0.529** (0.239)	-1.027* (0.595)	0.562** (0.276)
Industrial company	-0.370** (0.156)	2.146*** (0.343)	-0.373** (0.180)	0.122 (0.157)	-1.149*** (0.403)	0.149 (0.192)
State	-0.625** (0.250)	1.191** (0.472)	-0.714** (0.324)	0.031 (0.192)	-1.699*** (0.638)	-0.050 (0.321)
Log sales	0.257*** (0.018)	0.585*** (0.061)	0.291*** (0.021)	0.183*** (0.032)	0.666*** (0.122)	0.217** (0.037)
Sales growth	-0.035 (0.029)	0.026 (0.033)	-0.017 (0.023)	-0.352 (0.220)	-0.481 (0.337)	-0.229 (0.252)
Log std. dev. *ROE*	-0.223*** (0.030)	-0.044 (0.039)	-0.177*** (0.030)	0.007 (0.046)	0.004 (0.037)	-0.013 (0.035)
Log leverage	-0.004 (0.032)	-0.200*** (0.051)	-0.051 (0.035)	-0.096 (0.066)	-0.020 (0.078)	-0.076 (0.059)
Constant	0.246 (0.696)	-4.393*** (0.894)	0.018 (0.873)	-3.202*** (0.528)	-8.779*** (1.242)	-3.264*** (0.592)
Rho			0.483			0.698
R^2	0.486***	0.848***	0.351***	0.581***	0.942***	0.550***
Adjusted R^2		0.772***			0.912***	
Wald chi^2			877.4***			631***
Pooled *N* (3 years)		1311			567	

[b] = Categorical dummies for firm fixed effects without industry and country dummies. [o] = Prais-Winsten regression with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation. ***|**|* = significant at 1%|5%|10% levels. Robust standard errors, standard errors of firm fixed effects and heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry, country and year dummies are not reported. Column 2 is robust pooled *OLS*, 3 is fixed effects pooled *OLS*, and 4 is Prais Winsten regression.

Ownership concentration has a negative effect (insignificant for dividends) on cash flow only in the fixed effects specifications. Once corrections have been made for heteroskedasticity, the effect on cash flow is weakly positive but strongly positive with dividend yield.

Board size has no monotonic linear relationship with either cash flow or dividend yield. Board independence generally has a negative effect on cash flow and dividend yield although with the former, it is insignificant in robust specifications. The relationship of these dependent variables with *CEO*-chairman separation is similar to that with board independence but much mixed and insignificant when we exclude the results for fixed effect controls (significantly negative with cash flow and significantly positive with dividends).

In terms of ownership categories, there is a generally negative relationship with cash flow. Public firms and the State have the most negative influence. Individuals and industrial companies have the least negative influence followed by financials. These results are true when corrections are made for panel heteroskedasticity although the order of the relationship is not the same with the other statistical models.

The negative values are also consistent in model 13 but very mixed in model 14 which is the fixed effects specification with no robust corrections. Leverage has a negative effect but insignificant in the more robust specifications. Risk has a negative effect on cash flow, firm size has a positive effect and sales growth has no effect on cash flow.

The relationship of ownership categories with dividend yield is however the opposite of cash flow. The State has an insignificantly negative relationship but all others are positive and only insignificant with industrial companies. Individuals/families have the highest effect followed by public firms and financial companies respectively. Leverage has a negative but insignificant effect on dividends. Size has a positive effect but risk and opportunities for growth have inconclusive relationships.

Accounting growth

Growths in operating revenue/turnover and in total assets are not logarithm-transformed as some observations post negative year to year growths. Table 21 present results of the final comparisons of linear relationships using pooled *OLS* regressions with either fixed effects or correction for heteroskedasticity, and corrections for panel heteroskedasticity and autocorrelation. We first elaborate on the results for the relationship between growth and shareholding concentration. For revenue growth, the relationship is linearly positive when robust measures are considered. That for asset growth is inconclusive as the robust measures, although positive are insignificant.

Table 21: Regression results of corporate governance and accounting growth

Variables	19[a]	20[b]	21[ao]	22	23[b]	24[ao]
	Growth in operating revenue/ turnover			Growth in total assets		
	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)	Coefficient (robust standard error)	Coefficient (standard error)	Coefficient (heteroskedastic panels-corrected standard error)
Log largest owner	0.021*** (0.008)	-0.701*** (0.072)	0.023*** (0.009)	0.011 (0.008)	-0.143*** (0.039)	0.012 (0.008)
Log board size	-0.068*** (0.022)	-2.725*** (0.253)	-0.065*** (0.024)	-0.034* (0.021)	-0.541*** (0.128)	-0.028 (0.022)
Board independence	-0.056** (0.027)	1.600*** (0.201)	-0.058* (0.031)	-0.071*** (0.027)	-0.442*** (0.142)	-0.071** (0.030)
CEO is not chairman	-0.021* (0.011)	-1.135** (0.152)	-0.022* (0.012)	0.015 (0.010)	0.680*** (0.172)	0.014 (0.011)
Individual/ family	0.002 (0.023)	0.658*** (0.157)	-0.001 (0.026)	0.038* (0.022)	-0.375*** (0.129)	0.034 (0.024)
Financials	0.008 (0.021)	3.613*** (0.383)	0.005 (0.025)	0.019 (0.020)	-0.735*** (0.204)	0.015 (0.022)
Public company	0.037 (0.032)	2.721*** (0.317)	0.031 (0.038)	-0.025 (0.031)	-0.431*** (0.116)	-0.020 (0.037)
Industrial company	0.003 (0.022)	1.796*** (0.243)	0.001 (0.026)	-0.011 (0.021)	-1.207*** (0.287)	-0.010 (0.023)
State	-0.019 (0.037)	0.549*** (0.203)	-0.020 (0.045)	-0.056 (0.040)	-1.052*** (0.258)	-0.048 (0.044)
Log sales	0.014*** (0.004)	0.429*** (0.038)	0.016*** (0.004)	0.010*** (0.004)	0.148*** (0.032)	0.011*** (0.004)
Sales growth	0.016 (0.014)	0.052*** (0.015)	0.021 (0.016)	-0.001 (0.010)	0.030** (0.013)	0.005 (0.012)
Log std. dev. *ROE*	-0.019*** (0.005)	0.042*** (0.012)	-0.012** (0.006)	-0.029*** (0.005)	0.024** (0.012)	-0.024*** (0.005)
Log leverage	0.000 (0.006)	-0.014* (0.007)	-0.011** (0.006)	0.011** (0.006)	0.002 (0.007	0.003 (0.005)
Constant	0.225*** (0.060)	-3.138*** (0.351)	0.149** (0.068)	0.188*** (0.073)	-0.657*** (0.222)	0.112* (0.063)
Rho			0.059			0.089
R^2	0.176***	0.426***	0.051***	0.182***	0.401***	0.071***
Adjusted R^2		0.133***			0.094***	
Wald chi^2			69.1***			88.71***
Pooled *N* (3 years)		1298			1290	

[a] = Industry dummies are not included as they are jointly insignificant. [b] = Categorical dummies for firm fixed effects without industry and country dummies. [o] = Prais-Winsten regression with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation. ***|**|* = significant at 1%|5%|10% levels. Robust standard errors, standard errors of firm fixed effects and heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry, country and year dummies are not reported. Columns 2 and 5 are robust pooled *OLS*, 3 and 6 are fixed effects pooled *OLS*, and 4 and 7 are Prais Winsten regressions.

The relationship with board size is generally negative but insignificant in the Prais-Winsten model when asset growth is the dependent variable. Board independence associates negatively with accounting growth (but is significantly positive with fixed effect specification on revenue growth). When the chairman of the board is not the *CEO*, there is a negative association with revenue growth.

The relationship with asset growth is however positive but not significant (except for the fixed effects model).

There is inconclusive evidence on the effect on ownership identity on both measures of firm growth. Leverage has a negative effect on revenue growth but this is significant at 5%. There is no global effect on asset growth although the sign of the coefficients are positive. Size as expected is positively related to growth in all models whereas risk is negatively related. Growth opportunities do not seem to influence past growth with the exceptions being when the less robust fixed effects model is specified.

Total factor productivity

We do not use the Prais-Winsten's regression to estimate the relationship between *TFP* and corporate governance. Although it is possible to use a logistic transformation of the *TFP* dependent variable to convert the bounded value of *TFP* from zero to negative infinity, Simar and Wilson (2007) do not recommend this; neither do they recommend a Tobit model. They suggest the use of a bootstrapped truncated regression to improve the estimates of *TFP* and the predictor variables.

Following this recommendation, we report the estimates of the the bootstrapped truncated model and compare these to that of fixed effects truncated models. These are given in table 22. We run a robust bootstrapped regression with 500 replications with industry, country and year dummies. Industry dummies are jointly insignificant so we remove them and rerun the truncated regression and report the results in column 2 (labelled as 25). The two results are very similar. We then run a fixed effects pooled truncated regression by introducing firm dummies and report the results in column three (labelled as 26). We do not control for country, industry or year with this specification. The *F*-test of joint significance of the firm dummies returns a chi^2 value of 458.38 significant at 1%. When we bootstrap the standard errors with the fixed effects estimation, STATA does not return results. An explanation is that by controlling for fixed effects, the standard errors are already corrected but inefficient.

Table 22: Truncated regression results of corporate governance and total factor productivity

	25[a,b]	26[c]	27[a]	28[c]
	Malmquist index as dependent variable		Upper confidence level of Malmquist index as dependent variable	
Variables	Observed coefficient (bootstrap standard error)	Coefficient (standard error)	Observed coefficient (bootstrap standard error)	Coefficient (standard error)
Log largest owner	-0.0075 (0.0073)	-0.0153 (0.0296)	-0.0175** (0.0088)	0.0086 (0.0409)
Log board size	0.0083 (0.0211)	-0.0340 (0.0899)	0.0206 (0.0219)	0.2475 (0.2224)
Board independence	0.0124 (0.0208)	-0.0316 (0.0824)	0.0102 (0.0304)	-0.3198** (0.1515)
CEO is not chairman	0.0053 (0.0079)	-0.1945** (0.099)	0.0176 (0.0110)	0.0976 (0.1725)
Individual/ family	0.0026 (0.0164)	-0.0871 (0.1160)	-0.0129 (0.0217)	-0.2130 (0.2155)
Financials	-0.0044 (0.0152)	0.3191** (0.1438)	-0.0272 (0.0213)	0.3199*** (0.1211)
Public company	-0.0156 (0.0277)	0.0176 (0.0636)	0.0093 (0.0409)	-0.1021 (0.1056)
Industrial company	0.0046 (0.0182)	0.0052 (0.0698)	0.0080 (0.0259)	0.0823 (0.1163)
State	0.0262 (0.0387)	-0.1173 (0.1164)	-0.0552 (0.0538)	-0.0923 (0.2450)
Log sales	-0.0049 (0.0030)	-0.0362** (0.0174)	-0.0110** (0.0047)	-0.1065***(0.0220)
Sales growth	-0.0243* (0.0124)	-0.0489*** (0.014)	-0.0326* (0.0167)	-0.0828***(0.0177)
Log std. dev. *ROE*	-0.0255*** (0.004)	-0.0190** (0.007)	-0.0163*** (0.006)	-0.0193** (0.0096)
Log leverage	0.0162** (0.0045)	0.0323*** (0.010)	0.0229*** (0.006)	0.0554*** (0.0135)
Constant	1.0511*** (0.041)	1.5916*** (0.299)	1.1928*** (0.061)	2.1401*** (0.4872)
Sigma	0.0982*** (0.0029)	0.0802*** (0.002)	0.1300*** (0.0057)	0.1087*** (0.0026)
Wald chi^2	132.25***	571.39***	161.51***	527.84***
Log likelihood	751.15	920.18	535.86	690.19
Pooled *N* (3 years)	833		862	

***|**|* = significant at 1%|5%|10% levels. Robust bootstrap standard errors and standard errors of fixed effect models are in parentheses. [a] = Control for industry, country and year. [b] = Industry control not significant and excluded. [c] = Control for firm fixed effects.

We substitute the average Malmquist index with the values of the upper limit of confidence for both models and report the values in columns four (labelled as 27) and five (labelled as 28). For the upper limit of confidence, dummies for industry, year and country are all jointly significant although that for country is only at the 10% level. We therefore report the result without re-running the regression. The malmquist index that proxies for total factor productivity is estimated for two successive periods and may not be the best measure as a longer time period is required for best results.

In model 25, we use bootstrapping for the standard errors with the value of the Malmquist index. Model 26 is a normal truncated regression with dummies for firm fixed effects. Models 27 and 28 replace the Malmquist index with the upper level of confidence at 95%. We observe that only model 27 (bootstrapped standard errors of upper level of Malmquist confidence interval) indicate a significantly negative relationship with ownership concentration. Board characteristics and ownership identity reveal no significant relationships. Leverage has a globally positively association with *TFP* growth. Firm size is negatively related to *TFP* (although this is not significant in model

25). Sales growth which proxies for growth opportunities is negatively associated with *TFP*. Firm risk is also negatively related to *TFP*. The coefficients with the bootstrapped standard errors are generally better than those controlling for fixed effects with observed information matrix (*OIM*).

Technical efficiency

Simar and Wilson (2007) propose the use of a bootstrapped truncated regression to improve the estimates of technical efficiency and the predictor variables. We follow this and report the results in table 23. We compare the estimates of the bootstrapped (500 replications) truncated model with a fixed effects truncated model. Dummies for industry, country and years are significant when the bias-corrected technical efficiency is used. In the case of the upper level of confidence of bias-corrected technical efficiency, the dummy for years is jointly insignificant so we exclude it and re-run the robust regression. The same process is done for technical efficiency results as the year dummy is jointly insignificant, although ownership concentration has a significantly positive effect at the 5% level of significance.

The type of owner is insignificant while all other board variables (size, independence and *CEO*-chairman separation) have significantly negative effects on technical efficiency.

Leverage has a significantly negative effect on all measures of technical efficiency. Sales (firm size) has a positive effect on technical efficiency indicating the advantages of scale and scope effects even though a variable returns to scale technology has been specified. The effect of sales growth on technical efficiency is negative and consistent with the robust specifications of bias-corrected efficiency with bootstrapped standard errors, upper confidence limit of bias-corrected technical efficiency and original technical efficiency values. Firm risk however has a very mixed effect with the robust specifications. It is significantly negative for bias-corrected efficiency and not significant for the other two alternative measures. In terms of the fixed effects non-robust standard errors of firm risk, there is a weakly positive or no relationship with technical efficiency. The robust measures however prevail, especially that of the bias-corrected technical efficiency.

Table 23: Truncated regression results of corporate governance and technical efficiency

	29	30 [b]	31 [a]	32	33 [b]	34 [a]
	Bias-corected *VRS* technical efficiency		Upper confidence limit of bias-corrected *VRS* technical efficiency		*VRS* technical efficiency	
Variables	Observed coefficient (bootstrap standard error)	Coefficient (standard error)	Observed coefficient (bootstrap standard error)	Coefficient (standard error)	Observed coefficient (bootstrap standard error)	Coefficient (standard error)
Log largest owner	0.020*** (0.008)	0.034* (0.019)	0.018 (0.013)	0.121*** (0.040)	0.023** (0.011)	0.043 (0.033)
Log board size	-0.058*** (0.023)	-0.357*** (0.080)	-0.070** (0.032)	-0.002 (0.203)	-0.105*** (0.031)	-0.204*** (0.066)
Board independence	-0.080*** (0.028)	-0.121* (0.068)	-0.143*** (0.049)	-0.334 (0.213)	-0.116*** (0.038)	0.077 (0.329)
CEO is not chairman	-0.025*** (0.009)	-0.316*** (0.053)	-0.037*** (0.012)	-0.127 (0.130)	-0.023** (0.012)	0.012 (0.109)
Individual/ family	0.010 (0.028)	-0.056 (0.074)	-0.012 (0.047)	0.121 (0.188)	0.013 (0.032)	0.061 (0.118)
Financials	-0.007 (0.028)	-0.068 (0.048)	-0.069 (0.049)	0.170 (0.170)	-0.029 (0.035)	0.059 (0.244)
Public company	-0.019 (0.029)	-0.059 (0.048)	-0.019 (0.060)	0.177 (0.255)	0.004 (0.047)	-0.297*** (0.097)
Industrial company	-0.032 (0.028)	-0.083 (0.092)	-0.087* (0.051)	-0.100 (0.171)	-0.061* (0.035)	-0.294** (0.128)
State	0.021 (0.055)	-0.344*** (0.082)	-0.029 (0.097)	0.394* (0.206)	0.018 (0.072)	0.085 (0.150)
Log sales	0.036*** (0.004)	0.078*** (0.009)	0.074*** (0.006)	0.087*** (0.011)	0.058*** (0.006)	0.088*** (0.011)
Sales growth	-0.027** (0.014)	0.015 (0.009)	-0.022* (0.013)	0.014 (0.011)	-0.031** (0.016)	0.019* (0.010)
Log std. dev. *ROE*	-0.009** (0.004)	0.008* (0.005)	-0.002 (0.008)	0.011* (0.006)	-0.010 (0.008)	0.007 (0.006)
Log leverage	-0.015*** (0.006)	-0.043*** (0.006)	-0.029*** (0.009)	-0.059*** (0.008)	-0.012 (0.008)	-0.052*** (0.007)
Constant	0.397*** (0.075)	0.758*** (0.183)	1.439*** (0.246)	0.139 (0.538)	0.148 (0.094)	0.231 (0.362)
Sigma	0.119*** (0.004)	0.055*** (0.001)	0.159*** (0.007)	0.063*** (0.002)	0.134*** (0.005)	0.059*** (0.002)
Wald chi^2	5230***	5310***	1196***	4363***	…….	4566***
Log likelihood	779.2	1464	765.9	1572	641	1262
Pooled *N* (3 years)	980		986		851	

[a] = Year dummies are not included as they are jointly insignificant. [b] = Categorical dummies for firm fixed effects without industry and country dummies. ***|**|* = significant at 1%|5%|10% levels. Robust bootstrap standard errors and standard errors of firm fixed effects models are in parentheses. Coefficients of industry and country dummies are not reported.

Comparisons of results to previous studies

We now summarise the findings where we utilise Prais-Winsten (and truncated) regressions with corrections for panel-level heteroskedasticity and first-order autocorrelation. We then compare these results with those that we have reviewed from previous empirical studies.

Ownership concentration

In terms of *MBV* and Tobin's *Q*, ownership concentration has a significantly negative effect as discussed all along. One of several studies that has observed this negative effect of ownership concentration on performance is Bøhren and Ødegaard (2004) for Norwegian listed firms. Bøhren et al. (2005) also find outsider ownership to decrease firm value after using pooled *OLS*, *GMM*, and partial *OLS* and *SE* regressions. Holderness and Sheehan (1988) find no effect of ownership concentration or diffusion on firm value for *US* firms. Demsetz and Villalonga (2001) find no relationship. McConnell and Servaes (1990) also report that block holding ownership has no effect on firm value. Renneboog (2000) find little support of the role of large owners in corporate control. Hypothesis *H1* which indicates a positive effect of ownership concentration on firm performance is therefore not supported with a valuation proxy.

Looking at the relationship between profitability and ownership concentration, we find no statistically significant relationship that ownership concentration increases or reduces both *ROA* and *ROE*. We however compare this finding to previous studies. Demsetz and Lehn (1985) find a negative but insignificant relationship between ownership and *ROE* for *US* firms. Demsetz and Villalonga (2001) also find no relationship using profitability. Holderness and Sheehan (1988) find no effect of ownership concentration or diffusion on *ROE* for *US* firms. Cubbin and Leech (1986) find no relationship between ownership and profits for *US* firms. Gugler (1998) finds a negative relationship of high levels of ownership, but with internal rate of return, for Austrian firms.

Kapopoulous and Lazereto (2007) find a positive relationship between ownership and profitability for Greek firms using *OLS* and *2SLS*. Gorton and Schmid (2000a) find a positive relationship for German firms. Claessens and Djankov (1999) using Czech firms and Xu and Wang (1997) using Chinese firms find a positive relationship with profitability. Pedersen and Thomsen (1999) use *OLS* regression and find *ROE* to be insignificantly decreasing with voting ownership. Earle et al. (2005) argue that only the largest owner has a systematic positive effect on *ROE*.

We do not find any significant support to the positive relationship between cash flow and ownership; however, we find a statistically positive relationship with dividend yields. Pindado and de la Torre (2006) find a positive relationship between outside ownership and dividends for Spanish firms. Furthermore, Pindado and de la Torre (2006) find no support of a relationship between cash flow ownership and cash flow using *OLS*, piecewise, *GMM* and Arellano/Bond (1998) regressions. Their results are similar to our findings in both cases.

With operating revenue/turnover growth and growth in total assets, we observe a positive relationship which is only statistically significant in the former. Thomsen and Pedersen (2000) finding ownership structure over a five-year period to be stable and exogenous report no significant relationship with sales growth. We also report a negative relationship with *TFP* growth which is significant when we use the upper level of confidence. Bartelsman and Doms (2000) however argue that ownership concentration has a positive effect on productivity. Year to year *TFP* growth (as used in our case) is not particularly useful as the technical change component requires a longer period for noticeable manifestations. For *TFP* and technical efficiency, we use a pooled truncated bootstrapped regression (resulting in double bootstrapping as suggested by Simar and Wilson, 2007) rather than a Prais-Winsten.

We finally consider the effect of ownership concentration on technical efficiency. We find a positive effect of ownership concentration on *VRS* technical efficiency and its bias-correction consistent with our hypothesis – *H1*. Lauterbach and Vaninsky (1999) find a reduced relationship between concentrated ownership and technical efficiency than with diffused ownership, albeit a positive effect. Lehmann et al. (2004) find a positive effect for Germany, Zheka (2005) also finds a positive effect for Ukraine, Nanka-Bruce (2006) reports a positive but insignificant effect for Spain. Zelenyuk and Zheka (2006) report a positive effect for Ukraine, and Destefanis and Sena (2007) also report a positive effect for Italy. Earle et al. (2005) argue that only the largest owner has a systematic positive effect on operational efficiency. Technical efficiency, with an input orientation, devoid of earnings management and market speculations can therefore be a preferred alternative to measuring performance effects of ownership.

Ownership identity

We first consider the effect of ownership types on market valuation. Financial firms have a positive effect on both Tobin's *Q* and *MBV* after controlling for panel heteroskedasticity and first order serial correlation. Dittmar and Mahrt-Smith (2007) also find a positive relationship between financials and *MBV* for *US*-listed firms. Seifert et al. (2005) report a mixed effect of institutional shareholders on firm value. Thomsen and Pedersen (2000) find positive support for the relationship between institutional owner (financials) and *MBV*. Sarkar and Sarkar (2000) find that all categories (their categorisation) of large shareholders increase *MBV* and Tobin's *Q*.

In our study, individuals/families also exhibit a positive relationship; the value is higher for Tobin's *Q* than with financials but lower for *MBV*. The positive relationship for both public firms and industrial companies are lower than individuals and financials. We observe that industrial companies have higher coefficients with Tobin's *Q* and lower coefficients with *MBV* when compared to public firms. De Jong et al. (2005) find a negative relationship between industrial companies and firm value for Dutch firms. The State has a negative relationship with both valuation measures albeit not statistically significant at conventional levels. This negative effect is only significant in the pooled fixed effects regressions.

We next consider the effect of ownership identity on profitability. Individuals/families have a statistically significant positive effect on both *ROA* and *ROE* while the positive effect when financial firms are considered is not significant in both measures. They are only significant when a pooled fixed effects model is specified. Dittmar and Mahrt-Smith (2007) find a positive relationship between financials and *ROA* for *US*-listed firms using an *OLS* specification.

Thomsen and Pedersen (2000) find evidence of a positive support for the relationship between institutional owners (financials) and *ROA*. From our estimations, publicly-listed firms produce statistically insignificant results with both profitability measures. This statistical insignificance is also shared by industrial companies where positive but insignificant effects are observed. The State has a negative effect on profitability in all specified models and this effect is statistically significant except in the Prais-Winsten specification when *ROE* is the dependent variable. Gugler (1998) find that State ownership decreases profitability. Thomsen and Pedersen (1996) find no significant differences across ownership categories with *ROE*. Sarkar and Sarkar (2000) find that all categories of large shareholders increase return on sales (*ROS*).

The next comparison after profitability is with cash flow and dividend yield. We find all ownership categories to have a negative effect on cash flow and this is significant for all except public firms. The State has the highest negative effect, followed by public (not significant), financials, industrials and individuals/families respectively. However, Dittmar and Mahrt-Smith (2007) using *OLS* regression find a positive relationship between financials and cash flow for *US*-listed firms. With regards to dividend yield, all categories except the State have positive effects albeit insignificant for industrial companies. Individuals/families have the highest influence followed by public firms, then financials. The negative effect of the State is statistically insignificant.

We have three measures of firm growth and we first consider growth in operating revenue/turnover and growth in total assets. We do not find any statistically significant effect of ownership identity on these two measures. Dittmar and Mahrt-Smith (2007) using *OLS* regression find a positive relationship between financials and sales growth for *US*-listed firms. Thomsen and Pedersen (1996) find no significant differences across ownership categories with sales growth in a European cross-country survey. Thomsen and Pedersen (2000) also do not find evidence of a relationship between institutional owners (financials) and sales growth in a European study.

With productivity growth too, we do not find any statistically significant effect of any ownership category. When we use the upper level of confidence of the Malmquist index, only financial companies now positively affect productivity growth. Nickell et al. (1997) find productivity to increase with financials and decrease with non-financials. They also find no effect of individual/ family ownership on productivity. Drake and Simper (2003) find differing effects of productivity growth for different types of banking ownership in the *UK*.

The last measure of performance we discuss is technical efficiency. We mostly observe statistically insignificant results so we can infer that the identity of ownership does not matter for firm technical efficiency. Similar studies include Wen et al. (2002) for China where State-owned firms are the least efficient. Drake and Simper (2003) find differing effects of technical efficiency change for different types of banking ownership in the *UK*. Lehmann et al. (2004) observe that financial firms do not have a systematic positive effect on technical efficiency. They further find that the difference between their ownership groups is not statistically significant at conventionally acceptable levels.

Other studies on the effect of ownership identity on performance include Demsetz and Lehn (1985) who find a positive relationship between individuals/family and standard error of market return. Agrawal and Mandelker (1990) find a positive relationship between institutional (financials) ownership and cumulative abnormal returns. Seifert et al. (2005) report a mixed effect of block holding identity on firm value. Cable (1985), McConnell and Servaes (1990 & 1995), Smith (1996), Gorton and Schmid (2000b) and Boehmer (2000) find institutional investors (financials) to have a positive impact on performance. Goergen et al. (2005), Hellwig (1998), Morck et al. (2000) find a negative relationship with institutional investors while Prowse (1992) and Zoido (1998) find no systematic relationship.

Board size

Bøhren and Ødegaard (2004) find a negative relationship between board size and firm value for Norwegian firms. Yemack (1996) also finds a negative relationship between firm value and board size while Mak and Yuanto (2002) report same with Singaporean and Malaysian firms. Dahya et al. (2008) however find a positive relationship between board size and value. Aggarwal et al. (2007) and Renneboog (2000) find no evidence of a relationship. The results we have point to a statistically insignificant relationship between board size and market value. As regards to *MBV*, the fixed effects specification indicates a negative effect of board size while the Prais Winsten and heteroskedasticity-corrected pooled *OLS* regressions with industry and country controls point to an insignificantly positive relationship.

Eisenberg et al. (1998) find a negative relationship of board size with profitability for Finnish firms. Carline et al. (2002) find similar results using operating profits for *UK* firms. We report a negative relationship of both *ROA* and *ROE* with board size supporting the hypothesis (*H3*) of having fewer board members unlike the results with market valuation, which is a bell-shaped relationship (extension to *H3* and considered in the next section).

We have further results of other performance measures and their relationship with board size. There is no statistically significant effect of board size on both cash flow and dividend yield except for the pooled *OLS* fixed effects specification where a negative effect prevails for cash flow. For our first two measures of growth (asset and operating revenue/turnover), we observe negative relationships with board size; but productivity growth returns a positive but insignificant relationship with board size. Technical efficiency returns a statistically significant negative relationship with board size which is robust across different model specifications supporting hypothesis *H3*.

Board independence

Agrawal and Knoeber (1996), Conyon and Peck (1998), Ezzamel and Watson (2002), De Jong et al. (2005) and Dwivedi and Jan (2004) find negative relationships between board outsiders and value. Kang and Shivdasani (1995) find no relationship. Hossain et al. (2001), Aggarwal et al. (2007) and

Dahya et al. (2008) report positive relationships. We observe a positive relationship between the percentage of board outsiders with Tobin's *Q* and also with *MBV* even after controlling for panel heteroskedasticity and first-order autocorrelation in support of hypothesis *H4*.

We further observe a negative but insignificant relationship between board independence and both *ROA* and *ROE*, although for the firm fixed effects specification (with no control for industry, year and country) the effects are positive and significant. With this same specification, the effect of board independence on cash flow is significantly positive while the effect on dividend yield is significantly negative. A negative effect is observed in all other specifications of board independence on cash flow and dividend yield which is significant for dividend yield but insignificant for cash flow. Board independence as reviewed from the literature has been hypothesised to have a positive relationship but we report mixed results as is the case with some of our review. This evidence is only supported when market valuation is the proxy for performance.

Furthermore, board independence has a significantly negative effect on operating revenue/turnover growth and asset growth in all specifications. The effect on productivity growth is generally mixed and insignificant. With technical efficiency, the negative effect of board independence is statistically significant. Board outsiders, it can be argued, do not have adequate knowledge of the firm's productive process to improve its technical efficiency.

CEO-chairman separation

Bozec and Dia (2007) find a positive relationship between the separation of the duties of the *CEO* and chairman of the board of directors. On the contrary, Finklestein and D'Aveni (1994) find a negative relationship. Dalton et al. (2004) and Kang and Zardkoohi (2005) report mixed effects of *CEO*-chairman separation on performance while Aggarwal et al. (2007) find no relationship. Coles and Hesterly (2000) and Conyon and Murphy (2000) also find no effect. As the review of 30 articles by Kang and Zardkoohi (2005) reveals, ten articles find no relationship, eight reveal positive relationships, seven indicate a negative relationship with only one article indicating statistical significance and five indicating both negative and positive relationships depending on the control variables used.

We add to these findings by comparing how *CEO*-board chairman separation relates to each of our ten measures of firm performance. We find a negative relationship with both *MBV* and Tobin's *Q* but these relationships are not significant when controlled for heroskedasticity and autocorrelation. The same relationships are observed with *ROA* and *ROE* where they are both insignificant. The negative relationship is also not significant for both cash flow and dividend yield while it is significant at a 10% level for operating revenue/turnover growth but insignificant for asset growth. With productivity growth, the significant negative relationship becomes positive and insignificant when controlled for heteroskedasticity. Using the upper level of confidence value of *TFP* gives positive but insignificant result.

With technical efficiency, the negative relationship still persists when correction has been made for bias *VRS* technical efficiency. With the foregoing discussion, we can infer that although there is a preponderant effect of a negative effect of *CEO*-board chairman separation on performance, the results are mostly insignificant and hence there is no significant effect of *CEO*-board chairman separation on performance. Thus, Hypothesis *H5* is not supported.

Financial policy

Sarkar and Sarkar (2000) find a positive relation between leverage and performance. Seifert et al. (2005) report a negative effect between leverage and firm value. Agrawal and Knoeber (1996) also find a negative relationship between leverage and value for large *US* firms. We find a negative relationship between leverage and both market-based measures of Tobin's *Q* and *MBV*. Kapopoulous and Lazereto (2007) find a negative relationship between leverage and profitability using *OLS* and *2SLS*. We also find a negative relationship between leverage and *ROA* which is significant but our negative relationship between leverage and *ROE* is not significant at conventional levels.

Both relationships of cash flow and dividend yield with leverage are negative but not statistically significant. We also observe a negatively significant relationship with operating revenue/turnover growth and an insignificantly positive relationship with asset growth. On the other hand, the positive relationship with productivity growth is statistically significant. Leverage also has a statistically significant negative relationship with all measures of technical efficiency contrary to that reported in Lauterbach and Vaninsky (1999) for Israel in a cross-sectional regression. Hypothesis *H6* is mostly supported.

Firm size

We observe in our bivariate regression analysis that although market capitalisation, total assets, operating revenue, total sales and total equity are all highly positively correlated, market capitalisation has a negative effect on Tobin's *Q* while all the other measures have positive effects. We utilise total sales as our proxy for firm size in the multivariate regressions and discuss its relationship to our ten performance proxies in comparison to prior empirical studies. Seifert et al. (2005) report a negative effect between size and firm value. Sarkar and Sarkar (2000) find a positive relation between size (by log of sales) and performance. We report a positive relationship of total sales with both Tobin's *Q* and *MBV*.

Kapopoulous and Lazereto (2007) find no relationship between size and profitability. We observe a positive relationship for both *ROA* and *ROE*. Additionally, we also observe a positive effect of size (measured by the natural logarithm of total sales) on cash flow, dividend yield, operating revenue/ turnover growth and asset growth while that with productivity growth is negative and significant. The negative relationship becomes insignificant when correction is made for heteroskedasticity. It is evident from our analyses that the performance variable that has the least relationship with our governance variables is productivity growth. Year-to-year *TFP* growth is therefore not a useful measure in examining governance dynamics over a relatively short period.

The relationship between technical efficiency and sales (size) is positive across all our robust specifications. Sheu and Yang (2005) also find a positive relationship between firm size (measured by total assets) and technical efficiency. Lauterbach and Vaninsky report a positive effect of size on technical efficiency. Our sample is drawn from the manufacturing industries where firm size leads to economies of scope and scale contributing to improved performance.

Firm volatility

We employ the standard deviation of four-year *ROE* (volatility) as a proxy for our measure of firm risk. Most studies use the firm's beta but we opt otherwise as we only have the values for the current year (2006) and this is only for less than half of the firms in our sample. Seifert et al. (2005) report a negative effect between risk and firm value. Investors are usually willing to invest in risky firms only where the return on investment is much more than in low-risk firms. Risky firms must have intangible assets that can be transformed into dividend payouts and hence must have higher future valuation.

We observe a positive relationship with Tobin's *Q* and *MBV* but that for *MBV* is insignificant when controlled for heteroskedasticity and autocorrelation. With *ROA* and *ROE*, our relationship is significantly negative. This is not surprising as profitability is backward-looking as espoused by Demsetz and Villalonga (2001). Pedersen and Thomsen (1999) use standard deviation of *ROE* and find it to affect *ROE*. We also observe a negative relationship with cash flow and dividend yield although that for dividend yield is not statistically significant at conventional levels.

The statistically significant negative relationship prevails with operating revenue/turnover growth, asset growth and productivity growth. We also find a negative relationship with heteroskedasticity-corrected (homoskedastic) bias-corrected *VRS* technical efficiency but this result is not significant when there is no correction for bias in efficiency. Sheu and Yang (2005) on the contrary find a positive relationship between firm risk (measured by *R&D*) and technical efficiency.

Opportunities for growth

As a proxy for opportunities for growth, we use the average of four-year sales growth. We report a positive effect of sales growth on both Tobin's *Q* and *MBV* which makes sense since valuation has a forward-looking perspective in line with Jo et al. (1994). Seifert et al. (2005) also report a positive effect between sales growth and firm value. Sarkar and Sarkar (2000) find a positive relationship between opportunities for growth (measured by intangible assets) and their measures of performance. Although the same positive relationships obtain for *ROA* and *ROE*, neither is statistically significant. Similar results prevail with cash flow, dividend yield, operating revenue/turnover growth and asset growth. A statistically significant negative relationship is observed between opportunities for growth and productivity growth, and also with bias-corrected technical efficiency. Obviously, if a firm has high growth opportunities, it does not concern itself with technical efficiency or productivity. It is rather firms with low-growth opportunities that concentrate on efficiency and productivity.

4.7 Non-linearity/non-monotonicity in governance and performance

In this section, we investigate the presence of non-linearities (quadratic) and non-monotonicities (piecewise linear) in the relationship between corporate performance and ownership concentration and also with board size. Board size has shown varying relationships with our measures of performance so far. A Lowess test of board size with Tobin's *Q* reveals a concave relationship and hence it is important to model board size as a quadratic function of valuation. In the *FGLS* estimations with control for serial correlation and panel heteroskedasticity, we have reported a concave relationship. As regards to ownership concentration and firm value, a negative relationship has so far been observed in the linear estimations. In the *FGLS* estimations with control for serial correlation and panel heteroskedasticity, we have reported a convex relationship. We now utilise Prais-Winsten regressions to make robust specifications in the quadratic and piecewise linear models.

4.7.1 Quadratic specification

In table A47, we report values of possible quadratic relationships of board size and ownership concentration with valuation (along with the ownership identity, board independence, *CEO*-chairman separation, financial policy and firm, industry and country controls) employing the rather over-confident Park's Feasible Generalised Least Squares (*FGLS*) approach with correction for panel heteroskedasticity and autocorrelation. Pindado and de la Torre (2006) find a non-linear relationship between outside ownership and firm value. De Miguel et al. (2004) also find a quadratic relationship. We find evidence of a convex relationship for the largest direct shareholder and also a concave relationship for board size.

There is no evidence of a quadratic relationship with board outsiders. Since the standard errors in the Park's model is over-confident, we further subject the analysis to a more rigorous Prais-Winsten model and follow Beck and Katz (1995) for our *OLS*-correction of panel heteroskedasticity. In table 24, we compare regression results of: 1) a pooled *OLS*; 2) a pooled *OLS* with White-correction for heteroskedasticity; 3) the Park's *FGLS* (with correction for heteroskedasticity and first-order autocorrelation), and; 4) a Prais-Winsten model (with *OLS* heteroskedastic-panel corrected standard error and correction for first order autocorrelation). In all four regressions, there is evidence of quadratic relationships for both ownership concentration and board size with Tobin's *Q*. The evidence in three of our four specifications is however insignificant at conventional levels for ownership concentration.

The relationship between ownership concentration and Tobin's *Q* is convex indicating that at low to medium levels of ownership, there is a negative effect on valuation but as ownership gets more concentrated, there is a positive effect, albeit not significant. This lends partial support for ownership to be very concentrated for rewarding effect giving support to our extension to hypothesis *H1*. The relationship between board size and valuation is concave. This implies that board size increases value until a threshold size after which it decreases firm valuation in support of the extension to hypothesis *H3*.

Table 24: Non-linearities in the relationship between corporate governance and firm value

	Regression 1¡	Regression 2¡	Regression 3¡	Regression 4¡
Log Tobin' s *Q*	Coefficient (standard error)	Coefficient (robust standard error)	Coefficient (heteroskedastic corrected standard error)	Coefficient (heteroskedastic panel-corrected standard error)
Ownership concentration	-0.537** (0.240)	-0.537** (0.230)	-0.654***(0.150)	-0.603** (0.272)
Square of ownership concentration	0.378 (0.301)	0.378 (0.272)	0.530***(0.175)	0.468 (0.321)
Board size	0.043** (0.017)	0.043** (0.017)	0.060***(0.010)	0.047** (0.021)
Square of board size	-0.002** (0.001)	-0.002** (0.001)	-0.003***(0.000)	-0.002** (0.001)
Board independence	0.104* (0.059)	0.104** (0.053)	0.130***(0.032)	0.118* (0.063)
CEO-chairman duality	-0.010 (0.022)	-0.010 (0.021)	-0.010* (0.006)	-0.010 (0.015)
Individual/ family	0.202***(0.058)	0.202***(0.055)	0.126***(0.029)	0.170**(0.067)
Financials	0.183***(0.057)	0.183***(0.053)	0.095***(0.028)	0.175***(0.065)
Public company	0.131 (0.086)	0.131* (0.074)	0.059 (0.036)	0.130 (0.096)
Industrial company	0.159***(0.057)	0.159***(0.052)	0.053**(0.026)	0.142**(0.063)
State	-0.039 (0.105)	-0.039 (0.099)	-0.132***(0.034)	0.000 (0.142)
Log sales	0.048***(0.007)	0.048***(0.008)	0.038***(0.004)	0.041***(0.009)
Sales growth	0.057***(0.014)	0.057***(0.017)	0.046***(0.003)	0.047***(0.015)
Log std. dev. *ROE*	0.031**(0.013)	0.031**(0.013)	0.026***(0.005)	0.037***(0.012)
Log leverage	-0.108***(0.014)	-0.108***(0.014)	-0.060***(0.008)	-0.085***(0.015)
Constant	-0.684***(0.185)	-0.684***(0.162)	-0.559***(0.099)	-0.604***(0.194)
Rho			0.589	0.551
R^2	0.237***	0.237***		0.246***
Adjusted R^2	0.216***			
Wald chi^2			2987***	605.8***
N	1797		1710	1797

¡ = Regression 1 is a pooled *OLS* regression; regression 2 is a pooled *OLS* regression with White-correction for heteroskedasticity; regression 3 is a Park *CSTS FGLS* regression with heteroskedasticity corrected standard errors and correction for first order autocorrelation; and regression 4 is a Prais-Winsten regression with *OLS* heteroskedastic panel-corrected standard errors and correction for first order autocorrelation. As Beck and Katz (1995) concur, the standard errors for the Park model are over-confident. ***|**|* = Significant at 1%|5%|10% levels. Standard errors are in parentheses. Coefficients of industry and country dummies are not reported even when jointly statistically significant. *ROE*, *ROA* and dividend yield exhibit no non-linearities. *MBV*, like Tobin's *Q*, has no statistically significant non-linearities with ownership concentration but a quadratic function with similar signs (like the latter) with board size. Cash flow exhibits a strongly significant quadratic relationship with expected hypothesised signs with both ownership concentration and board size

Having controlled for the quadratic relationships, we will now add to the results of the other governance and control variables and how they relate with valuation. Board independence has a positive effect in all regression models while *CEO*-board chairman duality mostly has a negative and insignificant effect on valuation. It is only in the Park's model where there is a statistical significance at the 10% level.

In terms of the identity of owner, the State has a negative but insignificant effect on valuation (significant in the Park's model) while the other four categories have positive effects. Public firms do not seem to have a statistically significant effect but the other three do. Of these, individuals/families seem to have a little improvement on valuation than financial firms (except for the Prais-Winsten model where the latter has a slight edge) but these two categories perform better than industrial companies. An *F*-test of joint significance reveals differences in at least one of the categories. Financial policy measured by firm leverage has a negative effect on valuation confirming what has been discussed in the previous section. Size has a positive effect on valuation in all specifications and so are opportunities for growth and firm risk. These are all expected from theory.

4.7.2 Piecewise linear specification

Literature has also suggested piecewise relationship of ownership concentration and performance. We have run analyses on six of our performance measures. We extend this piecewise relationship to board size as well and have reported the values in tables A48 to A51. The breakpoint for ownership in the first analysis is at 20% and for board size at 5 and 15 members. With Tobin's *Q* and *MBV*, we report a negative but insignificant relationship with ownership of 20% or less, while that for more than 20% is significant. A board size of up to 5 members returns an insignificant relationship while that for six to 15 members is significantly positive. Board sizes more than 15 members have a negative effect on both *MBV* and Tobin's *Q* in support to the extension of hypothesis *H3*.

Both measures of profitability obtain significantly positive relationships with ownership up to 20% and more than 20% but the coefficient of the former is much more than the latter. Board sizes of less than 6 members have no effect (insignificantly negative with a lower beta coefficient than the other two categories) on profitability but we observe a negative relationship between profitability and the ideal board size of six to 15 members, the coefficient is however four times less than board sizes of more than 15 members. This reveals that although board size negatively affects profitability, the effect is more intense as board size increases.

With cash flow, up to 20% ownership has a negative (but insignificant) effect but more than 20% ownership has a statistically significant positive effect implying a convex relationship – extension to hypothesis *H1*. A board size of up to five members has a statistically negative effect which coefficient is more than the statistically insignificant effect when the board size is between six and 15 and far less than when the board size is more than 16 members. Both ownership levels have a statistically significant positive relationship with dividends. Ownership levels of up to 20% have a better impact on dividends than more than 20%. Board size does not seem to have any statistical effect on dividends (although all coefficients are positive).

We now increase the ownership level to up to 25% and more than 25% while we have only one knot for board size at up to 15 members and more than 15 members. We keep this (board size) knot for the other two results reported in (ownership knot at 50%) and (ownership knot at 70%).

When the ownership knot is at 25%, both Tobin's *Q* and *MBV* obtain negative relationships below and above this knot. Shares up to 25% have two-third the value of shares more than 25%. This implies the negative relationship is more evident as shares increase. A board size of less than 16 members' impacts positively on valuation while that of more than 15 members has a negative impact. *ROA* and *ROE* both exhibit a statistically insignificant positive relationship with ownership levels of up to 25% and more than 25%. With board size, there is a significantly negative relationship where the intensity of a board size of more than 15 members is about four times more than when the board size is up to 15 members.

Cash flow relates positively with up to 25% of ownership. The positive relationship after this knot is insignificant. Less than 16 board members have a negative effect on cash flow while more than 15 members have a positive and significant effect (a reverse finding of the relationship between market valuation and board size). As regards to dividend yield, the positive relationship with shares less than 25% is less intense than when the shares are more than 25% indicating that concentrating ownership is a good practice for improving dividend yield. With board size, there is still no significant positive relationship with both splines on dividend yield.

We now increase the ownership knot to 50% and observe that both Tobin's *Q* and *MBV* have a significantly negative relationship with up to 50% of ownership but more than 50% ownership obtains an insignificant negative relationship. On the other hand, both measures of profitability have a significantly positive relationship with up to 50% ownership and an insignificant relationship with more than 50% ownership. Cash flow and dividend yield both obtain the same results with ownership as profitability measures do.

What we have seen in this is that up to 50% ownership levels have a statistical relationship with the performance measures while concentrating ownership after this threshold does not generally lead to any statistical improvements. To see if this is true, we increase the ownership knot further to 70%. Similar results obtain for all the performance measures except that more than 70% ownership levels lead to a statistically significant negative relationship with cash flow; whereas that with more than 50% ownership levels is negative but not statistically significant.

Summary of non-linear/non-monotonic relationships

Depending on the performance measure used then, we expect to get different results. For instance, Thomsen and Pedersen (2000) find a concave relationship with *MBV* and *ROA* but not with sales growth. We obtain a convex relationship with Tobin's *Q* and our *MBV* relationship is not any different, although the positive side of this quadratic is not significant. Drobetz et al. (2004b) estimate their non-linear relationship between governance and ownership concentration using piecewise *OLS* and *2SLS* and obtain similar results to our study.

In terms of board independence, there is a significantly positive effect on Tobin's *Q* and *MBV*; significantly negative with *ROA* and; no significant relationships with *ROE*, cash flow and dividend yield. *CEO*-chairman separation tends to have negative relationships with most performance proxies but they are not statistically significant except with *ROE*, which is only at 10%. We now report the effect of ownership identity on the six performance measures. The State has a significantly positive effect on dividend yield. It has a negative but insignificant relationship with the rest of the performance measures. Public firms are seen to contribute negatively to cash flow. All other ownership categories contribute negatively as well but none is statistically significant. Individuals/families, financial companies, public firms and industrial companies contribute positively to Tobin's *Q*, *MBV*, *ROA*, *ROE* and dividend yield but in varying proportions.

Leverage has a negative effect (but this is insignificant with *MBV*) on the measures of performance. Firm size has a positive effect with all six measures of performance. Sales growth is positive with valuation, negative with profitability and unrelated (negative but insignificant) with cash flow and dividend yield. Firm risk (standard deviation of *ROE*) is positively related to Tobin's *Q* and *MBV*; negatively related to profitability and cash flow, and; indicates no significant effect on dividend yield.

The results from these non-linear/non-monotonic specifications largely support the findings from our linear specifications for ownership identity, board independence, *CEO*-chairman separation, financial policy, firm size, volatility and opportunities for growth.

4.8 Breaking down the ownership and value relationship to country level

In our analyses so far, we have considered the corporate governance relationship at a global level with dummy variables to control for country effects. We now break down the analysis to the level of the 17 individual countries in three alternative specifications of ownership concentration namely; the largest direct shareholder, the five largest direct shareholders and the largest total (direct and indirect) shareholder as shown in table 25. This is to verify whether the global results as regards to the relationship between ownership concentration and valuation obtain at the country level, or whether institutional differences matter. We only indicate the signs and statistical significance of the coefficients as we are interested in the signs of the coefficients.

The first proxy of ownership concentration is analysed with firm value using: no control variables; control for firm fixed effects; firm controls for financial policy, size, risk and growth opportunities but no industry control, and; the four firm controls together with industry dummies. In the second proxy of ownership concentration using five largest direct shareholders, we do not control for firm fixed effects while in the third proxy of largest total shareholder, we use all the firm control variables and industry dummies.

The eight regression results are reported in the table. The *USA* has a consistently negative effect of all proxies of ownership concentration on performance. This negative effect is not consistent in the *UK* since some of the regressions return statistically insignificant results on the effect of ownership concentration on valuation. Netherlands for instance returns insignificant negative results throughout. Apart from the “five largest shareholders” that returns an insignificantly negative result; all results for Spain are negatively significant. In Austria and France for instances, the results are mixed but all significant results indicate a negative relationship. Finland, Sweden and Switzerland also indicate significant negative relationships in their different specifications.

The opposite is true for Greece, Ireland and Italy where all significant associations are positive. Belgium, Denmark, Germany, Norway and Portugal exhibit a mixed effect depending on the specification. Apart from the *USA*, *UK*, Germany, France, Sweden and Switzerland, the other countries are under-represented in the sample as obtains in the OSIRIS database. It is probable that the negative result obtained in the global analysis has been influenced a lot by firms from the *USA*. Having said this, most listed firms in the manufacturing industries of interest are incorporated in the *USA* while others have multi-national cross-listings so this bias must be noted but the results obtain.

Table 25: Alternative specification regressions of ownership concentration and corporate value by country

	Largest direct shareholder				Five largest direct shareholders			Largest direct and indirect shareholders
Country	No control variables	Control for only firm fixed effects	Controls without industry	All controls	No control variables	All controls	Controls without industry	All controls
Austria	-***	-***	+	-	-***	+	-**	-
Belgium	-	+***	+	-	-***	+	-**	+***
Denmark	-	-	+	-**	-	+***	+	-***
Finland	-***	-***	-**	-	-***	-	-**	-
France	-*	-	-***	-	+	-	-	-*
Germany	-	+	+	+	-	-*	-	+***
Greece	+	-	+*	+	+***	+	+***	+
Ireland	+	+	+**	+***	+	+**	+*	+***
Italy	+	+	+***	+***	-	-	-	+*
Netherlands	-	-	-	-	-	-	-	-
Norway	-	-***	+	+	-	+*	+*	+
Portugal	-	+***	+	-	+***	-*	+	-***
Spain	-***	-***	-**	-**	-***	-*	-***	-
Sweden	-***	-	-***	-***	-	-**	-*	-**
Switzerland	-***	-***	-***	-***	-	-	+	-***
UK	-*	-***	-	-	-***	+	-	-*
USA	-***	-**	-***	-***	-***	-***	-***	-***

***|**|* = significant at 1%|5%|10% levels. The control variables are: natural logarithm of sales; average of five-year sales growth; natural logarithm of the standard deviation of four-year return on equity; natural logarithm of leverage, and; industry dummies when significant. The number of firms with data for five largest shareholders is substantially less than the largest direct shareholder (or largest direct or indirect shareholder). This is because while some firms report only the largest shareholder, other highly concentrated firms have less than five significantly large shareholders.

We further investigate the non-linearities and non-monotonicities of ownership concentration and firm valuation at the country level and report our results in table 26. The only controls are with industry dummies. We continue to use the direct shares of the largest owner as our proxy for ownership concentration. For non-monotonocity, we put the spline at 50% where more than 50% ownership indicates majority control. In Austrian firms majority ownership has a negative effect on value but only significant at 10%. There is no evidence of non-linearities, and ownership levels of less than 50% have no significant impact on valuation.

Table 26: Pooled piecewise and quadratic *OLS* regressions of firm value and ownership concentration

Country	Owner <=50% direct shares	Owner >50% direct shares	Largest direct owner	Squared largest direct owner
Austria	-	-*	-	-
Belgium	-	-	-	-
Denmark	-***	+	-***	+*
Finland	-	-	-	+
France	+*	-***	+	-
Germany	-	+***	-	+**
Greece	-	-	-	-
Ireland	+***	-	+***	-
Italy	-	+**	+**	-**
Netherlands	-	-	-	+
Norway	+***	+***	+***	+***
Portugal	+***	+***	+***	-***
Spain	-*	+	-	+
Sweden	-***	+	-***	+
Switzerland	-***	+	-***	-
UK	-	-	-	-
USA	-***	+	-***	-

***|**|* = Significant at 1%|5%|10% levels. Country results of separate regressions when largest direct ownership is splined into less than 50% and more than 50%, and when ownership is squared. The only controls are industry dummies. The results are almost the same when the breakpoint is increased to 70%.

There is no evidence of non-linearity or non-monotonicity in Belgian firms. In Denmark, less than 50% ownership negatively impacts on value but there is no effect with more than 50% or more ownership. There is evidence of a convex relationship (the positive coefficient on square of ownership is only significant at 10%) between firm ownership and valuation. There is no relationship in any of the specifications in Finland. In France, less than 50% ownership has a positive effect (at 10%) and 50% or more ownership has a negative effect. This is seen in the positive but insignificant value of ownership and the negative but insignificant value of its square indicating an insignificant concave relationship.

We now consider Germany where majority ownership (>50%) has a significantly positive effect on value but less than 50% ownership has an insignificantly negative effect. Other countries where there is a significantly positive effect of ownership "less than 50%" is Ireland, Norway and Portugal. Spain, Sweden, Switzerland and the *USA* indicate significantly negative effects at these levels of ownership. When the levels are increased to 50% or more, Italy, Norway and Portugal show significantly positive effects while the positive effects for Spain, Sweden, Switzerland and the *USA* are not statistically significant.

Norway shows both positive effects with ownership and its squared value (piecewise linear), while Italy and Portugal indicate concave relationships. The squared values of ownership for Ireland, Netherlands, Spain, Sweden, Switzerland, *UK* and *USA* are insignificant. We must also indicate here that the results have not been subjected to robustness tests of heteroskedasticity, autocorrelation or endogeneity as our intention here is to see if the more robust global results from our earlier analyses can be replicated at the country level. We see that there are differences in the relationship between country-level ownership and market valuation indicating the usefulness of institutional complementarity of agency theory as the relationship between valuation and concentrated ownership is dependent on a firm's and country's peculiar institutional environment.

Denmark, Finland, Germany, Netherlands, Spain and Sweden, more or less, support our global convex relationship. Austria, Belgium, Greece, *UK* and the *US* exhibit negative piecewise linear relationships. Norway exhibits a positive piecewise linear relationship. France, Ireland, Italy and Portugal exhibit concave relationships. In summary then, twelve of our seventeen countries (more than 90% of all firms), more or less, support our global linear relationship of ownership concentration and performance. We now extend the global results to include investor protection in the subsequent section.

4.9 Corporate governance, investor protection and performance

In this section we examine the effect of protection given to investors on corporate performance by adding alternative proxies of investor protection to our multivariate model. We also follow La Porta et al. (2002) to do alternative specifications to make the findings robust. We start by looking at the correlation of the measures of investor protection and our dependent and control variables used in the preceding section. Table 27 reveals that ownership concentration is moderately correlated with investor protection index at -0.44; with the number of governance codes at -0.31, and; with the revised anti-director rights index at -0.05. All the other predictor variables are not highly correlated with the investor protection measures. The investor protection measures are also correlated with all the performance proxies.

The investor protection proxies are all positively correlated. The number of governance codes correlate at 0.73 with investor protection index and 0.50 with revised anti-director rights index. The relation between investor protection index and revised anti-director rights index is only at 0.14. The number of governance codes has not been used in prior research and it is indeed refreshening to know it correlates strongly with the other two frequently used measures.

Table 27: Correlation of investor protection, corporate governance and performance

	Tobin's *Q*	*MBV*	*ROA*	*ROE*	Cash flow	Dividend yield	Asset growth	Rev. growth	*TFP*	Tech. eff.
Invest. prot.	0.27***	0.10***	-0.25***	-0.26***	-0.4***	-0.31***	-0.08***	0.01	0.05***	-0.20***
Gov. codes	0.19***	0.07***	-0.18***	-0.20***	-0.3***	-0.27***	-0.06***	0.00	0.08***	-0.15***
Rev. *ADRI*	0.00	0.03**	0.03***	0.03**	0.02*	-0.15***	0.04***	0.01	0.06***	-0.03*

	Own conc.	Board size	Board indep.	Leverage	Sales	Sales growth	Std. dev. *ROE*	Invest. prot.	Gov. codes
Invest. prot.	-0.44***	-0.1***	0.19***	-0.01	-0.1***	-0.02	0.19***		
Gov. codes	-0.31***	-0.2***	-0.01	0.00	-0.1***	-0.02	0.16***	0.73***	
Rev. *ADRI*	-0.05***	0.02***	-0.30***	-0.01	0.00	0.01	-0.02	0.14***	0.50***

***|**|* = significant at 1%|5%|10% levels.

The linear model from equation (4.6.4) has been extended by adding a right hand side parameter which alternatively takes the value of; number of governance codes, investor protection index and anti-director rights index, legal origin and extended legal origin. Only the first three measures are transformed with their natural logarithms. We also use only four of the initial ten dependent variables of Tobin's *Q*, *ROA*, dividend yield and bias-corrected technical efficiency. The model is given in equation (4.9.1).

$$\begin{aligned} D(Q,ROA,DIV,TE)_{it} &= \beta_0 + \beta_1 LOG\_OWNERSHIP\_CONCENTRATION_i + \beta_2 LOG\_ \\ & BOARD\_SIZE_i + \beta_3 BOARD\_INDEPENDENCE_i + \beta_4 CEO\_CHAIR\_SEPARATION_i + \\ & \sum_{h=1}^{h=6} \beta_h OWNERSHIP\_IDENTITY_{hi} + \beta_6 LOG\_SALES_{it} + \beta_7 SALES\_GROWTH_{it} + \\ & \beta_8 LOG\_STANDARD\_DEVIATION\_4\_YEAR\_ROE_{it} + \beta_9 LOG\_LEVERAGE_{it} + \\ & \beta_{10}[(LOG\_No.\_OF\_GOVERNANCE\_CODES, INVESTOR\_PROTECTION\_INDEX, \\ & REVISED\_ANTI\_DIRECTOR\_RIGHTS\_INDEX), LEGAL\_ORIGIN, EXTENDED\_ \\ & LEGAL\_ORIGIN]_i + \sum_{j=1}^{j=17} \beta_j INDUSTRY_{ji} + \sum_{k=1}^{k=17} \beta_k COUNTRY_{ki} + \psi_t + \eta_i + \varepsilon_{it} \end{aligned} \tag{4.9.1}$$

We start with valuation (Tobin's *Q*) as the dependent variable and alternatively insert the investor protection proxies together with the governance variables and the controls. We report the results in table 28. It can be seen that the coefficients and their standard errors of the other predictor variables are the same in all the legal origin specifications. Ownership concentration as expected from our initial analyses is significantly negative with valuation. Board size is not related as expected as there is evidence of a concave relationship with valuation. Board independence is positively associated with firm value while separation of *CEO* and board chairman duties does not contribute significantly to valuation.

Table 28: Investor protection, corporate governance and valuation

Variables	Revised *ADRI*	Legal origin	Ext. legal origin	Gov. codes	Investor prot. Index
Log Tobin's *Q*	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Log shares	-0.063***(0.02)	-0.063***(0.021)	-0.063***(0.021)	-0.063***(0.021)	-0.063***(0.021)
Log board size	0.080 (0.054)	0.080 (0.054)	0.080 (0.054)	0.080 (0.054)	0.080 (0.054)
Board independence	0.124** (0.062)	0.124** (0.062)	0.124** (0.062)	0.124** (0.062)	0.124** (0.062)
CEO-chairman separation	-0.025 (0.030)	-0.025 (0.030)	-0.025 (0.030)	-0.025 (0.030)	-0.025 (0.030)
Individual/ family	0.166** (0.068)	0.166** (0.068)	0.166** (0.068)	0.166** (0.068)	0.166** (0.068)
Financials	0.182***(0.065)	0.182***(0.065)	0.182***(0.065)	0.182***(0.065)	0.182***(0.065)
Public	0.132 (0.096)	0.132 (0.096)	0.132 (0.096)	0.132 (0.096)	0.132 (0.096)
Industrial company	0.142** (0.064)	0.142** (0.064)	0.142** (0.064)	0.142** (0.064)	0.142** (0.064)
State	-0.007 (0.141)	-0.007 (0.141)	-0.007 (0.141)	-0.007 (0.141)	-0.007 (0.141)
Log rev. *ADRI*	-0.817***(0.19)				
Common law origin		0.038 (0.144)			
English			-0.761***(0.151)		
French			-0.618***(0.167)		
German			-0.748***(0.171)		
Log nº. gov. codes				-0.007 (0.047)	
Log inv. Prot. Index					-0.572***(0.131)
Log sales	0.043***(0.009)	0.043***(0.009)	0.043***(0.009)	0.043***(0.009)	0.043***(0.009)
Sales growth	0.050***(0.013)	0.050***(0.013)	0.050** (0.013)	0.050***(0.013)	0.050***(0.013)
Log std. dev. *ROE*	0.041***(0.012)	0.041***(0.012)	0.041***(0.012)	0.041***(0.012)	0.041***(0.012)
Log leverage	-0.087***(0.01)	-0.087***(0.015)	-0.087***(0.015)	-0.087***(0.015)	-0.087***(0.015)
Constant		-0.748***(0.171)		-0.741***(0.201)	
Rho	0.559	0.559	0.559	0.559	0.559
R^2	0.242***	0.242***	0.242***	0.242***	0.242***
Wald chi^2	2075***	605.5***	2075***	605.5***	2075***
N (panel for 3 years)			1870		

For the legal origin model (Common vs. Civil), Common law origin is negatively significant when country controls are excluded. ***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation.

All ownership categories with the exception of the State (negative but insignificant) contribute positively to firm value with financial companies exerting the most influence followed by individuals/families and then industrial companies. Public companies exert the least positive influence. Leverage as expected is significantly negative while firm size (sales) is positive and significant. Opportunities for growth and firm risk all contribute positively to valuation.

We will now comment on the measures of investor protection. All measures either have no effect or negatively affect valuation. In terms of common origin, the effect is positive but not significant at 10% while the extended origins of English, French and Scandinavian show varying levels of negative effects on value. The number of governance codes does not seem to exert a global influence but investor protection index and the revised anti-director rights index reduce firm value with the latter's effect more pronounced.

This foregoing observation is in contradiction to the results reported by La Porta et al. (2002) so we will use their specification to check this issue after we see the effect of the investor protection proxies on our other measures of firm performance. We use the investor protection index in the *ROA* and technical efficiency regressions and the number of governance codes in the dividend yield regression. The results are given in table 29. Ownership concentration is positively related to *ROA*, dividend yield and technical efficiency. Board size, board independence and *CEO*-board chairman separation are negatively related to *ROA* and technical efficiency but unrelated with dividend yield.

All ownership categories are positively related to dividend yield but State ownership is not related to *ROA*. Ownership identity has no global effect on technical efficiency (as in the other linear model without a proxy for investor protection). Individuals/families contribute to both *ROA* and dividend yield more than financial, public and industrial companies. Financials in turn outperform public and all three perform better than industrial companies. Leverage, sales growth and firm risk contribute negatively while the size of a firm has a positive impact on all three measures of performance. These are all supportive of our other findings.

Table 29: Corporate governance, investor protection and performance

Variables	*ROA*	Log dividends	Bias-corrected technical efficiency
	Coefficient (heteroskedastic panel-corrected standard error)	Coefficient (heteroskedastic panel-corrected standard error)	Coefficient (bootstrap standard error)
Log largest direct shares	1.396** (0.661)	0.249***(0.064)	0.023***(0.008)
Log board size	-9.825***(1.605)	0.266 (0.178)	-0.080***(0.020)
Board independence	-5.537***(2.105)	0.101 (0.217)	-0.086***(0.028)
CEO-chair separation	-1.405* (0.887)	-0.007 (0.110)	-0.024***(0.010)
Individual/ family	8.007***(1.886)	0.673***(0.187)	0.025 (0.027)
Financials	4.854***(1.780)	0.582***(0.168)	0.006 (0.027)
Public	4.687* (2.773)	0.442** (0.222)	-0.013 (0.037)
Industrial company	3.529** (1.781)	0.377** (0.166)	-0.028 (0.030)
State	-0.533 (3.945)	0.627** (0.306)	0.033 (0.052)
Log investor protection index	-26.04***(3.522)		0.055 (0.040)
Log nº. governance codes		-0.903***(0.133)	
Log sales	5.039***(0.323)	0.179***(0.033)	0.040***(0.004)
Sales growth	-1.221***(0.466)	-0.380 (0.242)	-0.024* (0.013)
Log std. dev. *ROE*	-2.125***(0.393)	-0.031 (0.034)	-0.013***(0.005)
Log leverage	-3.60***(0.44)	-0.112** (0.055)	-0.015***(0.006)
Constant		-2.522***(0.671)	0.421***(0.112)
Rho	0.509	0.692	
Sigma			0.127***(0.004)
Log likelihood			785.982
R^2	0.330***	0.550***	
Wald chi^2	1073***	768.7***	1100.7***
N (panel for 3 years)	1932	758	1049

***|**|* = significant at 1%|5%|10% levels. Standard errors of models are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation. 500 replications are used for bootstrapping standard errors of bias-corrected technical efficiency. Year dummies in the bootstrapped regression are not individually or jointly significant.The three dependent variables in addition to market valuation are selected from the remaining nine to explain the investor protection, governance and performance relationships.

Our results on the relationship between investor protection and firm valuation do not support the findings from La Porta et al, (2002) so we adapt their specification to compare our earlier findings. The incentive effects of the investor protection proxies are very small in their study and significant at 5% or more levels. In table 30, we report our findings. We have four models (1 to 4) indicating a common legal origin (model 1) or its interaction with cash flow ownership (model 2). Model 3 is with the anti-director rights index and model 4 is its interaction with cash flow ownership (largest direct shareholder).

The only control variable is sales growth. In models 5 to 8, we add industry controls to models 1 to 4. We observe that common law origin in models 1 and 5 have statistically positive effects on valuation while the revised anti-director rights index (in their study, they used the original anti-director rights index) in models 3 and 7 are significantly negative and insignificantly positive respectively supporting our initial results. The interactions between legal origin and ownership in models 2 and 6 are insignificant.

Table 30: Investor protection, ownership concentration and firm valuation

Variables	1	2	3	4
Log Tobin's *Q*	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Common law origin	0.270*** (0.018)	0.142** (0.058)		
ADRI§			-0.033*** (0.012)	0.032 (0.029)
Log largest direct shares		-0.106*** (0.018)		-0.285*** (0.063)
Sales growth	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Ownership*legal origin		-0.012 (0.031)		
Ownership*ADRI§				0.038** (0.019)
Constant	0.281*** (0.011)	0.163*** (0.021)	0.552*** (0.041)	0.061 (0.097)
Rho	0.568	0.597	0.586	0.599
R^2	0.117***	0.129***	0.072***	0.119***
Wald chi^2	256.31***	271.6***	27.24***	212.7***
N (panel for 3 years)	3946	2990	3946	2990
Industry adjusted regressions of specifications 1 to 4				
	5	6	7	8
Common law origin	0.079*** (0.021)	-0.034 (0.056)		
ADRI§			0.012 (0.011)	-0.005 (0.027)
Log largest direct shares		-0.095*** (0.016)		-0.082 (0.058)
Sales growth	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Ownership*legal origin		-0.004 (0.029)		
Ownership*ADRI§				-0.003 (0.017)
Constant	0.285*** (0.051)	0.197*** (0.051)	0.247*** (0.061)	0.215** (0.102)
Rho	0.559	0.580	0.553	0.581
R^2	0.178***	0.197***	0.176***	0.196***
Wald chi^2	712.94***	655.30***	725.82***	645.44***
N (panel for 3 years)	3946	2990	3946	2990

Signs of coefficients are the same when the continuous variables are not log-transformed. The regressions are Prais-Winsten transformations with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation (common *AR1*). ***|**|* = significant at 1%|5%|10% levels. § = Revised anti-director rights index (*ADRI*). Heteroskedastic panels-corrected standard errors models are in parentheses. Coefficients of industry dummies are not reported. The models are selected based on that used in La Porta et al.'s (2002) "investor protection and corporate valuation".

The interaction between anti-director rights index and ownership in model 4 is positive and significant at 5% while that in model 8 (with industry control) is negative and insignificant. These interactions are also insignificant in La Porta et al.'s (2002) study. In the study done by La Porta and colleagues, ownership concentration (measured with cash flow ownership at 10% or more) is positive with firm value in all their random effects regressions while we have reported a negative relationship in all aspects of our studies so far, except with a Common law origin proxy. We also report negative relationships with cash flow ownership in models 2, 4, 6 and 8 where they have been interacted with investor protection proxies.

We now extend the La Porta et al.'s (2002) model to factor in our investor protection proxy of number of corporate governance codes in table 31. In models 1 and 2 where there is no control for industry, the number of governance codes is positively related to valuation. The inclusion of ownership reduces the strength of this relationship. Models 3 and 4 adjust with industry dummies. Once we control for industry with the inclusion of dummies, the relationship becomes negative and insignificant. Inclusion of ownership when industry is controlled makes the number of governance codes significantly negative with firm valuation which supports our initial prediction.

Table 31: Number of corporate governance codes, ownership concentration and firm valuation

	1	2	3	4
Variables	Basic		Industry- adjusted	
Log Tobin's Q	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Log number of corporate governance codes	0.115*** (0.012)	0.058*** (0.015)	-0.001 (0.013)	-0.036** (0.015)
Log largest direct shares		-0.149*** (0.013)		-0.096*** (0.013)
Sales growth	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Constant	0.198*** (0.025)	0.066** (0.029)	0.287*** (0.054)	0.246*** (0.054)
Rho	0.576	0.590	0.554	0.581
R^2	0.087***	0.120***	0.175***	0.198***
Wald chi^2	108.66***	234.37***	714.03***	658.75***
N (panel for 3 years)	3946	2990	3946	2990

Prais-Winsten transformations with heteroskedastic panels-corrected standard errors and correction for first-order autocorrelation (common $AR1$). ***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors models in parentheses. Coefficients of industry dummies are not reported. The models are selected based on that used in La Porta et al.s' (2002) "investor protection and corporate valuation".

Summary on investor protection

Durnev and Kim (2005), La Porta et al. (2000, 2002 & 2006), Lins (2003), Doidge et al. (2004a & 2004b), Klapper and Love (2004) and Djankov et al. (2008) have argued that countries with good investor protection have more firm value and need lesser good corporate governance practices. Good governance is required when the country does not have laws protecting investors, and hence investor protection has a positive effect on valuation. When we add a proxy for investor protection in our governance-valuation model, we find a negative effect of investor protection on valuation except where legal origin is the proxy in which case a positive but insignificant result obtains.

The number of governance codes returns a negative but insignificant effect on valuation while the extended legal origin (English, French, German and Scandinavian), revised anti-director rights index, and investor protection index are all significantly negative. When we use *ROA* as the dependent variable, investor protection index is still significantly negative. For bias-corrected *VRS* technical efficiency, the index is positive but not significant at conventionally accepted levels. Using the number of governance codes by a country returns a significantly negative relationship with dividend yield; this is in line with our prediction – *H7*.

We then follow La Porta et al.'s (2002) specification. Common law origin returns a significantly positive relationship with valuation (and is significant even after controlling for the type of industry) while revised anti-director rights index still returns a negative association with valuation. This result becomes positive but insignificant when controlled for industry. We have also regressed the number of governance codes and sales growth/ ownership concentration on valuation. The number of governance codes is positive with valuation but this changes to negative when industry is controlled for; supporting our initial observation of a negative relationship between valuation and investor protection. Of course, we have argued in the literature build-up that increased investor protection by firms enhance valuation in countries with existing low investor protection, usually in developing countries. It is however clear that using the legal origin as a proxy for investor protection reveals a positive effect on valuation.

4.10 Chapter summary

In this chapter we have first carried out non-parametric analyses of technical efficiency, technical change and productivity change at the industry and country levels for a sample of sixteen *OECD* countries. In general, we have seen in applying the method prescribed by Simar and Wilson (2007) that differences in efficiency and productivity levels across countries and legal origins are not statistically significant with the exception of Ireland. The use of bootstrapped techniques have enabled us make some statistical generalisations which have hitherto been absent from earlier studies of efficiency and productivity.

We then introduce the results as inputs into our second parametric study where we have analysed the relationship between corporate governance and ten measures of performance in a sample involving seventeen countries. The study has revealed that depending on the measure of performance, ownership and board characteristics have different impacts. The global analysis has been broken down to country level for linear, quadratic and piecewise linear regressions. We have analysed how to control for endogeneity, panel heteroskedasticity, contemporaneous and serial correlations. We have finalised the analyses by investigating the role of investor protection.

In the relationship between governance and performance, we have seen that depending on the performance measure used, different results have been reported in the linear, quadratic and piecewise specifications. The discussion has also revealed a few differences in the ownership-value relationship when the analysis is done at the country level. Not all (but most of the) countries have exhibited the negative or convex relationship observed at the global level due to institutional differences. Board size has a concave relationship with firm value whereas its relationship with some other measures (like profitability, technical efficiency, asset growth and turnover growth) has mostly been negative.

The relationship between firm value and ownership concentration at the country's manufacturing industry level as discussed above implies that the results pertaining to one industry (country) cannot be loosely generalised as what prevails in other industries (countries), even with countries that have the same legal origin. What we have seen is that not all countries exhibit the non-linear relationship in the global specification after controlling for industries. The relationship between ownership and value must be an individual firm's response to several competitive, financial, institutional and environmental characteristics.

The authors who agree to this argument as well as those who believe that the relationship is at best spurious have a point. The use of different control variables (measuring the same characteristics for example firm size) can lead to different results. We have found contradictory evidence of the effect of investor protection on valuation, even after adapting La Porta et al.'s (2002) methodology. Spamann (2006) has already faulted the inconsistent coding of the anti-director rights index and we have been unable to confirm the positive impact of investor protection on valuation. We have to agree with Bøhren and Ødegaard that the framework for looking at the relationship between ownership, and for that matter governance, and performance is still under-developed and that a substantive theoretical governance framework needs to be developed.

5. SUMMARY OF THE THESIS AND CONCLUSIONS

In the final chapter to this study we will consider its significance to academia and policy makers. A summary of the study is made followed by our main findings within our limitations. Directions for future research are also laid down.

5.1 Significance of the study

The editorial by William Judge in the September 2008 issue (volume 16, issue 5) of *Corporate Governance: An International Review* reiterates our observation in a title: *What is the Dependent Variable in Corporate Governance Research*? This study has made the differences in the governance and performance relationship more obvious. Measures of profitability, valuation, dividend yield, cash flow, growth and efficiency have given us insights that performance is not a monolithic yardstick that can be interchanged. In other words, the comparisons beleaguering literature review that corporate ownership has a positive relationship with performance is not entirely genuine. It is not uncommon, even in the literature review to this study, to see that a study using return on assets (*ROA*) as a profitability proxy compares its finding with another study that uses return on equity (*ROE*).

This even extends to researchers comparing the relationship of governance to valuation measures with other measures such as profitability or dividend yield. *ROA* and *ROE* have a very high and significantly positive correlation (0.92 in this study) but the analysis has revealed that they give different results when used as performance proxies of governance effects. Valuation on the other hand has negative correlations with measures of cash flow, dividend yield, efficiency and profitability (*ROA* and *ROE*). It is therefore only useful to compare the same measures for example *ROE* vs. *ROE*, *MBV* vs. *MBV*, etc. The choice of a performance measure is an important key to verifying an existing relationship. Our use of bias-corrected technical efficiency as a performance measure has supported most of the governance – performance hypotheses we have developed.

This brings us to another significant contribution. The negative relationship of board size with valuation is not monotonic as envisaged in earlier studies. We find a concave relationship indicating board size increases valuation until a maximum threshold and then devaluation sets in. On the other hand, we find a statistically insignificant support that the global relationship between valuation and ownership concentration is non-linear. We report a convex relationship meaning that increasing ownership decreases valuation until a minimum threshold after which we observe a positive, but statistically insignificant, relationship between ownership and valuation. What this means is that ownership needs to be very highly concentrated in the hands of an outsider for any meaningful impact on valuation otherwise dispersed ownership is preferred, whereas this is not the case for technical efficiency, dividend yield or profitability.

We recall that our data is from seventeen countries with different institutional settings. Antagonists will argue that this analysis is like comparing apples with oranges because of differences between the Anglo-Saxon and continental governance settings. We have made efforts to control for this. Proponents and protagonists will however argue that there are more similarities in corporate governance codes than are differences; and that the codes developed in continental Europe borrow extensively from the Anglo-Saxon codes. This is supported by the fact that most large publicly listed firms are international and trade on multiple stock exchanges irrespective of legal origins or governance models.

We therefore contribute to policy by reiterating that in terms of firm valuation, dispersed or concentrated ownership both matter for governance and is dependent on a firm's peculiarities, contracting and competitive environment. The recent stock market crashes across the globe has not spared firms with highly concentrated shareholdings. If anything at all, they have been the bigger losers. Our linear regressions point out that, disregarding statistically insignificant non-linearities, ownership has a global negative effect on valuation. This effect is however not replicative in a few countries such as Ireland, Italy, Norway and Portugal. The institutional environment therefore needs to be considered in matters concerning governance.

The relationship of governance and performance is very sensitive to the choice of control variables. Instead of researchers looking for the best choice of existing control variables to verify a relationship, it makes sense to use other measures of the control variables to examine the relationship rather than only focusing on using sophisticated research techniques in the spirit of controlling for unobservable heterogeneity, endogeneity (omitted variables bias, simultaneity bias and measurement errors), cross-sectional and panel heteroskedasticity, autocorrelation and contemporaneous correlation. Bøhren and Ødegaard (2004) have argued that endogeneity tests do not indicate significant relationships and that the theory relating governance to performance may be underdeveloped. In their opinion, using a broader set of mechanisms is not necessary for capturing the effect of a single mechanism. Agarwal and Knoeber (1996) however argue for interdependence as analysis of single mechanisms can lead to misleading inferences. The choice of a performance measure is what matters most like using Tobin's Q, book return on assets (*ROA*) and market return on equity (*ROE*).

The use of bootstrap techniques in deriving technical efficiency and total factor productivity is useful to make statistical generalisations hitherto absent in studies involving corporate governance, efficiency and productivity. This study has apparently shown that an industry whose arithmetic mean score indicates technical regress or progress does not always reflect the situation of the majority of firms. The confidence intervals of the individual firms' scores can help to make better inferences.

We have achieved results using several measures of investor protection which require a second look at the relationship between investor protection and valuation. Different legal frameworks reveal differences in the effect of corporate governance on performance. Whereas La Porta et al. (2002) report a positive effect of investor protection on valuation (albeit weak), we observe a positive relationship; which is weakened and becomes negative when we control for industry and country differences with the variables (or proxies) that these same authors used as well as other proxies. Our result is not surprising as shareholders become agitated when there is lowered firm valuation and as such look out for good corporate governance practices. Lowly valued firms are forced to improve their governance practices than highly-valued firms. The coding of the investor protection indices has also come under harsh criticism (for example Spamann, 2006).

Our sample only consists of 17 *OECD* developed economies whereas La Porta et al.'s (2002) study is made up of developing, emerging and developed economies. The usefulness of protecting investors to increase firm value is more relevant in developing and emerging economies. If we follow Scott and Meyer (1991) and Oliver (1997b) about their conceptualisation of technical and institutional environments, then our results differ from La Porta and his colleagues because we only employ data from the manufacturing industry; which is a technical environment with less considerations for institutional protection of investors. This is probably why most of our hypotheses are supported when technical efficiency is the performance variable.

These significant contributions to the study of the corporate governance and performance field are further summarised in the next section.

5.2 Summary of the thesis

This thesis has been made in eight major steps. The first step is a global overview about corporate governance and the development of governance codes and indices. In the second step, we limit the discussion on governance to ownership, board characteristics, financial policy and investor protection where we provide a comprehensive literature review. The third step is with measures of performance where we consider and then analyse the influence of our selected governance variables on ten measures. We discuss into detail two of the measures, which are technical efficiency and total factor productivity.

In the fourth step, we provide conceptualisations of our research questions based on the literature review. In the fifth step, we consider univariate analyses of our ownership and board measures comparing our results to previous studies. This then extends to bivariate analyses in terms of correlations and simple regressions of the continuous variables and analysis of variance with our categorical variables against the dependent measures. We then consider a cross-sectional multivariate regression analysis of three individual years after which we pool the data for analysis. After considerations of endogeneity, we delve into cross-sectional time series analysis that corrects for panel heteroskedasticity and first order autocorrelation. As these analyses have been carried out assuming a monotonic linear relationship, in the sixth step, we start looking for evidence of non-linearities by quadratic and piecewise linear (non-monotonic) specifications.

Up until now, we have been analysing 17 countries together controlling for countries with categorical variables. The seventh step is to break down the relationship to country level and present our findings. In the eighth and final step, we analyse and discuss the effect of investor protection on valuation, profitability, dividend yield and technical efficiency together with our other governance variables. The detailed summary follows.

Developments in corporate governance

Corporate scandals of immense financial losses and consequent scanty retributions (cases in point: the ex-*CEO* of the Royal Bank of Scotland's [Fred Goodwin] annual pension he is entitled, after recording substantial banking losses in the *UK*, and the resulting hullabaloo, and; financial losses to several Irish banking firms) have incited governmental instruments across the globe to orchestrate codes of good business practices to protect investors from management and board of directors. These codes spell out the role and responsibilities of the board of directors and other internal control mechanisms to complement commercial codes and corporate laws. As yet, most of these country codes are of a voluntary "comply or explain" nature with mandatory disclosure. The New York and London stock exchanges target full compliance to their codes. In order to be able to globally compare firms in different countries along the lines of good corporate governance, several corporate governance indices have been constructed based on governance codes and other practices thought to improve firm performance.

There has been a strong support that firms with good governance mechanisms have easier access to external finance, better market valuation and superior performance (Klapper and Love, 2004). Gompers et al. (2003) use 24 governance rules to construct a governance index to proxy for shareholder rights in about 1500 firms and report that higher shareholder rights relate to higher profits, sales growth, lower capital expenditures and fewer corporate acquisitions.

Investors and firms are using corporate governance reports to reduce risks and improve market value of firms. Weak governance in a firm does affect the value of shares but firms still continue to survive. *FTSE ISS CGI* Series Research Report for April 2005 argues that "it is more the risk that poor corporate governance becomes pervasive throughout the firm, and it is this fact that leads ultimately to poor share price performance." The research report continues in adding other governance mechanisms that research indicate links with firm performance as: compensation systems for executive and non-executive directors; executive and non-executive stock ownership; equity structure; structure and independence of the board of directors, and; independence and integrity of the audit process. The structure and independence of the board, non-executive stock ownership and the structure of equity have been considered in our analysis. We now summarise our discussions from the literature.

Internal mechanisms of governance and investor protection

We have provided descriptive statistics of our components of corporate governance and compared the results with previous studies. The largest outside shareholder that has controlling shares has been argued to improve firm performance and that this shareholder's identity further differentiates the enhanced performance. Although our literature review suggests this development for several of our studies, other studies find a reduction in firm value as confirmed by our study. Others find no significant effects of shareholding concentration or type on valuation, profitability or growth. Board characteristics such as size and composition have also been argued to affect firm performance.

The separation of duties of the *CEO* and board chairman has generated the most mixed results. Some studies have argued for duality, others for separation and many others report that it does not really matter. Our own results seem to agree that whether the *CEO* is the chairman or not does not matter and that what matters is the size and composition of the board together with whether shares are much dispersed or highly concentrated (convexity). In our analysis of the positive influence of board outsiders on performance, only market valuation satisfies this relationship. The effect on other performance variables is either insignificant or a negative relationship. For example board outiders have a negative effect on firm technical efficiency; a reason attributable to their disadvantaged position as to the knowledge of the firm's production possibility set.

Financial policy by way of the debt to equity ratio (leverage) is also seen to affect performance but depends on the investment opportunity set. In low-growth firms, leverage has been found to have a positive effect on performance while in high-growth firms, there is a negative effect. We find a negative effect in our study having controlled for growth opportunities as most of our firms are in high-growth manufacturing industries. Equity is therefore a preferred means of firm financing than debt in our sample firms in line with the pecking order hypothesis.

La Porta et al. (2002) argue that firm value increases with the degree of protection of investors using a coding that is argued by Spamann (2006) to be inconsistent in predicting market performance, invalid as a measure of investor protection and does not bring out differences in legal origins. Some studies have however supported La Porta et al.'s assertion. In countries with low investor protection, increased protection of investors by firms contribute to higher valuation (i.e. in developing countries) more than when a country already has good investor protection laws (as in the developed countries in our study).

We find that in general, for the developed economies, investor protection has a negative impact on value in our robust specifications considering our data set from the manufacturing industry. Investor protection increases firm value when the existing protection is low. Our observation has also been that the number of governance codes that have been developed by a country correlates positively with the anti-director rights index and investor protection index developed by Djankov et al. (2008).

When we use it to proxy as a measure of investor protection in La Porta et al.'s model, we obtain a negative impact on valuation and other measures in line with our prediction.

Measures of performance

Several measures of firm performance have been used to investigate the impact of corporate governance. We have done an extensive review of these and have used ten such measures capturing: market valuation (Tobin's *Q* and *MBV*); profitability (*ROA* and *ROE*); technical efficiency (and its bias corrected measure in a *VRS* technology); cash flow; dividend yield; growth (asset growth, operating turnover/ revenue growth and total factor productivity growth). In our preliminary analysis, we also use earnings per share as a performance measure. Generally, both *MBV* and Tobin's *Q* have given similar relationships albeit with varying strengths; since we use book rather than replacement values. The measures of profitability have not always given similar relationships. Dividend yield as a measure has provided more consistent relationships with corporate governance than cash flow. Technical efficiency for instance is positively influenced by ownership concentration and firm size. It generally satisfies most of our hypothesised relationships. The measures of growth (especially *TFP*) have not generally supported our hypothesised relationships.

We now summarise the analysis of technical efficiency and productivity growth (and technical change) from our investigation below.

Technical efficiency, technical change and total factor productivity

There have only been a few studies on corporate governance that have used technical efficiency and productivity as measures of performance. As market valuation is based in part on speculation, the use of productivity measures, more ideally, captures any effects in governance. We have used data envelopment analysis to compute our levels of efficiency and productivity following the bootstrap data generation process recommended by Simar and Wilson (2007). We investigate technical efficiency, technical change and total factor productivity in the industries and countries covered in our study before analysing corporate governance impacts on efficiency and productivity (using a second bootstrap truncated regression).

Industrial machinery manufacturing industry is the most efficient at 84% whereas pharmaceutical and medicine manufacturing industry is the least efficient at only 55%. The semiconductor and other electronic component industry is the second most efficient at 71% and the difference from the industry occupying the first position is statistically significant at 5%. Navigational, measuring, medical and control manufacturing industry places third at 68% but this score is not statistically different from that occupying the second position. Communications equipment manufacturing takes the penultimate position at 64% but this is not statistically different to that taking the third or second positions. Therefore industrial machinery manufacturing is statistically the most technically efficient industry and the pharmaceutical and medicine manufacturing industry is statistically the least technically efficient of the five industries.

In terms of country efficiency, Ireland is, statistically speaking, the least technically efficient country in the sixteen countries analysed. Austria, Germany, Greece, Finland, Italy, Norway and Switzerland are the most technically efficient countries in the sample of manufacturing industries that is analysed. The *UK*, Spain, and the *USA* together with bottom-placed Ireland are the least technically efficient countries for the six years (2000-2005). Between these two categories are placed Belgium, Denmark, France, Netherlands and Sweden. Ireland is the only country whose technical inefficiency is statistically different from all the other fifteen countries. In terms of legal origin, German followed closely by French and Scandinavian are more technically efficient than English legal origin countries but neither origin has a statistically different mean (at 5% significance) from the others.

In terms of technical change during a five-year period (2000-2005), three of our five industries experience 4% and 7% technical progress: communications equipment manufacturing (7%); industrial machinery manufacturing (4%), and; semiconductor and other electronic component manufacturing (7%). The remaining two at first glance experience remarkable technical regress: navigational, measuring, medical, and control instruments manufacturing (7%), and; pharmaceutical and medicine manufacturing (12%). We therefore consider the firms individually to see which record technical progress, no technical change or technical regress.

In the first industry with arithmetic mean 7% technical regress, 79% of the firms experience no statistically significant technical changes while the remaining 21% do. Since only a fifth of the firms in this industry record significant technical regress, we infer that the majority of firms experience no technical change during the period. In the second case with arithmetic mean 12% technical regress, 97% of the firms record no technical change leading us to generalise there is no significant technical change in this industry. When we consider technical change by country, none of the sixteen countries record a statistically significant technical change. The same observation applies with technical change in terms of legal origin.

In terms of total factor productivity, all the five industries experience statistically significant growths of between 1% and 8% for the five-year period. The industrial machinery manufacturing industry records the least growth of 1%, followed by communications equipment manufacturing at 2%. The navigational, measuring, medical, and control instruments manufacturing industry places third with a 3% growth and the second position is taken by semiconductor and other electronic component manufacturing industry at 5%. The pharmaceutical and medicine manufacturing industry experience the highest growth at 8% and we can recall that it is the least technically efficient industry. At country level, countries like Ireland, Netherlands, Spain, *UK* and *USA* show statistically significant positive growths. Austria, Norway and Sweden are the three countries that show a decrease in total factor productivity growth. Belgium, Denmark, Finland, France, Germany, Greece, Italy and Switzerland show no significant productivity changes.

The relationship between governance and performance

We examine the following governance measures: ownership concentration and identity; board size and composition: *CEO*-chairman separation, and financial policy. We then link these attributes to ten measures of valuation, profitability, technical efficiency, growth, dividend yield and cash flow. We employ simple bivariate techniques of correlation and linear *OLS* regressions in a cross-sectional analysis. We then perform individual multivariate regressions for our three years of data before pooling these in a single regression controlling for industry, country, firm size, opportunities for growth and firm risk.

Literature suggests that ownership concentration may be endogenous so we examine its relationship with firm value using two-stage least squares and generalised method of moments regressions with our pooled data. Pooling data, although useful in checking heterogeneity, introduces problems with serial correlation and panel heteroskedasticity. We therefore argue and use a cross-sectional time series Prais-Winsten model to examine our linear relationships. Ownership concentration and firm value have been argued to exhibit a non-linear relationship. Literature also suggests that there is a number beyond which board sizes decrease firm value. We examine these relationships for the whole sample and country subsamples.

We find some evidence of a quadratic relationship between board size and firm value (concave) and also between ownership concentration and firm value (convex). At conventional levels however, the quadratic relationship between ownership concentration and firm value is statistically insignificant in robust specifications controlling for size, risk, industry, country, growth opportunities, board characteristics and financial policy. We continue the investigation with piecewise specifications of ownership and board size and support our earlier findings with the quadratic specification. When we break down the analysis to country level, we observe that not all the countries exhibit similar relationships as in the global analysis; both in our linear and non-linear specifications even though we control for countries in the global estimations. We then extend our analysis to include investor protection using such measures as the investor protection index, anti-director rights index, legal origin, extended form of the legal origin and the number of corporate governance codes developed by a country.

5.3 Listing of the main conclusions

The conclusions with technical efficiency and total factor productivity have been given above. Although not exhaustive, we list the main conclusions of our univariate analyses followed by bivariate relationships between our ten measures of performance and ten independent measures of governance together with firm-level control variables.

- French and German legal origin firms have the highest concentration of ownership followed by Scandinavian firms. English legal origin firms have the lowest concentration of ownership.
- Shares owned by a public company is the highest among the largest direct shareholding categories followed very closely by that owned by industrial companies (but all less than 50%). Individuals/families and the State follow with less than 30% of total shares. The average largest direct shareholding owned by a financial company is less than 20%.
- On the average, a firm has a board size of seven members with 56% of the members being outsiders.
- On the average, 66% of firms have the duties of the *CEO* and chairman of the board of directors separated.
- On the average, the ratio of debt to equity for the firms is 2.2.
- Leverage has a positive relationship with ownership concentration.
- Growth opportunities has a negative relationship with ownership concentration.
- Size has a negative relationship with ownership concentration.

- Volatility has a negative relationship with ownership concentration.

Ownership concentration has:

- a negative relationship with Tobin's *Q* ratio in linear specifications and a convex relationship in a quadratic specification but the positive slope is not statistically significant.
- a negative relationship with market to book value (*MBV*).
- a statistically insignificant positive relationship with return on assets (*ROA*).
- no significant relationship with return on equity (*ROE*).
- a statistically insignificant positive relationship with cash flow.
- a positive relationship with dividend yield.
- no significant relationship with asset growth.
- a positive relationship with operating revenue/ turnover growth.
- no significant relationship with productivity growth
- a positive relationship with technical efficiency

Ownership identity

- Individuals/families followed by financial firms then industrial companies and public companies (in this order) all have positive effects on Tobin's *Q* although the effect of public companies is not statistically significant (more so, because a public firm may have dispersed ownership). The State has an insignificantly negative effect on Tobin's *Q*.
- Public companies followed by financial companies then individuals/families and industrial companies (in this order) all have positive effects on *MBV*. The State has an insignificantly negative effect on *MBV*.
- The State has a negative effect on *ROA* but all other ownership types have no significant effects.
- Individuals/families have a positive effect on *ROE* and the State has a negative effect. The other categories have no significant effect on *ROE*.
- All ownership categories have a negative effect on cash flow. The State has the most marked effect followed by financial firms, industrial companies and then individuals/families. Public firms have an effect only surpassed by the State but this is not significant.

- Individuals/families, public companies, financial companies and industrial companies all have positive effects on dividend yield (in this order) but the effect of industrial companies is insignificant. The State has an insignificant negative effect on dividend yield.
- The category of the largest shareholder has no significant effect on asset growth, operating revenue/turnover growth or total factor productivity growth.
- The category of the largest shareholder has no significant effect on technical efficiency.

Board size has:

- no significant effect on Tobin's *Q* in linear specifications but it has a concave relationship in quadratic specifications.
- no significant effect on *MBV* in linear specifications but it has a concave relationship in quadratic specifications.
- a negative effect on *ROA*.
- a negative effect on *ROE* but this is not statistically significant.
- a negative effect on cash flow but this is not statistically significant.
- no significant effect on dividend yield.
- negative effects on both operating revenue/ turnover growth and asset growth.
- no significant effect on year-to-year productivity growth.
- a negative effect on technical efficiency.

Board independence has:

- positive effects on both Tobin's *Q* and *MBV*.
- no significant effects on both *ROA* and *ROE*.
- no significant effect on cash flow.
- a negative effect on dividend yield.
- negative effects on both asset growth and operating revenue/turnover growth.
- no effect on year-to-year total factor productivity growth.
- a negative effect on technical efficiency.

CEO-board chairman separation has:

- insignificant negative effects on both Tobin's *Q* and *MBV*.
- insignificant negative effects on both *ROA* and *ROE*.

- an insignificant negative effect on cash flow but a significant negative effect on dividend yield.
- a negative effect on operating revenue/turnover growth but an insignificant positive effect on asset growth.
- an insignificant positive effect on productivity growth.
- a negative effect on technical efficiency.

Leverage (financial policy) has:

- a negative effect on Tobin's *Q* and no significant effect on *MBV*.
- a negative effect on *ROA* but its negative effect on *ROE* is insignificant.
- insignificant negative effects on both cash flow and dividend yield.
- a negative effect on operating revenue/turnover growth and an insignificant positive effect on asset growth.
- a positive effect on total factor productivity growth.
- a negative effect on technical efficiency.

Investor protection

- Firms in common law countries have higher valuation than firms in civil law countries.
- The basic positive relationship between investor protection and valuation becomes negative in more robust specifications.
- Investor protection has a negative relationship with both *ROA* and dividend yield.
- Investor protection has a positive but statistically insignificant impact on technical efficiency.
- The number of governance codes developed by a country has an insignificant negative effect on market valuation and a negative effect on dividend yield partially supporting our predicted relationship.

Firm size has:

- a positive association with both Tobin's *Q* and *MBV*.
- a positive association with both *ROA* and *ROE*.
- a positive relationship with both cash flow and dividend yield.
- a positive relationship with both operating revenue/ turnover growth and asset growth.

- a negative relationship with productivity growth.
- a positive relationship with technical efficiency.

Firm volatility (proxying for risk) has:

- a positive association with Tobin's *Q*. The positive association with *MBV* is not significant at conventional levels.
- negative associations with both *ROA* and *ROE*.
- a negative relationship with cash flow but no relationship with dividend yield.
- negative relationships with both operating revenue/ turnover growth and asset growth.
- a negative relationship with productivity growth.
- a negative relationship with technical efficiency.

Growth opportunities has

- a positive effect on both Tobin's *Q* and *MBV*.
- an insignificant positive effect on both *ROA* and *ROE*.
- an insignificant negative effect on both cash flow and dividend yield.
- an insignificant positive effect on both operating revenue/turnover growth and asset growth.
- a negative effect on productivity growth.
- a negative effect on technical efficiency.

Support for the hypotheses

In table 32, we tabulate the results that accept, or otherwise, our hypotheses. We do not find support that separating the duties of the *CEO* and board chairman improves performance. Additionally, we do not support the positive relationship between investor protection and valuation. We find partial support that ownership has a convex relationship with valuation; and report for the linear specification, a negative relationship between ownership concentration and valuation but a positive relationship with technical efficiency.

We only report the quadratic specification between valuation and ownership concentration in the table below. Ownership concentration for example has positive associations with technical efficiency, dividend yield, profitability and accounting growth. There are differences in the effect of ownership categorisation on all measures of performance although in some instances these are not statistically significant. Firm size has an overwhelming positive effect on performance except for productivity growth where a negative relationship is observed. In general, leverage has a negative effect on the performance measures except again for productivity growth where a positive effect is observed. The effect of growth opportunities on firm performance is however mixed with positive, negative or no effect depending on the performance measure used.

Table 32: Comparing the results to the hypotheses

HYPOTHESES	DIRECTION OF HYPOTHESISED SIGN	SUPPORTED?
H1: The performance of a firm increases with increasing ownership levels.	+	Partial support. Not supported with market valuation.
H2: The identity of a shareholder impacts on firm performance	+ and -	Yes
H3: The size of the board of directors is negatively related to performance.	-	Yes (concave for valuation).
H4: Board independence increases firm performance.	+	Yes (only for market valuation).
H5: *CEO*-board chairman separation positively impacts on performance.	+	No
H6: High levels of debt to equity decreases firm performance.	-	Yes
H7: Firms in low-performing countries need to find the best governance codes to improve performance.	-	Yes (partial support).
H8: Investor protection is positively related to performance	+	Not supported. Weak support with technical efficiency.

5.4 Limitations of the study

One important limitation is that the countries in the sample are not proportionally distributed. This is because we only use listed firms. More firms in the *US* and *UK* are listed than in continental Europe and we mostly rely on data from the OSIRIS database. The lack of complete data on several of our variable measures also means that our sample size is markedly reduced in our pooled and panel data analyses, resorting to the partial approach method and lack of rich data espoused by Bøhren and Ødegaard (2004). We have assumed that data values for board and ownership variables remain unchanged in the three years of our study following the observations made by La Porta et al. (1999), Thomsen and Pedersen (2000) and Bauer et al. (2004). We have been limited to use alternative variable measures for some of our control variables because of missing data on some firms or lack thereof in the database and respective firms' websites. We have also excluded the very important variable of insider ownership due to its unavailability in the database or rather to the fact that only a few firms have insiders as the largest shareholders in the manufacturing sectors we have employed.

One variable that is useful in technical efficiency analysis and missing from our analyses is age. Powell (1991) has argued that investments in learning that take on a measure of irreversibility shape institutions and for that matter firms. Age is therefore an important variable in controlling for firm heterogeneity. We are however unable to use this important institutional variable due to less than half of the sample having available information; even after visiting all websites of firms that have missing data on this from the database. We admit that the use of a pooled bootstrapped truncated regression may not have completely purged out omitted variable-bias from our results. It is however acknowledged that age itself has given contradicting evidence of its effects on efficiency as the literature review has revealed.

Another important measure for firm risk is the firm's beta. The database only has current values of firms' betas and this is not useful for our study which relies on data from previous years; hence we substitute this with the standard deviation of return on equity which in effect is a volatility measure. We also use investor protection proxies which have been developed with far more countries than in our study and see this as a source of bias and thus our inability to support the corresponding hypothesis. Consequently, the country-average revised antidirector rights index may not be a reflection of a firm's true index. Spamann (2006) has also faulted the two measures of investor protection in La Porta et al. (1998) and Djankov et al. (2008) by arguing that the coding used is inconsistent and that it is not a valid measure of shareholder protection, unpredictive of stock market outcomes and has no significantly distributed differences between common and civil law countries.

We have used the same model specifications for the analyses of all our ten dependent variables that indicate performance proxies so as to be able to make comparisons. We are aware of the fact that other equally correct specifications but with different control variables for each performance measure could have been used. An important caution to make here is that the relationships we observe have been made with only a few sectors of the manufacturing industry and may not be the true reflection of the larger industrial economy.

Fixed effects specifications are recommended in panel data estimations. Although we have included firm fixed effects' specifications in most of our regression analyses, we have made minimal comments on these results (other than for comparison sake) owing to the fact that we have time-invariant variables and therefore achieve this by introducing dummy variables for every decision making units. This saps the related models of interpretative strengths. The STATA software we utilise drops time-invariant variables in its fixed effects panel specifications. We have therefore made our statistical generalisations from robust forms of random effects' specifications.

5.5 Future research directions

We have only conducted a partial investigative analysis of corporate governance and its impact on performance. Our literature review has elaborated several aspects considered in the development of a corporate governance index. Obviously, the size of the board alone without detailing out how their responsibilities are delegated or which committees are available does not clearly bring out a board's impact on performance. A very important cause for consideration is the criterion for who a board outsider should be. The literature review and our own contribution indicate that definitive work is needed in this direction so as to be able to compare firms in cross-country studies.

Firm performance is also affected by so many factors that are even beyond the scope of corporate governance. It is useful in the future to conduct an extensive study that involves several of these factors vital for firm performance. We argue that using the same measures of performance on the same sample of firms will bring out more clearly how governance affects multi-tasking performance. We have not tackled the possibilities of non-linearities in all our measures of performance as only non-linearities in the governance-valuation relationship has been the prime concern of that aspect to this study.

A composite measure that incorporates all the proxies of firm performance should be considered and tested. For example *DEA* can be used to estimate such inputs of accounting based measures and such outputs of market based measures to one particular performance measure like pertains in the derivation of corporate governance indices. This is a controversial yet promising avenue in the research into performance measures.

A casual observation has been that board changes in Ireland, the *UK* and the *US* are more frequent within a fiscal year than for other countries and it is interesting in the future to study if the common law origins play a part in this. Additionally, this is the first study, to our knowledge, that seeks to find a link between the number of corporate governance codes developed by a country and firms in that country's performance. Work in this direction is necessary to reveal if there is any relationship as we report that there is a negative relationship but this is not statistically significant in some of our proxies of performance. It is of interest to replicate this study still at a global level but with representative country subsamples and at the level of analysis of the country involving all industrial sectors of the economy.

In the light of corporate failures in recent times and the continued slow down of the global economy, it is prudent to question whether the corporate governance indices that have been developed, putting most Anglo-Saxon firms in a better light, do not need significant revisions that can be predictive of future stock market outcomes. The current global downturn of corporate entities and the heat that *CEO*s and board of directors have been taking is all the proof there is to it.

Most corporate governance studies have been analysed with the agency theoretical approach and to lesser extents, the institutional and stakeholder approaches. We recommend that more research needs to be carried out using the stakeholder approach. As we agree with previous researchers that the conceptual framework underpinning corporate governance analysis may be underdeveloped, we propose to follow the lead in an earlier paper we published in the field of entrepreneurship and regional development (Johannisson et al., 2007) where we use four different contrasting frameworks to “interstand” developments in industrial districts. The use of several theoretical frameworks on the same investigation and data can be the answer to some uninspiring studies that have been done in the study of the effect of corporate governance on performance.

The new book by Manzoni and Islam (2009) has given an embryonic lead in how to use a complete approach in examining the total field of corporate governance (from suppliers through production operations and management to the end users with links to other stakeholders) and multi-faceted/multi-dimensional performance by using *DEA* in an innovative way to integrate several non-traditional measures of performance. We welcome this approach whole-heartedly.

BIBLIOGRAPHY

- Aggarwal, R. & Kyaw, N. A. (2006). "Leverage, Investment Opportunities, and Firm Value: A Global Perspective on the Influence of Financial Development." 2006 *FMA Annual Meeting*, Salt Lake City, USA, October. http://www.fma.org/SLC/Papers/ AggarwalKyaw.pdf: Accessed: 13/08/2008.
- Aggarwal, R., Erel, I., Stulz, R. M. & Williamson, R. G. (2007). "Do U.S. Firms have the Best Corporate Governance? A Cross-Country Examination of the Relation between Corporate Governance and Shareholder Wealth." Fisher College of Business Working Paper No. 2006-03-006 Available at SSRN: http://ssrn.com/abstract=954169. Accessed: 21/02/2007.
- Agrawal, A. & Knoeber, C. R. (1996). "Firm Performance and Mechanisms to Control Agency Problems between Managers and Shareholders." *Journal of Financial and Quantitative Analysis* **31** (3), 377-397.
- Agrawal, A. & Mandelker, G. N. (1990). "Large Shareholders and the Monitoring of Managers: The Case of Antitakeover Charter Amendments." *Journal of Financial and Quantitative Analysis* **25** (2), 143-161.
- Agrell P. J., Bogetoft P. & Tind J. (2002). "Incentive Plans for Productive Efficiency, Innovation and Learning." *International Journal of Production Economics* **78** (1), 1- 11.
- Aguilera, R. V. & Cuervo-Cazurra, A. (2004). "Codes of Good Governance Worldwide: What is the Trigger?" *Organization Studies* **25** (3), 415-443.
- Aguilera, R. V. & Jackson, G. (2003). "The Cross-National Diversity of Corporate Governance: Dimensions and Determinants." *Academy of Management Review* **28** (3), 447-465.
- Aguilera, R. V. (2004). "Corporate Governance and Employment Relations: Spain in the Context of Western Europe." In Pendleton, A. & Gospel, H. (Eds.). *Corporate Governance and Labour Management: An International Perspective*. Oxford University Press, Oxford, 197-225.
- Aldama [Report] Miñón, E., Bustelo García del Real, C., Iranzo Martín, J. et al. (2003). *Report by the Special Commission to Foster Transparency and Security in the Markets and in Listed Companies.* Madrid, January.
- Alonso, P-A., Lopez Iturriaga, F. J. & Rodriguez Sanz, J. A. (2005), "Financial Decisions and Growth Opportunities: A Spanish Firms Panel Data Analysis,"*Applied Financial Analysis* **15** (6), 391-407.
- Althaler, K. S. & Slavova, T. (2000). "DEA Problems Under Geometrical or Probability Uncertainties of Sample Data." Working Paper: Economics Series 89**,** Institute for Advanced Studies, Vienna.
- Aly, H. Y. & Grabowski, R. (1988). "Technical Change, Technical Efficiency, and Input Usage in Taiwanese Agricultural Growth." *Applied Economics* **20** (7), 889-899.
- Anderson, R. C & Reeb, D. M. (2003). "Founding-Family Ownership and Firm Performance: Evidence from the S&P 500." *Journal of Finance* **58** (3), 1301-1328.
- Anderson, R., Mansi, S. & Reeb, D. (2004). "Board Characteristics, Accounting Report Integrity, and the Cost of Debt." *Journal of Accounting and Economics* **37** (3), 315-342.
- Arellano, M. & Bond S. R. (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies* **58** (2), 277-297.
- Arellano, M. & Bond, S. (1998). "Dynamic Panel Data Estimation Using DPD98 for GAUSS: A Guide for Users." http://www.american.edu/academic.depts/cas/econ/gaussres/regress/dpd/dpd98. pdf. Accessed: 18/07/2008.
- Arellano, M. & Bover, O. (1995). "Another Look at the Instrumental-Variable Estimation of Error-Components Models." *Journal of Econometrics* **68** (1), 29-52.
- Avkiran, N. K. (2007). "Stability and Integrity Tests in Data Envelopment Analysis." *Socio-Economic Planning Sciences* **41** (3), 224-234.
- Banker, R. D & Maindiratta, A. J. (1988). "Nonparametric Analysis of Technical and Allocative Efficiencies in Production." *Econometrica* **56** (6), 1315-1332.
- Banker, R. D. & Johnston, H. H. (1994). "Evaluating the Impacts of Operating Strategies on Efficiency in the US Airline Industry." In Charnes, A., Cooper, W., Lewin, A. Y. & Seiford, L. M. (Eds). *Data Envelopment Analysis*. Kluwer, Boston.
- Banker, R. D., Charnes, A., Cooper, W. W. (1984). "Some Models for Estimating Technical and Scale

Inefficiencies in Data Envelopment Analysis." *Management Science* **30** (9), 1078-1092.

- Banker, R. D., Charnes, A., Cooper, W. W., Swarts, J. & Thomas, D. (1989a). "An Introduction to Data Envelopment Analysis with Some of Its Models and Their Uses." *Research in Governmental and Nonprofit Accounting* **5**, 25-64.
- Banker, R. D., Das, S. & Datar, S. M. (1989b): "Analysis of Cost variances for Management Control in Hospitals." *Research in Governmental and Nonprofit Accounting* **5**, 269-292.
- Barca, F. & Becht, M. (2001). *The Control of Corporate Europe*. Oxford University Press, Oxford.
- Barclay, M. J., Marx, L. M. & Smith, Jr. C. W. (2003). "The Joint Determination of Leverage and Maturity." *Journal of Corporate Finance* **9** (2), 149-167.
- Barclay, M. J., Morellec, E. & Smith, Jr. C. W. (2006). "On the Debt Capacity of Growth Options." *Journal of Business* **79** (1), 37-59.
- Barreto, I. & Baden-Fuller, C. (2006). "To Conform or to Perform? Mimetic Behaviour, Legitimacy-Based Groups and Performance." *Journal of Management Studies* **43** (7), 1559-1581.
- Bartelsman, E. J. & Doms, M. (2000). "Understanding Productivity: Lessons from Longitudinal Micro Data." *Journal of Economic Literature* **38** (3), 569-594.
- Bathala, C. T., Moon, K. P. & Rao, R. P. (1994). "Managerial Ownership, Debt Policy, and the Impact of Institutional Holdings: An Agency Perspective." *Financial Management* **23** (3), 38.50.
- Bauer, R., Günster, N. & Otten, R. (2004). "Empirical Evidence on Corporate Governance in Europe: The Effect on Stock Returns, Firm Value and Performance." *Journal of Asset Management* **5** (2), 91-104.
- Baysinger, B. D. & Hoskisson, R. R. (1990). "The Composition of Boards of Directors and Strategic Control: Effects on Corporate Strategy." *Academy of Management Review* **15** (1), 72–87.
- Bebchuk, L. A., Cohen, A. & Ferrell, A. (2005). "What Matters in Corporate Governance?" John M. Olin Discussion Paper Series Nº 491, Harvard Law School, March.
- Beck, N. & Katz, J. N. (1995). "What to Do (and not to Do) with Times Series Cross Section Data in Comparative Politics." *American Political Science Review* **89** (3), 634-647.
- Beck, N. & Katz, J. N. (1996). "Nuisance vs. Substance: Specifying and Estimating Time Series Cross Section Models." *Political Analysis* **6** (1), 1-36.
- Beck, N. & Walgenback, P. (2005). "Technical Efficiency or Adaptation to Institutionalized Expectations? The Adoption of ISO 9000 Standards in the German Mechanical Engineering Industry." *Organization Studies* **26** (6), 841-866.
- Beiner, S., Drobetz, W., Schmid, M. M. & Zimmerman, H. (2006). "An Integrated Framework of Corporate Governance and Firm Valuation" *European Financial Management* **12** (2), 249–283.
- Bekaert, G. & Harvey, C. R. (2000). Foreign Speculators and the Emerging Equity Markets." *Journal of Finance* **55** (2), 565-614.
- Bennedsen, M. & Nielsen, K. M. (2006). "The Principle of Proportional Ownership, Investor Protection and Firm Value in Western Europe." ECGI – Finance Working Paper No. 134/2006 Available at SSRN: http://ssrn.com/abstract=941054. Accessed: 25/03/2007.
- Berle, A. A. & Means, G. C. (1968)[1932]. *The Modern Corporation and Private Property*. Larcourt, Brace & World Inc., New York, NY.
- Billett, M. T., King, T-H. D. & Mauer, D. C. (2007). "Growth Opportunities and the Choice of Leverage, Debt Maturity, and Covenants." *Journal of Finance* **62** (2), 2697 – 2730.
- Black, B. S., Jang, H. & Kim, W. (2006). "Does Corporate Governance Predict Firms' Market Values? Evidence from Korea". *Journal of Law, Economics, and Organization* **22** (2), 366-413.
- Blundell, R. W. & Bond, S. R. (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* **87** (1), 115-143.
- Boehmer, E. (2000). "Business Group, Bank Control and Large Shareholders: An Analysis for German Takeover." *Journal of Financial Intermediation* **9** (2), 117-148.
- Bogetoft, P. (1994). "Incentive Efficient Production Frontiers: An Agency Perspective on DEA." *Management Science* **4** (8), 959-968.
- Bogetoft, P. (1995). "Incentives and Productivity Measurements." *International Journal of Production*

Economics **39** (1-2), 67-81.

- Bøhren, Ø. & Ødegaard, B. A. (2000). "The Ownership Structure of Norwegian Firms: Characteristics of an Outlier." Norwegian School of Management Research Report No. 13/2000.
- Bøhren, Ø & Ødegaard, B. A. (2004). "Governance and Performance Revisited." ECGI – Finance Working Paper No. 28/2003; EFA 2003 Annual Conference Paper No. 252. Available at SSRN: http://ssrn.com/ abstract =423461. Accessed: 02/10/2006.
- Bøhren, Ø., Priestley, R. & Ødegaard, B. A. (2005). "The Duration of Equity Ownership." *EFA 2005 Moscow Meetings* Available at SSRN: http://ssrn.com/abstract=676552. Accessed: 02/10/2006.
- Bosworth, W., Mehdian, S. & Vogel, T. (2002). "Executive Compensation and Efficiency: A Study of Large Bank Holding Companies in the United States." *American Business Review* **21** (1), 91-99.
- Bothwell, J. L. (1980). "Profitability, Risk, and the Separation of Ownership from Control." *Journal of Industrial Economics* **28** (3), 303-311.
- Boudreaux, K. J. (1973). "Managerialism and Risk-Return Performance." *Southern Economic Journal* **39** (3), 366-372.
- Bowlin, W. F., Renner, C. J. & Rives, J. M. (2003). "A DEA Study of Gender Equity in Executive Compensation." *Journal of the Operational Research Society* **54** (7), 751-757.
- Bozec, R. & Dia, M. (2007). "Board Structure and Firm Technical Efficiency: Evidence from Canadian State-owned Enterprises." *European Journal of Operational Research* **177** (3), 1734-1750.
- Brainard, W., Shoven, J., Weiss, L., Cagan, P. & Hall, R. E. (1980). "The Financial Valuation of the Return to Capital," *Brookings Papers on Economic Activity* **1980** (2), 453-511.
- Brennan, M. J. & Cao, H. H. (1997). "International Portfolio Investment Flows." *Journal of Finance*, **52** (5), 1851-1880.
- Brennan, M. J. & Subrahmanyam, A. (1996). "Market Microstructure and Asset Pricing: on the Compensation for Illiquidity in Stock Returns." *Journal of Financial Economic*s **41** (3), 341-364.
- Breusch, T. S. & Pagan, A. (1979) "A Simple Test of Heteroskedasticity and Random Coefficient Variation." *Econometrica* **47** (5), 1287-1294.
- Breusch, T. S. & Pagan, A. (1980). "The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics." *The Review of Economic Studies* **47** (1), 239-253.
- Brown, C. (2005). "Is there an Institutional Theory of Distribution?" *Journal of Economic Issues* **39** (4), 915-931.
- Brown, L. D. & Caylor, M. L. (2004). "Corporate Governance and Firm Performance." Working Paper, Georgia State University.
- Bruce, A., Buck, T. & Main, B. (2005). "Top Executive Remuneration: A View from Europe." *Journal of Management Studies* **42** (7), 1493-1506.
- Burkart, M. (1995). "Initial Shareholdings and Over-Bidding in Takeover Contests. *Journal of Finance* **50**, 1491-1515.
- Burkart, M., Gromb, D. & Panunzi, F. (1997). "Large Shareholders, Monitoring, and the Value of the Firm." *Quarterly Journal of Economics* **112** (3), 693-728.
- Burton, B. M., Lonie, A. A. & Power, D. M. (2000). "The Impact of Corporate Growth Opportunities on the Market Response to New Equity Announcements." *Applied Financial Economics* **10** (1), 27-36.
- Cable, J. (1985). "Capital Market Information and Industrial Performance: The Role of West German Banks." *Economic Journal* **95** (377), 118-132.
- Callen, J. L. &, Falk, H. (1993). "Agency and Efficiency in Nonprofit Organizations: The Case of "Specific Health Focus" Charities." *Accounting Review* **68** (1), 48-65.
- Carline, N. F., Linn, S. C. & Yadav, P. K. (2002). "The Influence of Managerial Ownership on Real Gains in Corporate Mergers and Market Revaluation of Merger Partners: Empirical Evidence." EFA 2002 Berlin Meetings Discussion Paper. Available at SSRN: http://ssrn.com/abstract=302606 or DOI: 10.2139/ssrn.302606.
- Chambers, R. G., Chung, Y. & Färe, R. (1998). "Profit, Directional Distance Functions, and Nerlovian

Efficiency." *Journal of Optimization Theory and Applications* **98** (2), 351-364.

- Charnes, A., Cooper W. W. & Rhodes E. (1978). "Measuring the Efficiency of Decision-Making Units." *European Journal of Operational Research* **2** (4), 429-444.
- Charnes, A., Haag, S., Jaska, P. & Semple, J. (1992). "Sensitivity of Efficiency Classifications in Data Envelopment Analysis." *Journal of Systems Sciences* **23** (5), 789-798.
- Chen, Y., Gregoriou, G. N. & Rouah, F. D. (2009). "Efficiency Persistence of Bank and Thrift CEOs Using Data Envelopment Analysis." *Computers and Operations Research* **36** (5), 1554-1561.
- Cheng, S. & Firth, M. (2005). "Ownership, Corporate Governance and Top Management Pay in Hong Kong." *Corporate Governance: An International Review* **13** (2), 291-302.
- Cherchye, L. & Post, T. (2003). "Methodological Advances in DEA: A Survey and an Application for the Dutch Electricity Sector." *Statistica Neerlandica* **57** (4), 410-438.
- Cho, M-H. (1998). "Ownership Structure, Investment and the Corporate Value. An Empirical Analysis." *Journal of Financial Economics* **47** (1), 103-121.
- Chordia, T., Subrahmanyam, A. & Anshuman, R. V. (2001). "Trading Activity and Expected Stock Returns." *Journal of Financial Economics* **59** (1), 3-32.
- Chung, K. H. & Pruitt, S. W. (1994) "A Simple Approximation of Tobin's Q." *Financial Management* **23** (3), 70-74.
- Claessens, S. & Djankov, S. (1997). "Managers, Incentives, and Corporate Performance: Evidence from the Czech Republic." Working Paper, World Bank Available at SSRN: http://ssrn.com/abstract=45774 or DOI: 10.2139/ssrn.45774
- Claessens, S. & Djankov, S. (1999). "Ownership Concentration and Corporate Performance in the Czech Republic." *Journal of Comparative Economics* **27** (3), 498-513.
- Claessens, S., Djankov, S. & Lang, L. (2000). "The Separation of Ownership and Control in East Asian Corporations." *Journal of Financial Economics* **58** (1-2), 81-112.
- Coles, J. W. & Hesterly, W. S. (2000). "Independence of the Chairman and Board Composition: Firm Choices and Shareholder Value." *Journal of Management* **26** (2), 195-214.
- Conyon, M. J. & Murphy, K. J. (2000). "The Prince and the Pauper? CEO Pay in the United States and the United Kingdom." *Economics Journal* **110** (467), 640-671.
- Conyon, M. J. & Peck, S. I. (1998). "Board Control, Remuneration Committees, and Top Management Compensation." *Academy of Management Journal* **41** (2), 146-157.
- Cooper, W. W., Huang, Z. M., Lelas, V., Xi, S. & Olesen, O. B. (1998). "Chance Constraint Programming Formulations for Stochastic Formulations of Efficiency and Dominance in DEA." *Journal of Productivity Analysis* **9** (1), 53-79.
- Corby, C. E. & Stohs, M. H. (1998). "Investment Opportunities and Irish Equity Offerings." *European Journal of Finance* **4** (4), 357-367.
- Crespi, R. & García-Cestona, M. A. (2001). "Ownership and Control of Spanish Listed Firms." In Barca, F. & Brecht, M. (Eds.). *The Control of Corporate Europe*. Oxford University Press.
- Crespi, R., García-Cestona, M. A. & Vicente, S. (2002). "Governance Mechanisms in Spanish Financial Intermediaries" UAB Business Economics Department Working Paper Number 2002/9
- Crespí-Cladera, R. & Gispert, C. (2002). "Causes and Consequences of Block Share Purchases: Evidence from Spanish Non-Financial Firms." *Journal of Management & Governance* **6** (3), 235-254.
- Cubbin, J. & Leech, D. (1986). "Growth versus Profit-Maximization: A Simultaneous Equations Approach to Testing the Marris Model." *Managerial and Decisions Economics* **7** (2), 123-131.
- Curcio, R. (1994). "The Effect of Managerial Ownership of Shares and Voting Concentration on Performance." 1994 London school of Economics' *Centre for Economic Performance* Paper Nº CEPDP0185, January.
- Dacin, M. T., Goodstein, J. & Scott, W. R. (2002). "Institutional Theory and Institutional Change: Introduction to the Special Research Forum." *Academy of Management Journal* **45** (1), 45-57.
- Dahya, J., Orlin, D. & McConnell, J. J. (2008). "Dominant Shareholders, Corporate Boards and Corporate Value: A Cross-Country Analysis." *Journal of Financial Economics* **87** (1), 73-100.

- Dalton, D. R., Daily, C. M., Ellstrand, A. E. & Johnson, J. L. (1998). “Meta-analytic Review of Board Composition, Leadership Structure, and Financial Performance.” *Strategic Management Journal* **19** (3), 269–290.
- Daniel, K. & Titman, S. (2006). “Market Reactions to Tangible and Intangible Information.” *Journal of Finance* **61** (4), 1605-1643.
- De Jong, A., DeJong, D. V., Mertens, G. & Wasley, C. E. (2005). “The Role of Self-Regulation in Corporate Governance: Evidence and Implications from the Netherlands.” *Journal of Corporate Finance* **11** (3), 473-503.
- De Miguel, A., Pindado, J. & de la Torre, C. (2004). “Ownership Structure and Firm Value: New Evidence from Spain.” *Strategic Management Journal* **25** (12), 1199-1207.
- De Miguel, A., Pindado, J. & de la Torre, C. (2005) “How Do Entrenchment and Expropriation Phenomena Affect Control Mechanisms?” *Corporate Governance: An International Review* **13** (4), 505-516.
- Debasish, S. S. (2006). Efficiency Performance in Indian Banking – Use of Data Envelopment Analysis.” *Global Business Review* **7** (2), 325-333.
- Delgado, M. A. & Robinson, P. M. (1992). “Nonparametric and Semiparametric Methods for Economic Research.” *Journal of Economic Surveys* **6** (3), 201-248.
- Demsetz, H. (1983). “The Structure of Ownership and the Theory of the Firm.” *Journal of Law and Economics* **26** (2), 375-394.
- Demsetz, H. & Lehn, K. (1985). “The Structure of Corporate Ownership: Causes and Consequences.” *Journal of Political Economy* **93** (6), 1155-1177.
- Demsetz, H. & Villalonga, B. (2001). “Ownership Structure and Corporate Performance.” *Journal of Corporate Finance* **7** (3), 209-233.
- Denis, D. J. & Denis, D. K. (1994) “Majority Owner-managers and Organizational Efficiency.” *Journal of Corporate Finance* **1** (1) 91-118.
- Denis, D. K. & McConnell, J. J. (2003). “International Corporate Governance” *Journal of Financial and Quantitative Analysis* **38** (1), 1-36.
- Destefanis, S. & Sena, V. (2007). Patterns of Corporate Governance and Technical Efficiency in Italian Manufacturing.” *Managerial and Decision Economics* **28** (1), 27-40.
- DiMaggio, P. J. & Powell, W. W. (1983). “The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields.” *American Sociological Review* **48** (2), 147-160.
- DiMaggio, P. J. & Powell, W. W. (1991). “Introduction.” In *The New Institutionalism in Organizational Analysis*. Powell, W. W. & DiMaggio, P. J. (Eds.). University of Chicago Press. Chicago, 1-38.
- Dimelis, S. & Louri, H. (2002). “Foreign Ownership and Production Efficiency: A Quantile Regression Approach.” *Oxford Economic Papers* **54** (3), 449-469.
- Dittmar, A. & Mahrt-Smith, J. (2007). “Corporate Governance and the Value of Cash Holdings.” *Journal of Financial Economics* **83** (3), 531-792.
- Dittmar, A., Mahrt-Smith, J. & Servaes, H. (2003). “International Corporate Governance and Corporate Cash Holdings.” *Journal of Financial and Quantitative Analysis* **38** (1), 111-133.
- Djankov, S., La Porta, R., Lopez-de-Salines, F. & Shleifer, A. (2008). “The Law and Economics of Self-Dealing.” *Journal of Financial Economics* **88** (3), 430-465.
- Doidge, C., Karolyi, A. & Stulz, R. M. (2004a). “Why Do Countries Matter So Much for Corporate Governance? Working Paper, ECGI #50/2004.
- Doidge, C., Karolyi, A. & Stulz, R. M. (2004b). “Why are Foreign Firms Listed in the U.S. Worth More?” *Journal of Financial Economics* **71** (2), 205-238.
- Downes, D. (2002) “Corporate Governance.” *Accountancy Ireland* **34** (2).
- Drake, L. & Simper, R. (2003). “Competition and Efficiency in UK Banking: The Impact of Corporate Ownership Structure.” Loughborough University’s Department of Economics Research Discussion Paper ERP03

- Drobetz, W., Gugler, K. & Hirschvogl, S. (2004b). "The Determinants of the German Corporate Governance Rating." Working Paper Available at http://www.wwz.unibas.ch/cofi/publications/papers/2004/02-04.pdf. Accessed: 26/02/2007.
- Drobetz, W., Schillhofer, A. & Zimmerman, H. (2004a). "Corporate Governance and Expected Stock Returns: Evidence from Germany." *European Financial Management*, **10** (2) 267–293.
- Durnev, A. & Kim, E. H. (2005). "To Steal or Not to Steal: Firm Attributes, Legal Environment, and Valuation." *Journal of Finance* **60** (3), 1461-1493.
- Dwivedi, N. & Jain, A. K. (2004). "Board Effectiveness and Corporate Performance: A Holistic View and Research Agenda." Paper published in the proceedings of the 25th McMaster World Congress on *Enhancing Corporate Governance* Hamilton, Ontario – Canada between January 14 and16.
- Dyck, A. & Zingales, L. (2004). "Private Benefits of Control: An International Comparison." *Journal of Finance* **59** (2), 537-600.
- Earle, J. S., Kucsera, C. & Telegdy, Á. (2005). "Ownership Concentration and Corporate Performance on the Budapest Stock Exchange: Do Too Many Cooks Spoil the Goulash? *Corporate Governance: An International Review* **13** (2), 254-264.
- Easterbrook, F. (1984). "Two Agency-Cost Explanations of Dividend." *American Economic Review* **74** (4), 650-659.
- Eckbo, B. E. & Smith, D. C. (1998). "The Conditional Performance of Insider Trades." *Journal of Finance* **53** (2), 467-498.
- Eisenberg, T., Sundgren, S. & Wells, M. T. (1998). "Larger Board Size and Decreasing Value in Small Firms." *Journal of Financial Economics* **48** (1), 35-54.
- Eisenhadt, K. M. (1989). "Agency Theory: An Assessment and Review." *Academy of Management Review* **14** (1), 57-74.
- Elliott, J. W. (1972). "Control, Size, Growth and Financial Performance in the Firm." *Journal of Financial and Quantitative Analysis* **7** (1), 1309-1320.
- Emrouznejad, A., Parker, B. R. & Tavares, G. (2008). "Evaluation of Research in Efficiency and Productivity: A Survey and Analysis of the First 30 Years of Scholarly Literature in DEA." *Socio-Economic Planning Sciences* **42** (3), 151-157.
- Ernst & Young (1997). "Measures that Matter." A Report from the Center for Business Innovation, Ernst & Young LLP. Available at http://www.corporatesunshine.org/measuresthatmatter.pdf. Accessed: 05/02/2007
- Ezzamel, M. & Watson, R. (2002). "Pay Comparability across and within UK Boards: An Empirical Analysis of the Pay Cash Awards to CEOs and other Board Members." *Journal of Management* **39** (2), 207-232.
- Faccio, M. & Lang, L. (2002). "The Ultimate Ownership of West European Corporations." *Journal of Financial Economics* **65** (3), 365-396.
- Fama, E. F. & Jensen, M. C. (1983). "Separation of Ownership and Control." *Journal of Law and Economics* **26** (2), 301–349.
- Fama E. F. & Jensen, M. C. (1985). "Organizational Forms and Investment Decisions." *Journal of Financial Economics* **14** (1), 101-119.
- Färe, R., Grosskopf, S., Lindgren, B. & Roos, P. (1992). "Productivity Changes in Swedish Pharmacies 1980-1989: A Non-Parametric Malmquist Approach." *Journal of Product Analysis* **3** (3), 85-101.
- Färe, R., Grosskopf, S. & Lovell, C. A. K. (1985). *The Measurement of Efficiency of Production* Kluwer, Boston.
- Färe, R., Grosskopf, S. & Lovell, C. A. K. (1994a). *Production Frontiers*. Cambridge University Press, Cambridge.
- Färe, R., Grosskopf, S., Norris, M. & Zhang, Z. (1994b). "Productivity Growth, Technical Progress, and Efficiency Changes in Industrialised Countries." *American Economic Review* **84** (1), 66–83.
- Farrell, M. J. (1957). "The Measurement of Productive Efficiency." *Journal of the Royal Statistical Society*. Series A (General) **120** (3), 253-290.

- Faulkender, M. & Wang, R. (2006). “Corporate Financial Policy and the Value of Cash.” *Journal of Finance* **61** (4), 1957-1990.
- Fernández-Alles, M. & Valle-Cabrera, R. (2006). “Reconciling Institutional Theory with Organizational Theories: How Neoinstitutionalism Resolves Five Paradoxes.” *Journal of Organizational Change Management* **19** (4), 503-517.
- Feroz, E. H., Kim, S. & Raab, R. L. (2003). “Financial Statement Analysis: A Data Envelopment Analysis Approach.” *Journal of the Operational Research Society* **54** (1), 48-58.
- Fiordelisi, F. (2007).“Shareholder Value Efficiency in European Banking.“ *Journal of Banking and Finance* **31** (7), 2151-2171.
- Finkelstein, S. & D’Aveni, R. A. (1994). “CEO Duality is Double-Edged Sword: How Boards of Directors Balance Entrenchment Avoidance and Unity Command.” *Academy of Management Journal* **37** (5), 1079–1108.
- Firth, M., Fung, M. Y. P. & Rui, O. M. (2006). “Corporate Performance and CEO Compensation in China.” *Journal of Corporate Finance* **12** (4), 693-714.
- Fox, K. J., Hill, R. J. & Diewert, W E. (2004). “Identifying Outliers in Multi-Output Models.” *Journal of Productivity Analysis* **22** (1), 73-94.
- Franks, J. R. & Mayer, C. (2001) “Ownership and Control of German Corporations.” *Review of Financial Studies* **14** (4), 943-977.
- Franks, J. R., Mayer, C. & Renneboog, L. (2001). “Who Disciplines Management in Poorly Performing Companies?” *Journal of Financial Intermediation* **10** (3-4), 209-248.
- Frick, B. (2004). “Does Ownership Matter? Empirical evidence from the German Wine Industry.” *KYKLOS* **57** (3), 357-386.
- Friend, I. & Hasbrouck, J. (1988). “Determinants of Capital Structure.” *Research in Finance* **7** (1), 1-19.
- Friend, I. & Lang, L. (1988). “An Empirical Test of the Impact of Managerial Self-interest on Corporate Structure.” *Journal of Finance* **43** (2), 271-281.
- FTSE/ISS-CGI (2005) “FTSE ISS Corporate Governance Rating and Index Series – Measuring the Impact of Corporate Governance on Global Portfolios.” *FTSE Research* FTSE ISS CGI Series Research Report, April.
- Fundación de Estudios Financieros [FEF] (2003). “Guide to Principles of Good Corporate Governance, Transparency of Information and Conflicts of Interests at Listed Companies. Fundación de Estudios Financieros *Papers of the FEF* Nº 2, Madrid.
- Fundación de Estudios Financieros [FEF] (2005). *Memoria de Actividades 2004* Fundación de Estudios Financieros, Madrid
- Galve Górriz, C. & Salas Fumás, V. (2005). “Family Ownership and Performance: The Net Effect of Productive Efficiency and Growth Constraints.” *ECGI Working Paper Series in Finance* Nº. 66/2005, February.
- Galve Górriz, C. & Salas Fumás, V. (1996). “Ownership Structure and Firm Performance: Some Empirical Evidence from Spain.” *Managerial and Decision Economics* **17** (6), 575-586.
- Gascón, F., González Fidalgo, E. & Fernández Alvarez, A. I. (2002). “Economic Efficiency and Value Maximization in Banking Firms.” EFMA 2002 London Meetings. Available at SSRN: http://ssrn.com/abstract=314264 or DOI: 10.2139/ssrn.314264. Accessed: 23/05/2007.
- Gattoufi, S., Oral, M. & Reisman, A. (2004). “Data Envelopment Analysis Literature: A Bibliography Update (1951-2001).” *Socio-Economic Planning Sciences* **38** (2-3), 159-229.
- Gedajlovic, E. R. & Shapiro, D. (1998). “Management and Ownership Effects: Evidence from 5 Countries.” *Strategic Management Journal* **19** (6), 533-555.
- Gedajlovic, E., Yoshikawa, T. & Hashimoto, M. (2005). “Ownership Structure, Investment Behaviour and Firm Performance in Japanese Manufacturing Industries.” *Organization Studies* **26** (1), 7-35.
- GMI [Governance Metrics International] (2006). GMI Governance and Performance Studies http://www.gmiratings.com/ (jo5gv0553je1of55jxbpt5j3)/Performance.aspx: Accessed: 16/02/2007.

- Goergen, M., Renneboog, L. & Correia da Silva, L. (2005). "When Do German Firms Change Their Dividends." *Journal of Corporate Finance* **11** (1-2), 375-399.
- Gomes, A. (2000). "Going Public without Governance: Managerial Reputation Effects." *Journal of Finance* **55** (2), 615-646.
- Gomez Anson, S. & Fernández Rodríguez, E. (2001). "Wealth Effects Associated with the Compliance with the Code of Best Practice: The Spanish Experience". EFMA 2001 Lugano Meetings. Available at SSRN: http://ssrn.com/abstract=264594. Accessed: 01/02/2007
- Gomez-Mejia, L., Wiseman, R. M. & Johnson Dykes, B. (2005). 'Agency Problems in Diverse Contexts: A Global perspective'. *Journal of Management Studies* **42** (7) 1507–1517.
- Gompers, P., Ishii, J. & Metrick, A. (2003). "Corporate Governance and Equity Prices." *Quarterly Journal of Economics* **118** (1), 107-155.
- Goncharov, I., Werner, J. R. & Zimmermann, J. (2006). "Does Compliance with the German Corporate Governance Code Have an Impact on Stock Valuation? An Empirical Analysis." *Corporate Governance: An International Review* **14** (5) 432-445.
- Gorton G. & Schmid F. (2000a). "Class Struggle inside the Firm: A Study of German Codetermination." Center for Financial Institutions Working Papers 00-36, Wharton School Center for Financial Institutions, University of Pennsylvania.
- Gorton, G. & Schmid, F. A. (2000b). "Universal Banking and the Performance of German Firms." *Journal of Financial Economics* **58** (1-2), 29-80.
- Greene W. H. (2008). "The Econometric Approach to Efficiency Analysis." In Fried, H., Lovell, C. A. K. & Schmidt, S. (Eds). *The Measurement of Productive Efficiency and Productivity Growth*. Oxford University Press, Oxford, 92-250.
- Grossman, S. J. & Hart, O. D. (1982). "Corporate Financial Structure and Managerial Incentives." In McCall, J. (Ed). *The Economics of Information and Uncertainty.* University of Chicago Press, Chicago, 107-140.
- Gugler, K. (1998). "Corporate Ownership in Austria." *Empirica* **25** (3), 285-307.
- Gugler, K. (2001) (Ed). *Corporate Governance and Economic Performance*. A Compilation for the European Corporate Governance Institute (ECGI). Oxford University Press, Oxford.
- Gul, F. A. (1999). "Growth Opportunities, Capital Structure and Dividend Policies in Japan." *Journal of Corporate Finance* **5** (2), 141-168.
- Hart, O. (2001). "Financial Contracting." *Journal of Economic Literature* **39** (4), 1079-1100.
- Hart, O., Shleifer, A. & Vishny, R. W. (1997). "The Proper Scope of Government: Theory and an Application to Prisons." *The Quarterly Journal of Economics* **112** (4), 1127-1161.
- Habib, M. A. & Ljunqvist, A. (2005). "Firm Value and Managerial Incentives: A Stochastic Frontier Approach." *Journal of Business* **78** (6), 2053-2094.
- Harvey, C. R., Lins, K. V. & Roper, A. H. (2004). "The Effect of Capital Structure When Agency Costs are Extreme," *Journal of Financial Economics* **74** (1), 3-30.
- Hausman, J. A. & Taylor, W. E. (1981). "Panel Data and Unobservable Individual Effects." *Econometrica* **49** (6), 1377-1398.
- Hausman, J. A. (1978). "Specification Tests in Econometrics." *Econometrica* **46** (6), 1251-1271.
- Hellwig, M. (1998). "Banks, Markets and the Allocation of Risk in an Economy", *Journal of Institutional and Theoretical Economics* **154** (1), 328-345.
- Hermalin, B. E. & Weisbach, M. S. (1991) "The Effects of Board Composition and Direct Incentives on Firm Performance." *Financial Management* **20** (4), 101-112.
- Himmelberg, C. P., Hubbard, R. G. & Palia, D. (1999) "Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance: An Investigation of Share Ownership and Corporate Performance." *Journal of Financial Economics* **53** (3), 353-384.
- Holderness, C. & Sheehan, D. (1988). "The Role of Majority Shareholders in Publicly Held Corporations: An Exploratory Analysis." *Journal of Financial Economics* **20** (1-2), 317-347.
- Holderness, C., Kroszner, R. & Sheehan, D. (1999). "Were the Good Old Times that Good? Changes in

Managerial Stock Ownership since the Great Depression." *Journal of Finance* **54** (1), 435-469.

- Holmstrom, B. & Tirole, J. (1993). "Market Liquidity and Performance Monitoring." *Journal of Political Economy* **101** (4)**,** 678-709.
- Hossain, M., Prevost, A. & Rao, R. (2001). "Corporate Governance in New Zealand: The Effect of the 1993 Companies Act on the Relation between Board Composition and Firm Performance." *Pacific Basin Finance Journal* **9** (2), 119-145.
- Hughes, J. P., Lang, W. W., Mester, L. J., Moon, C.-G. & Pagano, M. S. (2003). "Do Bankers Sacrifice Value to Build Empires? Managerial Incentives, Industry Consolidation, and Financial Performance." *Journal of Banking and Finance* **27** (3), 417-447.
- IC-A (Professional Standards Committee of the Instituto de Consejeros-Administradores) (2005). "Principles of Good Corporate Governance – Spain: Code of Good Practice for Boards and Directors." *Instituto de Consejeros-Administradores*, Madrid, November.
- Jensen, M. & Meckling, W. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure." *Journal of Financial Economics* **3** (4)**,** 305-360.
- Jensen, M. (1993). "The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems." *Journal of Finance* **48** (3), 831-880.
- Jepperson, R. L. (1991). "Institutions, Institutional Effects and Institutionalism." In Powell, W. W. & DiMaggio, P. J. (Eds.). *The New Institutionalism in Organizational Analysis*, University of Chicago Press, Chicago.
- Jo, H., Pinkerton, J. M. & Sarin, A. (1994). "Financing Decisions and the Investment Opportunity Set: Some Evidence from Japan." *Pacific Basin Finance Journal* **2** (1), 227-242.
- Johannisson, B., Centeno, C. L., Discua, C. A. F., Epure, M., Hormiga, E. P., Kapelko, M., Murdock, K., Nanka-Bruce, D., Olejárová, M., Sanchez A. L., Sekki, A., Stoian, M. C., Tötterman, H. & Bisignano, A. (2007). "Interstanding the Industrial District: Contrasting Conceptual Images as a Road to Insight". *Entrepreneurship and Regional Development: An International Journal* **19** (6), 527-554.
- Johnson, S., La Porta, R., Lopez de Salines, F., & Shleifer, A. (2000). "Tunnelling." *American Economic Review* **90** (2), 22-27.
- Jung K., Kim, Y.-C. & Stulz, R. M. (1996). "Timing, Investment Opportunities, Managerial Discretion, and the Security Issue Decision." *Journal of Financial Economics* **42** (2), 159-185.
- Kalcheva, I. & Lins, K. (2004). "International Evidence on Cash Holdings and Expected Managerial Agency Problems." Working Paper, University of Utah, Salt Lake City, Utah.
- Kang, E. & Zardkoohi, A. (2005). "Board Leadership Structure and Firm Performance." *Corporate Governance: An International Review* **13** (6), 785-799.
- Kang, J. & Shivdasani, A. (1995). "Firm Performance, Corporate Governance, and Top Executive Turnover in Japan." *Journal of Financial Economics* **38** (1), 29-58.
- Kapopoulos, P. & Lazaretou, S. (2007). "Corporate Ownership Structure and Firm Performance: Evidence from Greek Firms." *Corporate Governance: An International Review* **15** (2), 144-158.
- Keasey, K., Short, H. & Watson, R. (1994). "Director Ownership and the Performance of Small and Medium Sized Firms in the UK." *Small Business Economics* **6** (3), 225-236.
- Kester, C. W. (1992). "Industrial Groups as Systems of Contractual Governance." *Oxford Review of Economic Policy* **8** (3), 24-44.
- Khiari, W., Karaa, A. & Omri, A. (2007). "Corporate Governance Efficiency: An Indexing Approach Using the Stochastic Frontier Analysis." *Corporate Governance: An International Review* **7** (2), 148-161.
- Kittel, B. (2001). "Sense and Sensitivity in Pooled Analysis of Political Data." *European Journal of Political Research* **35** (2), 225–253.
- Klapper, L. F. & Love, I. (2004). "Corporate Governance, Investor Protection, and Performance in Emerging Markets." *Journal of Corporate Finance* **10** (5), 703-728.
- Kneip, A. S. & Simar, L. (1996). "A General Framework for Frontier Estimation with Panel Data." *Journal of Productivity Analysis* **7** (2-3), 182-212.

- Kohler, A. (1990). "National Effort Needed to Save the Non-Banks." *Australian Financial Review*, July 3rd.
- Köke, J. & Renneboog, L. (2002). "Does Good Corporate Governance Lead to Stronger Productivity Growth? Evidence from Market-oriented and Blockholder-based Governance Regimes." Tilburg University, Centre for Economic Research Discussion Paper Nº. 2002-89.
- Kole, S. R. (1993). "Managerial Ownership and Firm Performance: Incentives or Rewards?" Financial Research and Policy Studies Working Paper Series, FR 93-10. Bradley Policy Research Center, Rochester, N.Y.
- Koopmans, T. C. (1951). "Analysis of Production as an Efficient Combination of Activities." In Koopmans, T. C. (Ed.). *Activity Analysis of Production and Allocation*. Wiley, New York.
- Kraatz, M. S. & Moore, J. H. (2002). "Executive Migration and Institutional Change." *Academy of Management Journal* **45** (1), 120-143.
- Kumbhakar, S. C. & Lovell, C. A. K. (2000). *Stochastic Frontier Analysis: An Econometric Approach.* Cambridge University Press, Cambridge.
- La Porta, P., Lopez-de-Salines, F., Shleifer, A. & Vishny, R. W. (1997). "Legal Determinants of External Finance." *Journal of Finance* **52** (3), 1131-1150.
- La Porta, P., Lopez-de-Salines, F., Shleifer, A. & Vishny, R. W. (1998). "Law and Finance." *Journal of Political Economy* **106** (6), 1113-1155.
- La Porta, R., Lopez-de-Salines, F. & Shleifer, A. (1999). "Corporate Ownership around the World." *Journal of Finance* **54** (2), 471-517.
- La Porta, R., Lopez-de-Salines, F., Shleifer, A. & Vishny, R. W. (2000). "Investor Protection and Corporate Governance." *Journal of Financial Economics* **58** (1), 3-27.
- La Porta, R., Lopez-de-Salines, F., Shleifer, A. & Vishny, R. W. (2002). "Investor Protection and Corporate Valuation" *Journal of Finance* **57** (3), 1147-1170.
- La Porta, R., Lopez-de-Silanes, F. & Shleifer, A. (2006). "What Works in Securities Laws?" *Journal of Finance* **61** (1), 1-32.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A. & Vishny, R. W. (2002). "Investor Protection and Corporate Valuation." *Journal of Finance,* **57** (3), 1147-1170.
- Lang, L. H. P., Stulz, R. M. & Walkling, R. A. (1991). "A Test of the Free Cash Flow Hypothesis: The Case of Bidder Returns," *Journal of Financial Economics* **29** (2), 315-336.
- Lange, H. P. & Sharpe, I. G. (1995). "Monitoring Costs and Ownership Concentration: Australian Evidence." *Applied Financial Economics* **5** (6), 441-447.
- Lauterbach, R. & Vaninsky, A. (1999). "Ownership Structure and Firm Performance: Evidence from Israel." *Journal of Management and Governance* **3** (2), 189-201.
- Lee, D. E. & Tompkins, J. G. (1999). "A Modified Version of the Lewellen and Badrinath Measure of Tobin's Q." *Financial Management* **28** (1), 20-31.
- Lee, J. (2004). "The Effects of Family Ownership and Management on Firm Performance." *SAM Advanced Management Journal* **69** (4), 46-53.
- Leech, D. & Leahy, J. (1991). "Ownership Structure, Control Type Classifications and the Performance of Large British Companies." *The Economic Journal* **101** (409), 1418-1437.
- Lehmann, E., Warning, S. & Weigand, J. (2004). "Governance Structures, Multidimensional Efficiency and Firm Profitability." *Journal of Management and Governance* **8** (3), 279-304.
- Leibenstein, H. (1966). "Allocative Efficiency vs. X-Efficiency." *American Economic Review* **56** (3), 392-415.
- Leibenstein, H. (1977). "X-Efficiency, Technical Efficiency, and Incomplete Information Use: A Comment" *Economic Development and Cultural Change* **25** (2), 311-316.
- Leibenstein, H. (1978). "X- Efficiency Xists: A Reply to an Xorcist." *American Economic Review* **68** (1), 203-211.
- Lewellen, W. G. & Badrinath, S. G. (1997). "On the Measurement of Tobin's Q." *Journal of Financial Economics* **44** (1), 77-122.

- Li, M. & Simerly, R. (1998), "The Moderating Effects of Environmental Dynamism on the Ownership and Performance Relationship." *Strategic Management Journal* **19** (2), 169-179.
- Lindenberg, E. B. & Ross, S. A. (1981). "Tobin's Q Ratio and Industrial Organization." *Journal of Business* **54** (1), 1-32.
- Lins, K. V. (2003). "Equity Ownership and Firm Value in Emerging Markets." *Journal of Financial and Quantitative Analysis* **38** (1), 159-184.
- Lipton, M. & Lorsch, J. (1992). "A Modest Proposal for Improved Corporate Governance." *Business Lawyer* **48** (1), 59-77.
- Liu, J. & Tone, K. (2008). "A Multistage Method to Measure Efficiency and its Application to Japanese Banking Industry." *Socio-Economic Planning Sciences* **42** (2), 75-91.
- Lombardo, D. & Pagano, M. (2000). "Legal Determinants of the Return on Equity." Stanford Law School Working Paper No. 193.
- Lozano, J. F. (2000). "The Spanish Code for Good Corporate Governance (Olivencia Report): An Ethical Analysis." *Journal of Business Ethics* **27** (1-2), 175-180.
- Lubatkin, M. (2007). "One More Time: What is a Realistic Theory of Corporate Governance?" *Journal of Organizational Behavior* **28** (1), 59–67.
- Lubatkin, M. H., Lane, P. J., Collin, S-O. & Very, P. (2005). "Origins of Corporate Governance in the USA, Sweden and France." *Organization Studies*, **26** (6), 867-888.
- Mahadevan, R. (2002). "A DEA Approach to Understanding the Productivity Growth of Malaysia's Manufacturing Industries." *Asia Pacific Journal of Management* **19** (4), 587–600.
- Mak, Y. T. & Yuanto, K. (2002). "Size Really Matters: Further Evidence on the Negative Relationship between Board Size and Firm Value." National University of Singapore (NUS) Business School Working Paper. Available at SSRN: http://ssrn.com/abstract=303505 or DOI: 10.2139/ssrn.303505. Accessed: 07/02/2007.
- Manzoni, A. & Islam, S. M. N. (2009). *Performance Measurement in Corporate Governance: DEA Modelling and Implications for Organisational Behaviour and Supply Chain Management*. Physica-Verlag HD, Heidelberg.
- March, J. G. & Olsen, J. P. (1989). *Rediscovering Institutions: The Organizational Basis of Politics.* The Free Press, New York.
- Martínez, M. J. C. & Giné, J. A. T. (2005). "Banks as a Firm's Blockholders: A Study for Spain." EFMA Symposium Paper, www.efmaefm.org/efmsympo2005/accepted _papers/ 23-Jose Casasola _Martinez_paper.pdf. Accesed: 17/10/2005.
- McConnell, J. J. & Servaes, H. (1990). "Additional Evidence on Equity Ownership and Corporate Value." *Journal of Financial Economics* **27** (2), 595-612.
- McConnell, J. J. & Servaes, H. (1995). "Equity Ownership and the Two Faces of Debt." *Journal of Financial Economics* **39** (1), 131-157.
- Medvedev, D. (2006). "Beyond Trade: The Impact of Preferential Trade Agreements on Foreign Direct Investment Inflow." *World Bank Policy Research* Working Paper 4065, November.
- Meyer, J. W. & Rowan, B. (1977). "Institutional Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* **83** (2), 340-363.
- Mintz, S. M. (2005). "Corporate Governance in an International Context: Legal Systems, Financial Patterns and Cultural Variables." *Corporate Governance: An International Review* **13** (5), 582-597.
- Mohan, N. & Ruggiero, J. (2003). "Compensation Differences between Male and Female CEOs for Publicly Traded Firms: A Nonparametric Analysis." *Journal of the Operational Research Society* **54** (12), 1242-1248.
- Moon, S., Sekwat, A. & Stanley, E. R. (2004). "Testing the Assumptions of Pooled Time Series Cross-Sectional Regression Analysis through ARIMA and Interrupted Time Series Modeling: Beck and Katz Revisited." Paper Presentation at Western Social Science Conference on April 16. Salt Lake City, Utah.
- Mørck, R., Nakamura, M. & Shivdasani, A. (2000). "Banks, Ownership Structure, and Firm Value in

Japan." *Journal of Business* **73** (4) 539-567.

- Mørck, R., Shleifer, A. & Vishny, R. W. (1988). "Management Ownership and Market Valuation: An Empirical Analysis." *Journal of Financial Economics* **20** (1-2), 293-315.
- Myers, S. & Majluf, N. (1984). "Corporate Financing and Investment Decisions when Firms have Information that Investors do not have." *Journal of Financial Economics* **13** (2), 187-221.
- Myers, S. C. & Rajan, R. G. (1998). "The Paradox of Liquidity." *Quarterly Journal of Economics* **113** (3), 733-771.
- Nanka-Bruce, D. (2006). "Corporate Ownership and Technical Efficiency Analysis in the Spanish Real Estate Sector." *Corporate Ownership & Control* **4** (2), 100-113.
- Nenova, T. (2003). "The Value of Corporate Voting Rights and Control: A Cross-Country Analysis." *Journal of Financial Economics* **68** (3), 325-352.
- Nickell, S., Nikolitsas, D. & Dryden, N. (1997). "What Makes Firms Perform Well?" *European Economic Review* **41** (3), 783-796.
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, Cambridge.
- North, D. C. (1992). "Institutions and Economic Theory." *American Economist* **36** (1), 3-6.
- NWS Treasury (2001). "Guide to Economic Performance Measurement for General Government Sector Agencies." Policy and Guidelines Paper TPP01-03.
- O'Connell, B. T., Webb, Jr. L. & Schwarzbach, H. R. (2003). "Corporate Governance and Disclosure Reforms in the Post-Enron World: An Institutional Perspective." Annual Meeting of American Accounting Association, Honolulu, Hawaii, August 3-6.
- Ocasio, W. (1999). "Institutionalized Action and Corporate Governance: The Reliance on Rules of CEO Succession." *Administrative Science Quarterly* **44** (2), 384-416.
- Odeck, J. (2006). "Identifying Traffic Safety Best Practice: An Application of DEA and Malmquist Indices." *Omega* **34** (1), 28-40.
- Ødegaard, B. A. & Bøhren, Ø. (2003). "Governance and Performance Revisited." ECGI – Finance Working Paper No. 28/2003; *EFA 2003 Annual Conference* Paper No. 252
- OECD (2004). *OECD Principles of Corporate Governance*. OECD Publications, Paris.
- Olivencia [Report] Ruíz M., Ramallo García, L., Ballvé Lantero, P. et al. (1998). "The Governance of Listed Companies: Spain." Special Commission to Consider a Code of Ethics for Companies' Boards of Directors. Madrid, February.
- Oliver, C. (1991). "Strategic Responses to Institutional Processes." *Academy of Management Review* **16** (1), 145-179.
- Oliver, C. (1992). "The Antecedents of Deinstitutionalization." *Organization Studies* **13** (1), 563-588.
- Oliver, C. (1997a). "Sustainable Competitive Advantage: Combining Institutional and Resource-Based Views." *Strategic Management Journal* **18** (9), 697-713.
- Oliver, C. (1997b). "The Influence of Institutional and Task Environment Relationships on Organizational Performance: The Canadian Construction Industry." *Journal of Management Studies* **34** (1), 99-124.
- Ondrich, J. & Ruggiero, J. (2002). "Outlier Detection in Data Envelopment Analysis: An Analysis of Jacknifing." *Journal of the Operational Research Society* **53** (3), 342-346.
- Ooi, J. T. L. (2000). "Managerial Opportunism and the Capital Structure Decisions of Property Companies." *Journal of Property Investment & Finance* **18 (**3), 316-331.
- Pack, H. (1974). "The Employment-Output Tradeoff in LDC's – A Microeconomic Approach." *Oxford Economic Papers* **26** (3), 388-404.
- Pagano, M. & Volpin, P. (2001). "The Political Economy of Finance." *Oxford Review of Economic Policy* **17** (4), 502-519.
- Pagano, M. & Volpin, P. (2005). "The Political Economy of Corporate Governance." *American Economic Review* **95** (4), 1005-1030.
- Park, B. U., Sickles, R. C. & Simar, L. (2007). "Semiparametric Efficient Estimation of Dynamic Panel

Models." *Journal of Econometrics* **136** (1), 281-301.

- Park, S. & Song, M. H. (1995). "Employee Stock Ownership Plans, Firm Performance, and Monitoring by Outside Blockholders," *Financial Management* **24** (4), 52-65.
- Parsons, T. ([1934] 1990). "Prolegomena to a Theory of Social Institutions." *American Sociological Review* **55** (3), 319-339.
- Pedersen, T. & Thomsen, S. (1999). "Economic and Systemic Explanations of Ownership Concentration among European's Largest Companies." *International Journal of the Economics of Business* **6** (3), 367-381.
- Perez Toledo, E. (2007). "Quality of Governance and Firm Performance: Evidence from Spain." Research Work, Department of Business Economics, UAB.
- Peter, P. (2005). "Corporate Governance – What Should the Government Be Doing?" Policy Paper of the *Institute of Directors*, July, UK.
- Pi, L. & Timme, S. G. (1993). "Corporate Control and Bank Efficiency." *Journal of Banking and Finance* **17** (2-3), 515-530.
- Pindado, J. & de la Torre, C. (2006). "The Role of Investment, Financing and Dividend Decisions in Explaining Corporate Ownership Structure: Empirical Evidence from Spain." *European Financial Management* **12** (5), 661–687.
- Pinkowitz, L., Stulz, R. & Willamson, R. (2006). "Does the Contribution of Corporate Cash Holdings and Dividends to Firm Value Depend on Governance? A Cross-country Analysis." *Journal of Finance* **61** (6) 2725-2751.
- Plümper, T. & Troeger, V. E. (2007). "Efficient Estimation of Time Invariant and Rarely Changing Variables in Panel Data Analysis with Unit Effects." *Political Analysis* **15** (2) 124-139.
- Popov, E. V. & Simonova, V. L. (2006). "Forms of Opportunism between Principals and Agents." *International Advances in Economic Research* **12** (1), 115–123.
- Post, G. T. (2001). "Performance Benchmarking in Stochastic Environments Using Mean-variance Data Envelopment Analysis." *Operations Research* **49** (2), 281-292.
- Post, T., Cherchye, L. & Kuosmanen, T. (2002). "Non-parametric Efficiency Estimation in Stochastic Environments." *Operations Research* **50** (4), 645-655.
- Pound, J. (1988). "Proxy Contests and the Efficiency of Shareholder Oversight." *Journal of Financial Economics* **20** (1-2), 237-265.
- Powell, W. W. (1991). "Expanding the Scope of Institutional Analysis." In Powell, W. W. & DiMaggio, P. J. (Eds.). *The New Institutionalism in Organizational Analysis*. University of Chicago Press, Chicago.
- Prowse, S. (1992). "The Structure of Corporate Governance in Japan." *Journal of Finance* **47** (3), 1121-1140.
- Ramirez, C. D. (1995). "Did J. P. Morgan's Men Add Liquidity? Corporate Investment, Cash Flow, and Financial Structure at the Turn of the Twentieth Century." *Journal of Finance* **50** (2), 661-678.
- Renneboog, L. & Szilagyi, P. G. (2007) "How Relevant is Dividend Policy under Low Shareholder Protection?" ECGI – Finance Working Paper No. 128/2006 Available at SSRN: http://ssrn.com/abstract=925190. Accessed: 26/03/2007.
- Renneboog, L. (2000). "Ownership, Managerial Control and the Governance of Companies Listed on the Brussels Stock Exchange**.**" *Journal of Banking and Finance* **24** (12), 1959-1995.
- Rogers, E. M. (1995). *Diffusion of Innovations*. 4th Ed. Free Press, New York.
- Rousseeuw, P. J. & Leroy, A. M. (1987). *Robust Regression and Outlier Detection*. Wiley, New York.
- Sarkar, J. & Sarkar, S. (2000). "Large Shareholder Activism in Corporate Governance in Developing Countries: Evidence from India." *International Review of Finance* **1** (3), 164-194.
- Scott, R. W. & Meyer, J. W. (1991). "The Organization of Societal Sectors." In Powell, W. W. & DiMaggio, P. J. (Eds.). *The New Institutionalism in Organizational Analysis*, University of Chicago Press, Chicago.
- Scott, R. W. (1987). "The Adolescence of Institutional Theory." *Administrative Science Quarterly* **32** (3),

493-511.

- Scott, R. W. (1991). "Unpacking Institutional Arguments." In Powell, W. W. & DiMaggio, P. J. (Eds.). *The New Institutionalism in Organizational Analysis*. University of Chicago Press, Chicago.
- Scott, R. W. (2001). *Institutions and Organizations*. 2nd Ed. Sage, Thousand Oaks, CA.
- Seaver, B. & Triants, K. (1995). "The Impact of Outliers and Leverage Points for Efficiency Measurement and Evaluation Using High Breakdown Procedures." *Management Science* **41** (6), 937-956.
- Seifert, B., Gonenc, H. & Wright, J. (2005). "The International Evidence on Performance and Equity Ownership by Insiders, Block holders, and Institutions." *Journal of Multinational Financial Management* **15** (2), 171-191.
- Shephard, R. W. (1970). *Theory of Cost and Production Functions*. Princeton University Press, Princeton, NJ.
- Sherer, P. D. & Lee, K. (2002). "Institutional Change in Large Law Firms: A Resource Dependency and Institutional Perspective." *Academy of Management Journal* **45**, (1), 102-119.
- Sheu, H. J & Yang, C. Y. (2005). "Insider Ownership and Firm Performance in the Electronics Industry: A Technical Efficiency Perspective." *Managerial and Decision Economics* **26** (5), 307-318.
- Shleifer, A. & Vishny, R. W. (1986). "Large Shareholders and Corporate Control." *Journal of Political Economy* **94** (3), 461-488.
- Shleifer, A. & Vishny, R. W. (1997). "A Survey of Corporate Governance." *Journal of Finance* **52** (2), 737-783.
- Shleifer, A. & Wolfenzon, (2002). "Investor Protection and Equity Markets." *Journal of Financial Economics* **66** (1), 3-27.
- Short, H. & Keasey, K. (1999). **"**Managerial Ownership and the Performance of Firms: Evidence from the UK**."** *Journal of Corporate Finance* **5** (1), 79-101.
- Short, H. (1994). "Ownership, Control, Financial Structure and the Performance of Firms." *Journal of Economic Surveys* **8** (3), 203-249.
- Short, H., Keasey, K. & Duxbury, D. (2002). "Capital Structure, Management Ownership and Large External Shareholders: A UK Analysis." *International Journal of the Economics of Business* **9** (3), 375-399.
- Simar, L. (2003). "Detecting Outliers in Frontier Models: A Simple Approach." *Journal of Productivity Analysis* **20** (3), 391-424.
- Simar, L. & Wilson, P. W. (1999). "Estimating and Bootstrapping Malmquist Indices." *European Journal of Operational Research* **115** (3), 459-471.
- Simar, L. & Wilson, P. W. (2007). "Estimation and Inference in Two-Stage, Semi-Parametric Models of Production Processes." *Journal of Econometrics* **136** (1), 31-64.
- Sison, A. J. G. (2000). "The Cultural Dimensions of Codes of Corporate Governance: A Focus on the Olivencia Report." *Journal of Business Ethics* **27** (1-2), 181-192.
- Smith, M. P. (1996). "Shareholder Activism by Institutional Shareholders: Evidence from CalPERS." *Journal of Finance* **51** (1), 227-252.
- Solow, R. M. (1957). "Technical Change and the Aggregate Production Function." *Review of Economics and Statistics* **39** (3), 312-320.
- Spamann, H. (2006). "On the Insignificance and/or Endogeneity of La Porta et al.'s 'Anti-Director Rights Index' under Consistent Coding." Discussion Paper Nº 7, John M. Olin Center for Law, Economics, and Business Fellows' Discussion Paper Series, Harvard Law School.
- Stulz, R., Karolyi, A. & Doidge C. (2004). "Why do Countries Matter so much for Corporate Governance?" *NBER* Working Paper 10726.
- Thiele, H. & Brodersen, C. (1999). "Differences in Farm Efficiency in West and East Germany." *European Review of Agricultural Economics* **26** (3), 331-347.
- Thomsen, S. & Pedersen, T. (1996). "Nationality and Ownership Structures: The 100 Largest Companies in Six European Nations." *Management International Review* **36** (2), 149-166.
- Thomsen, S. & Pedersen, T. (1998). "Industry and Ownership Structure." *International Review of Law*

and Economics **18** (4), 385-402.

- Thomsen, S. & Pedersen, T. (2000). “Ownership Structure and Economic Performance in the Largest European Companies.” *Strategic Management Journal* **21** (6), 689-705.
- Tolbert, P. S. & Zucker, L. G. (1983). “Institutional Sources of Change in the Formal Structure of Organizations: The Diffusion of Civil Service Reform, 1888-1935.” *Administrative Science Quarterly* **28** (1), 22-39.
- Tortosa-Ausina, E., Grifell-Tatjé, E., Armero, C. & Conesa, D. (2008). “Sensitivity Analysis of Efficiency and Malmquist Productivity Indices: An Application to Spanish Savings Banks.” *European Journal of Operational Research* **80** (3), 474-499.
- Turk, J. (1998). “Productive Performance of Slovenian Milk Farms under the Former Regime and During the First Stages of Economic System Transformation.” *Eastern European Economics* **36** (2), 7-30.
- UNCTAD (2006). Guidance on Good Practices in Corporate Governance Disclosure. UNCTAD/ITE/TEB/2006/3, United Nations Publicaions, New York and Geneva.
- Weil, Gotshal & Manges [Gregory, H. J. & Simmelkjaer II, R. T.] (2002). “Comparative Study of Corporate Governance Codes Relevant to the European Union and its Member States.” A Report for the European Commission Internal Market Directorate General. Available at http://ec.europa.eu/ internal_ market/company/docs/corpgov/corp-gov-codes-rpt-part1_en.pdf. Accessed: 09/05/2007
- Wen, M., Li, D. & Lloyd, P. (2002). “Ownership and Technical Efficiency: A Cross-Section Study on the Third Industrial Census of China.” *Economic Development and Cultural Change* **50** (3), 709–734.
- Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. Free Press, New York, NY.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. Free Press, New York, NY.
- Wilson, P. W. (1993). “Detecting Outliers in Deterministic Nonparametric Frontier Models with Multiple Outputs.” *Journal of Business and Economic Statistics* **11** (3), 319-323.
- Wilson, P. W. (1995). “Detecting Influential Observations in Data Envelopment Analysis.” *Journal of Productivity Analysis* **6** (1), 27-46.
- Wilson, P. W. (2008). “FEAR: A Software Package for Frontier Efficiency Analysis with R.” *Socio-Economic Planning Sciences* **42** (4), 247-254.
- Wright, P., Mukherji, A. & Kroll, M. J. (2001). “A Reexamination of Agency Theory Assumptions: Extensions and Extrapolations.” *Journal of Socio-Economics* **30** (5), 413-429.
- Xu, X. & Wang, Y. (1997). “Ownership Structure, Corporate Governance, and Firms’ Performance: The Case of Chinese Stock Companies.” World Bank Policy Research Working Paper No. 1794. Available at SSRN: http://ssrn.com/abstract=45303. Accessed: 21/11/2006
- Yeh, Y. H. & Woidtke, T. (2005). “Commitment or Entrenchment?: Controlling Shareholders and Board Composition.” *Journal of Banking and Finance* **29** (7), 1857-1885.
- Yermack, D. (1996). “Higher Valuation of Companies with a Small Board of Directors.” *Journal of Financial Economics* **40** (2), 185–212.
- Young, G. J., Stedman, Y. & Beekun, R. I. (2000). “Boards of Directors and the Adoption of a CEO Performance Evaluation Process: Agency- and Institutional- Theory Perspectives.” *Journal of Management Studies* **37** (2), 277-295.
- Zeckhauser, R. J. & Pound, J. (1990). “Are Large Shareholders Effective Monitors? An Investigation of Share Ownership and Corporate Performance.” In Hubbard, R. G. (Ed.) *Asymmetric Information, Corporate Finance and Investment*. University of Chicago Press, Chicago, 149-180.
- Zelenyuk, V. & Zheka, V. (2006). “Corporate Governance and Firm’s Efficiency: The Case of a Transitional Country, Ukraine.” *Journal of Productivity Analysis* **25** (1), 143-157.
- Zheka, V. (2005). “Corporate Governance, Ownership Structure and Corporate Efficiency: The Case of Ukraine.” *Managerial and Decision Economics* **26** (7), 451-460.
- Zoido, M. E. (1998). “Un Estudio de Las Participaciones Accionariales de Los Bancos en Las Empresas Españolas.” *Investigaciones Económicas* **22** (3), 427-467.

- Zucker, L. G. (1987). "Institutional Theories of Organization." *Annual Review of Sociology* **13**, 443-464.

APPENDICES

Appendix A2.2: Corporate governance codes

Text box A1: The role of institutional differences: A *UK* perspective of value-decreasing corporate governance practices in Spain

How the Press, institutional activists and financial analysts in the *UK* (that unarguably has a more advanced corporate governance practice) view shareholding value decreasing practices in a Spanish Bank. It goes to buttress the importance of cross-country studies on corporate governance. At the time, Santander Central Hispano was rated as one of the best governed firms in Spain. This is one of the numerous articles that were written to prevent Abbey National's shareholders from voting in favour of the acquisition. Abbey National is now part of the Santander Group.

Critics question *SCH* governance
Financial Times - 14/15 August 2004; Jane Croft and Mark Mulligan

The gleaming new corporate headquarters building of Santander Central Hispano, Spain's largest bank, outside Madrid is still only partially built, yet it is already provoking claims of extravagance as far away as London. Built at a cost of €480m (£322m), Santander believes the citadel of office buildings, shopping and restaurant complexes, a workplace nursery, swimming pool and 18- and nine-hole golf courses is the future of corporate Europe. Some observers question the amount spent on the project. It is from this 150-hectare site dotted with 2,500 trees of 212 species and designed by leading architect Kevin Roche that Santander is masterminding its £8.2bn bid for Abbey National. If it succeeds, 1.7m *UK* retail investors will hold shares in *SCH*. But the Spanish bank, so well-known among consumers in Spain and Latin America, is virtually unknown in the *UK* and must persuade shareholders of the merits of its cash and shares bid. "Santander is having to sell this pretty hard to Abbey's investors," said a Madrid-based analyst. ……………………………………

James Leal, analyst at Teather & Greenwood, said: "Many *UK* private shareholders will never have heard of Santander." Miguel Trias, a Spanish mergers and acquisitions lawyer, said: "We can expect a lot of questions from the *UK* institutions. They tend to be a lot more independent and powerful than we are used to in Spain." **One issue attracting attention is the constitution of *SCH*'s 21-strong board - large by *UK* standards**. *SCH* bylaws mean the *SCH* board can have up to 30 directors - something unthinkable in a UK company. ***SCH* is run by Emilio Botín, who has been the bank's chairman since succeeding his father in 1986. Mr Botín's sons, Javier and Emilio, are on the 21-strong board, as well as his daughter, Ana Patricia.** Many observers consider this too large a representation for the family's 2.8 per cent stake in the bank. Sarah Wilson, managing director of Manifest, the proxy voting agency, said: "I think when talking about a bank of such size, people want to see smaller boards with more independent non-executives. A board with 21 directors seems enormous. The number of family members does seem out of proportion to the shares they own." The Botín family is not the only family within *SCH* represented on the board. Another director is Matías Rodríguez Inciarte. His brother, Juan Inciarte, is *SCH*'s executive vice-president Europe, although he is not on the board.

In its annual report, *SCH* says of the 16 non-executive directors on the board - eight are regarded as independent, five are proprietary and three are neither independent nor proprietary. Deminor, the Belgian-based rating agency, raised the issue of the Botín family influence in its corporate governance assessment of Santander, published in April, although it concludes: "This influence, coupled with a strong personality of the banking dynasty, has thus far been favourable to the long-term interests of the bank's stakeholders." Deminor gave Santander eight out of 10 for corporate governance, citing "superior performance". *SCH* has been stung by what it sees as a propaganda war against its bid for Abbey in the *UK*. It has been directing doubters to the **Deminor corporate governance report**, which concludes that *SCH* is "one of the leading corporate governance actors in continental Europe". In 2000, *SCH* was one of six global banks to agree to new guidelines against money laundering and it was the first company in Spain to disclose board remuneration and executive pay. "After the Enron scandal, Mr Botín saw which way corporate disclosure was headed and acted on it," said one person close to the bank. Nevertheless, there are differences to the *UK*. At *SCH*, there is no upper age limit for directors after changes to company statutes last year. ………………………

Antonio de Sommer Champalimaud, who joined the board three years ago, was 86 when he died in May. Santander defends the change, arguing that age should not be a determining factor in a person's qualifications for a seat. Pay-offs for departing directors [is] another issue. **In a form 20-F filing with the *US* Securities and Exchange Commission, *SCH* says some departing directors could receive payments of three to five times their total annual compensation - including fixed and variable compensation - if they leave.** "This is the equivalent of five years salary," said Sarah Wilson, of Manifest. "In the *UK*, the typical payment would be six months to a year." Mr Botín is also under investigation by a Spanish magistrate over a €164m severance package to two former executives of Banco Central Hispano, which merged with Banco Santander in 1999. ………… (emphasis added).

Source: Jane Croft and Mark Mulligan of Financial Times - 14/15 August 2004;

http://www.voteplus.net/news/2004/20041408FT2.htm Accessed: 08/02/2007

Table A1: Codes of corporate governance for 16 Western European countries and the *USA*

This starts with the publication of the *UK*'s Cadbury Report in 1992 after some major corporate failures in the late 1980s. Since then several countries and institutions have published and updated recommendations of good corporate governance practices over the past 15 years. The *UK* tops with 20 reports in this compilation. *US* has 12; Germany has 10; Spain has eight; Belgium has seven; France and Netherlands have six each; Italy and Portugal have five each; Denmark and Sweden have four each; Austria has three; Finland, Greece, Norway and Switzerland have two each, and; Ireland has one report. There are a total of 99 codes for the 17 countries. The number of codes and the country's (revised) anti-director rights index (*ADRI*) which ranges from zero to six are included besides each country name (*ADRI* are given in parentheses). The source of this compilation is the European Corporate Governance Institute (*ECGI*) – www.ecgi.org (accessed: January 2007) and Djankov et al. (2008).

Austria 3 (2.5)

- Austrian Code of Corporate Governance amended 2006
- Austrian Code of Corporate Governance amended 2005
- Austrian Code of Corporate Governance drafted 2002

Belgium 7 (3.0)

- Code Buysse: Corporate governance for non-listed companies 2005
- Belgian Corporate Governance Code 2004
- Draft Belgian Corporate Governance Code 2004
- Director's Charter 2000
- Guidelines on Corporate Governance Reporting 1999
- Corporate governance for Belgian listed companies (The Cardon Report) 1998
- Corporate Governance - Recommendations 1998

Denmark 4 (4.0)

- Revised Recommendations for Corporate Governance 2005
- Report on Corporate Governance in Denmark 2003
- The Nørby Committee's report on Corporate Governance 2001
- Guidelines on Good Management of a Listed Company 2000

Finland 2 (3.5)

- Improving Corporate Governance of Unlisted Companies 2006
- Corporate Governance Recommendations for Listed Companies 2003

France 6 (3.5)

- Recommandations sur le gouvernement d'entreprise 2004
- The Corporate Governance of Listed Corporations 2003
- Promoting Better Corporate Governance In Listed Companies 2002
- Vienot II Report 1999
- Recommendations on Corporate Governance 1998
- Vienot I Report 1995

Germany 10 (3.5)

- Amendment to the German Corporate Governance Code - The Cromme Code 2006
- Amendment to the German Corporate Governance Code - The Cromme Code 2005
- Corporate Governance Code for Asset Management Companies 2005
- Amendment to the German Corporate Governance Code - The Cromme Code 2003
- The German Corporate Governance Code - The Cromme Code 2002
- Baums Commission Report 2001
- German Code of Corporate Governance 2000
- Corporate Governance Rules for German Quoted Companies January 2000
- *DSW* Guidelines June 1998
- Gesetz zur Kontrolle und Transparenz im Unternehmensbereich 1998

Greece 2 (2.0)

- Principles of Corporate Governance 2001
- Principles on Corporate Governance in Greece: Recommendations for its Competitive Transformation 1999

Ireland 1 (5.0)

- Corporate Governance, Share Option and Other Incentive Schemes1999

-------------------*continued on next page*-----------------

Table A1 continued: Codes of corporate governance for 16 Western European countries and the *USA*

This starts with the publication of the *UK*'s Cadbury Report in 1992 after some major corporate failures in the late 1980s. Since then several countries and institutions have published and updated recommendations of good corporate governance practices over the past 15 years. The *UK* tops with 20 reports in this compilation. *US* has 12; Germany has 10; Spain has eight; Belgium has seven; France and Netherlands have six each; Italy and Portugal have five each; Denmark and Sweden have four each; Austria has three; Finland, Greece, Norway and Switzerland have two each, and; Ireland has one report. There are a total of 99 codes for the 17 countries. The number of codes and the country's (revised) anti-director rights index (*ADRI*) which ranges from zero to six are included besides each country name (*ADRI* are given in parentheses). The source of this compilation is the European Corporate Governance Institute (*ECGI*) – www.ecgi.org (accessed: January 2007) and Djankov et al. (2008).

Italy 5 (2.0)

- Corporate Governance Code 2006
- Handbook on Corporate Governance Reports 2004
- Corporate Governance Code 2002
- Report and Code of Conduct (The Preda Code) 1999
- Testo Unico sulle disponsizioni in materia di intermediazione 1998

Norway 2 (3.5)

- The Norwegian Code of Practice for Corporate Governance - Revised 2005
- The Norwegian Code of Practice for Corporate Governance 2004

Portugal 5 (2.5)

- White Book on Corporate Governance 2006
- Recommendations on Corporate Governance 2003
- *CMVM* Regulation Nº 11/2003: Corporate Governance 2003
- *CMVM* Regulation No 07/2001: Corporate Governance 2001
- Recommendations on Corporate Governance 1999

Spain 8 (5.0)

- Code of Ethics for Companies 2006
- Draft Unified Code of Recommendations for the Good Governance 2006
- *IC-A*: Principles of Good Corporate Governance 2004
- Decálogo del Directivo 2004
- *FEF*: Guide to Principles of Good Corporate Governance, Transparency of Information and Conflicts of Interest at Listed Companies 2003
- The Aldama report 2003
- Código de Buen Gobierno (the Olivencia report) 1998
- Círculo de Empresarios 1996

Sweden 4 (3.5)

- Swedish Code of Corporate Governance Report of the Code Group 2004
- Swedish Code of Corporate Governance A Proposal by the Code Group 2004
- The *NBK* Recommendations 2003
- Corporate Governance Policy 2001

Switzerland 2 (3.0)

- Swiss Code of Best Practice for Corporate Governance 2002
- Corporate Governance Directive 2002

The Netherlands 6 (2.5)

- *SCGOP* Handbook of Corporate Governance 2004
- The Dutch corporate governance code (the Tabaksblat Code) 2003
- Draft Corporate Governance Code 2003
- *SCGOP* Handbook of Corporate Governance 2001
- Government Governance; Corporate governance in the public sector, why and how? 2000
- Peters Report & Recommendations, Corporate Governance in the Netherlands 1997

----------------*continued on next page*----------------

Table A1 continued: Codes of corporate governance for 16 Western European countries and the *USA*

This starts with the publication of the *UK*'s Cadbury Report in 1992 after some major corporate failures in the late 1980s. Since then several countries and institutions have published and updated recommendations of good corporate governance practices over the past 15 years. The *UK* tops with 20 reports in this compilation. *US* has 12; Germany has 10; Spain has eight; Belgium has seven; France and Netherlands have six each; Italy and Portugal have five each; Denmark and Sweden have four each; Austria has three; Finland, Greece, Norway and Switzerland have two each, and; Ireland has one report. There are a total of 99 codes for the 17 countries. The number of codes and the country's (revised) anti-director rights index (*ADRI*) which ranges from zero to six are included besides each country name (*ADRI* are given in parentheses). The source of this compilation is the European Corporate Governance Institute (*ECGI*) – www.ecgi.org (accessed: January 2007) and Djankov et al. (2008).

United Kingdom 20 (5.0)

- The Combined Code on Corporate Governance 2006
- Good practice suggestions from the Higgs Report 2006
- Internal Control: Revised Guidance for Directors on the Combined Code 2005
- Pension Scheme Governance - fit for the 21st century: A Discussion Paper from the *NAPF* 2005
- Good Governance: The Code of Governance for the Voluntary and Community Sector 2005
- Corporate Governance: A Practical Guide 2004
- The Combined Code on Corporate Governance 2003
- Audit Committees - Combined Code Guidance (the Smith Report) 2003
- The Higgs Report: Review of the role and effectiveness of non-executive directors 2003
- The Responsibilities of Institutional Shareholders and Agents - Statement of Principles 2002
- The Hermes Principles 2002
- Review of the role and effectiveness of non-executive directors (Consultation Paper) 2002
- Code of Good Practice 2001
- The Combined Code: Principles of Good Governance and Code of Best Practice 2000
- Hermes Statement on International Voting Principles 1999
- The *KPMG* Review Internal Control: A Practical Guide 1999
- Internal Control : Guidance for Directors on the Combined Code (Turnbull Report) 1999
- Hampel Report 1998
- Greenbury Report (Study Group on Directors' Remuneration)1995
- Cadbury Report (The Financial Aspects of Corporate Governance) 1992

United States of America 12 (3.0)

- Asset Manager Code of Professional Conduct 2004
- Final *NYSE* Corporate Governance Rules 2003
- Restoring Trust - The Breeden Report on Corporate Governance for the future of *MCI*, Inc. 2003
- Commission on Public Trust and Private Enterprise Findings and Recommendations: Part 2: Corporate Governance 2003
- Corporate Governance Rule Proposals 2002
- Principles of Corporate Governance 2002
- Core Policies, General Principles, Positions & Explanatory Notes 2002
- Principles of Corporate Governance: Analysis & Recommendations 2002
- Report of the *NACD* Blue Ribbon Commission on Director Professionalism 2001
- *TIAA-CREF* Policy Statement on Corporate Governance 2000
- Global Corporate Governance Principles 1999
- Statement on Corporate Governance 1997

Text box A2: The Cadbury report

In 1995, a working party of the Centre for European Policy Studies (*CEPS*) drafted a report in which the Cadbury Report was summarised. The *CEPS* paper reports that a survey found only about half of the listed *UK* companies fully applying the Cadbury Report recommendations. The subsequent introduction of the Combined Code adopted in 2003 adds more recommendations and is the template of most national corporate governance codes in Europe and other countries.

The Cadbury Committee was set up in 1991 out of concern about standards of financial reporting and accountability and with the aim of taking a position on the role of executive and non-executive directors in corporations. The Committee adopted a "Code of Best Practice on the Financial Aspects of Corporate Governance" in 1992. Although it is voluntary, the Code is part of the listing requirements for the London Stock Exchange, and *UK*-listed companies have to make a statement of compliance in their annual report and eventually explain the reasons for any non-compliance. The main recommendations of the report are outlined below.

The board of directors

• Strong preference for a division of the role of the chief executive and chairman of a corporation.

• Importance of an independent element on the board: non-executive directors should be truly independent and of high calibre; they should be able to obtain independent advice, their pay should reflect time spent on the board and they should be appointed via a formal process.

• Executive directors' pay should be disclosed and subject to recommendations of a remuneration committee.

Reporting

• Requirement to appoint an audit committee, which is obliged to follow very detailed procedures; and

• The directors should report on the effectiveness of the internal control procedures and state that the business is a going concern.

British industry sees the Code as a serious burden and finds that it insists too much on structure. It is not easy to find non-executive directors of the right calibre and with sufficient time to complete their tasks, they argue, and statements in the annual report such as "the business is a going concern" and "internal controls are going on" can have far-reaching implications. A recent study found that more than one-half of a sample of 190 companies did not fully comply with the Code. In a continental European context, certain of the recommendations are seen as very British, whereas others pose little problem.

Source: CEPS Working Report Nº. 12, page 2, 1995

Appendix A2.3: Corporate governance attributes

This appendix gives ten tables of several governance attributes that are used to develop indices of good corporate practices. The more developed the capital markets, the more attributes are required. The rating firm Deminor has 300 corporate governance attributes which essentially covers every aspect of corporate governance. Institutional Shareholder Service (*ISS*) has an index of 55 attributes. The Investor Responsibility Research Centre (*IRRC*), a rating agency has joined forces with *ISS*. Credit Lyonnais Securities Asia (*CLSA*) has an index of 57 attributes. Another well-known rating agency is Governance Metrics International (*GMI*). Most empirical studies utilise ratings of firms done by these agencies or develop questionnaires based on some of these attributes and their relevance to the studies' samples. The ten tables compiled in this appendix show the similarities in governance indices used in the literature review. In some cases, percentage of firms that satisfy some of these governance attributes have been provided to see the importance of these attributes in corporate decision making.

Table A2: Governance provisions compiled by Investor Responsibility Research Centre

Gompers et al. (2003) used these governance provisions for *IRRC* data for 1990 (1357 *US* firms), 1993 (1343 *US* firms), 1995 (1373 *US* firms) and 1998 (1708 *US* firms). Please refer to Gompers et al. (2003: 145-150) for definitions of provisions. Each provision is awarded a point if it restricts shareholder rights (or increases managerial discretion). They build democracy (strongest shareholder rights) and dictatorship (weakest shareholder rights) portfolios.

Delay (tactic for delaying hostile bids Blank check, Classified board, Special meeting, Written consent
Protection (director/officer protection) Compensation plans, Contracts, Golden parachutes, Indemnification, Liability, Severance
Voting (voting rights) Bylaws, Charter, Cumulative voting, Secret ballot, Supermajority, Unequal voting
Other (other takeover defenses*)* Antigreenmail, Directors' duties, Fair price, Pension parachutes, Poison pill, Silver parachutes
State (State laws) Antigreenmail law, Business combination law, Cash-out law, Directors' duties law, Fair price law, Control share acquisition law

Table A3: 32 of the 57 questions in the *CLSA* questionnaire

This is used by Klapper and Love (2004) and Durnev and Kim (2005) in Developing a Governance Index for Emerging Economies

DISCIPLINE – Managerial incentives and discipline towards value-maximising actions
1. Has the company issued a mission statement that explicitly places a priority on good corporate governance?
2. Is expected remuneration of top managers tied to the value of firm shares?
3. Does management stick to clearly defined core businesses?
4. Has the company built up cash levels over the past five years?
5. Does the company's annual report devote a section to company's performance in governance implementation?
TRANSPARENCY – Timely and accurate disclosure
6. Does the company publish its annual report within 4 months of the end of the financial year?
7. Does the company publish results and announcements in the English (or another major) language within one working day?
8. Has management disclosed 3- or 5-year *ROA* or *ROE* targets?
INDEPENDENCE – Board independence
9. Is the chairman an independent non-executive director?
10. Does the company have a management board that has more than twice its representation on the directors' board and not dominated by major shareholders?
11. Does the company has an audit committee and is it chaired by an independent director?
12. Does the company has a remuneration committee and is it chaired by an independent director?
13. Does the company has a nominating committee and is it chaired by an independent director?
14. Are the external auditors unrelated to the company?
15. Does the board have representatives of banks or other large creditors of the company?
ACCOUNTABILITY – Board accountability
16. Does the company have independent directors on the board?
17. Are independent directors more than 50% of the board size?
18. Are there foreign nationals on the board?
19. Are full board meetings held at least four times in a year?
20. Does the audit committee supervise internal audit and accounting procedures?
RESPONSIBILITY – Enforcement and management accountability
21. Is the board size lesser than or equal to 12?
22. Are there mechanisms to punish the management board in the event of mismanagement?
23. Have the management/directors' boards taken decisions in recent times to benefit them at the expense of shareholders?

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Table A3 continued **: 32 of the 57 questions in the *CLSA* questionnaire**

This is used by Klapper and Love (2004) and Durnev and Kim (2005) in Developing a Governance Index for Emerging Economies

FAIRNESS/PROTECTION – Minority shareholder protection
24. Is the necessary information made available to shareholders before the General Meeting?
25. Do all shareholders have the right to call a general meeting?
26. Is proxy voting allowed?
27. Does the majority shareholder group own less than 40% of the company?
28. Does the head of Investor Relations report to either the *CEO* or a board member?
29. Has total directors' remuneration over the past five years increased faster than net profit after exceptionals?
SOCIAL AWARENESS – Social responsibility
30. Does the company have public policy statements that emphasize strict ethical behaviour?
31. Does the company adhere to specified industry guidelines on sourcing of materials?
32. Is the company environmentally conscious?

Table A4: Corporate governance attributes for 16 Western European countries and the *US*

The table has been taken from Aggarwal et al. (2007: 34). The results for attributes are in percentages. The first five are board characteristics. BOARD INDEPENDENCE: board is controlled by more than 50% independent outside directors; BOARD SIZE: board size is at greater than five but less than 16; CHAIRMAN/*CEO* SEPARATION: chairman and *CEO* are separated or there is a lead director; BOARD STRUCTURE: annually elected board (no staggered board); AUDIT COMMITTEE INDEPENDENCE: audit committee comprised solely of independent outsiders; AUDITOR RATIFICATION: auditors ratified at most recent annual meeting; and STOCK CLASSES: only single class, common stock (no dual class). They report both country and firm level differences in their analyses. Where the attribute is available for Spain, the percentage is juxtaposed in parentheses with results obtained by Perez-Toledo (2007) please refer to table A11.

Country	Board Independence	Board Size	Chairman/*CEO* Separation	Board Structure	Audit Committee Independence	Auditor Ratification	Stock Classes
Austria	11	84	100	5	0	89	100
Belgium	20	76	68	0	16	20	96
Denmark	68	82	100	59	9	95	73
Finland	68	81	100	87	48	100	71
France	29	76	46	1	22	35	42
Germany	44	86	100	0	4	95	100
Greece	5	91	89	2	9	98	100
Ireland	38	81	81	6	38	88	100
Italy	3	65	79	0	7	31	99
Netherlands	85	74	98	6	57	51	64
Norway	71	57	100	19	29	5	100
Portugal	36	71	64	0	21	14	86
Spain	7	69	63	2	9	89	96
Sweden	65	98	100	98	26	19	70
Switzerland	71	81	98	16	57	98	98
UK	35	91	97	7	68	98	99
USA	90	82	42	48	88	66	94

Table A5: Some questions on governance provisions in the German corporate governance rating

SHAREHOLDER RIGHTS
Is there a one share one vote provision?
Are there subscription rights for capital increases?
Are there modern communications for General Meetings and voting?
MANAGEMENT BOARD MATTERS
Are there remuneration and performance criteria of directors?
Is there a disclosure of directors' fixed and variable pay in annual reports?
Is there a selection process of directors?
What is the board size
Are there separate board subcommittees?
TRANSPARENCY
GOVERNANCE COMMITMENT
Are there firm-specific corporate governance guidelines set out in writing?
Is there a presence of a corporate governance subcommittee?
AUDITING
Are there firm-specific rules to ensure that the auditor does not perform other services for the firm (e.g. consulting work)?
Is International Accounting Standard (*IAS* and *GAAP*) used?
Does annual report contain information of risk-management system?

This is used in Drobetz et al. (2004b)

Table A6: Examples of some of the 300 corporate governance criteria in the four categories used in the Deminor governance rating

Rights and duties of shareholders Do shareholders exert sufficient power to determine corporate action? Is voting structure and procedure favourable to shareholders? Are shareholders able to file items on the agenda and counterproposal before and during general meetings? Are pre-emptive rights of existing shareholders guaranteed against voting power dilution?
Range of takeover defences Is the likelihood of a hostile takeover significantly decreased by adoption of antitakeover amendments? Is this done at the expense of shareholders?
Governance disclosure Are shareholders easily able to obtain comprehensive information about the firm's finances, board members, structure, committees, remuneration and stock option plans?
Board structure and functioning What is the composition of the board? How are board members elected? What are their remunerations and how do they function?

Bauer et al. (2004) use these attributes in their study.

Table A7: Corporate governance quotient rating criteria

Corporate governance attributes from *FTSE* Institutional Shareholder Service (*ISS*) Corporate Governance Index (*CGI*) Series Research Report (2005).

BOARD STRUCTURE	Retirement Age for Directors	Shareholder Approval of Option Plans
Board Composition	Board Performance Review	Compensation Committee Interlocks Director Compensation
Nominating Committee	Meetings of Outside Directors	Pension Plans for Non-Employee Directors
Compensation Committee	*CEO* Succession Plan	Option Expensing
Governance Committee	Outside Advisors Available to Board	Option Burn Rate
Board Structure	Directors Resign Upon Job Change	Corporate Loans
Board Size	Director Education	**AUDIT**
Changes in Board Size	**EQUITY STRUCTURE**	Audit Committee
Cumulative Voting	Features of Poison Pills	Audit Fees
Boards Served on – *CEO*	Vote Requirements	Auditor Rotation
Boards Served on – Other Than *CEO*	Written Consent	Auditor Ratification
Former *CEO*s	Special Meetings	**OWNERSHIP**
Chairman/*CEO* Separation	Board Amendments	Director Ownership
Board Guidelines	Capital Structure	Executive Stock Ownership Guidelines
Response to Shareholder Proposals	Takeover Provision Applicable Under State Law – Has Company Opted Out?	Director Stock Ownership Guidelines
Board Attendance	**COMPENSATION**	Officer and Director Stock Ownership
Board Vacancies	Cost of Option Plans	
Related Party Transactions	Option Re-pricing	

Table A8: Examples of anti-director rights that contribute to good corporate governance

This is abridged from La Porta et al. (1998)

Mailing of proxy vote.
Cumulative voting is allowed.
There is proportional representation of minority investors on the board.
There is a mechanism for oppressed minority.
Shareholders are not required to deposit their shares prior to a General Meeting.
There is a minimum percentage of share capital that allows a shareholder to call an extraordinary shareholders' meeting.
Shareholders' pre-emptive rights can only be waived by the shareholders' vote.

Table A9: 44 Governance attributes of the 55 provisions of the Institutional Shareholder Service

This index is used by Dahya et al. (2008) who divide the attributes into four sub-categories of board, audit, anti-takeover, and compensation and ownership. Seven individual attributes are included in their sub-governance index (*GOV*-7) and are indicated by an asterisk. *GOV*-7 index includes: Board independence; Board Size; Chairman/*CEO* Separation; Board Structure; Audit Committee Independence; Auditor Ratification; and Stock Classes. The sample consists of 2,234 foreign firms listed on a *US* stock exchange.

BOARD	24. Does not ignore shareholder proposal
1. All directors attended 75% of board meetings or had a valid excuse	25. Qualifies for proxy contest defences' combination points
2. *CEO* serves on the boards of two or fewer public companies	**AUDIT**
3. Board is controlled by more than 50% independent outside directors*	26. Consulting fees paid to auditors are less than audit fees paid to auditors
4. Board size is greater than five but less than 16*	27. Audit committee comprised solely of independent outsiders*
5. *CEO* is not listed as having a related-party transaction	28. Auditors ratified at most recent annual meeting*
6. No former *CEO* on the board	**ANTI-TAKEOVER**
7. Compensation committee comprised solely of independent outsiders	29. Single class, common*
8. Chairman and *CEO* are separated or there is a lead director*	30. Majority vote requirement to approve mergers (not supermajority)
9. Nominating committee comprised solely of independent outsiders	31. Shareholders may call special meetings
10. Governance committee exists and met in the past year	32. Shareholder may act by written consent
11. Shareholders vote on directors selected to fill vacancies	33. Company either has no poison pill or a pill that was shareholder approved
12. Governance guidelines are publicly disclosed	34. Company is not authorized to issue blank check preferred
13. Annually elected board (no staggered board)*	**COMPENSATION AND OWNERSHIP**
14. Policy exists on outside directorships (four or fewer boards is the limit)	35. Directors are subject to stock ownership requirements
15. Shareholders have cumulative voting rights	36. Executives are subject to stock ownership guidelines
16. Shareholder approval is required to increase/decrease board size	37. No interlocks among compensation committee members
17. Majority vote requirement to amend charter/bylaws (not supermajority)	38. Directors receive all or a portion of their fees in stock
18. Board has the express authority to hire its own advisors	39. All stock-incentive plans adopted with shareholder approval
19. Performance of the board is reviewed regularly	40. Options grants align with company performance and reasonable burn rate
20. Board approved succession plan in place for the *CEO*	41. Company expenses stock options
21. Outside directors meet without *CEO* and disclose number of times met	42. All directors with more than one year of service own stock
22. Directors are required to submit resignation upon a change in job	43. Officers' and directors' stock ownership is at least 1% but not over 30% of total shares outstanding
23. Board cannot amend bylaws without shareholder approval or can only do so under limited circumstances	44. Repricing is prohibited

Table A10: Corporate governance provisions used in the construction of *Gov*-score

This is the governance index by Brown and Caylor (2004). 51 provisions are grouped into eight categories of Audit; Board of Directors; Charter/Bylaws; Director Education; Executive and Director Compensation; Ownership; Progressive Practices, and; The State of Incorporation. The individual measures, categorised measures and *Gov*-Score are tested for expected relationships with six measures of operating performance, valuation and shareholder payout namely: Return on equity; Net profit margin; Sales growth; Tobin's *Q*; Dividend yield, and; Stock repurchases. They report that good governance measured using executive and director compensation is the most highly associated with good performance, while measures using charter/bylaws is most highly associated with bad performance.

AUDIT	**DIRECTOR EDUCATION**
Audit committee consists solely of independent outside directors.	At least one member of the board has participated in an ISS-accredited director education program.
Auditors were ratified at the most recent annual meeting.	**EXECUTIVE AND DIRECTOR COMPENSATION**
Consulting fees paid to auditors are less than audit fees paid to auditors.	No interlocks exist among directors on the compensation committee.
Company has a formal policy on auditor rotation.	Non-employees do not participate in company pension plans.
BOARD OF DIRECTORS	Option re-pricing did not occur within last three years.
Managers respond to shareholder proposals within 12 months of shareholder meeting.	Stock incentive plans were adopted with shareholder approval.
CEO serves on no more than two additional boards of other public companies.	Directors receive all or a portion of their fees in stock.
All directors attended at least 75% of board meetings or had a valid excuse for non-attendance.	Company does not provide any loans to executives for exercising options.
Size of board of directors is at least six but not more than 15 members.	The last time shareholders voted on pay plan, *ISS* did not deem its cost to be excessive.
No former *CEO* serves on the board.	The average options granted in the past three years as a percentage of basic shares outstanding did not exceed 3% (burn option rate).
CEO is not listed as having a "related party transaction" in proxy statement.	Option re-pricing is prohibited.
Board is controlled by more than 50% independent outside directors.	Company expenses stock options.
The *CEO* and Chairman duties are separated or a lead director is specified.	**OWNERSHIP**
Shareholders vote on directors selected to fill vacancies.	All directors with more than one year of service own stock.
Board members are elected annually.	Officers' and directors' stock ownership is at least 1% but not over 30% of total shares outstanding.
Shareholder approval is required to change board size.	Executives are subject to stock ownership guidelines.
Nominating committee is comprised solely of independent outside directors.	Directors are subject to stock ownership guidelines.
Governance committee meets at least once a year.	
Shareholders have cumulative voting rights to elect directors.	**PROGRESSIVE PRACTICES**
Board guidelines are in each proxy statement.	Mandatory retirement age for directors exist.
Policy exists requiring outside directors to serve on no more than five additional boards.	Performance of the board is reviewed regularly.
CHARTER / BYLAWS	A board approved *CEO* succession plan is in place.
A simple majority vote is required to approve a merger (not a supermajority).	Board has outside advisors.
Company either has no poison pill or a pill that was shareholder approved.	Directors are required to submit their resignation upon a change in job status.
Shareholders may act by written consent and the consent is non-unanimous.	Outside directors meet without *CEO* and disclose the number of times they met.
Company is not authorized to issue blank check preferred stock.	Director term limits exist.
Board cannot amend bylaws without shareholder approval or can do so under limited circumstances.	**STATE OF INCORPORATION**
	Incorporation States with anti-takeover provisions.

Table A11: Corporate governance provisions in Spain

The table gives the 25 questions used in Perez-Toledo (2007) to construct a governance index for Spanish listed firms. The percentage of firms with any of provisions is also indicated. 41% of the sample exhibit *CEO*/Chairman separation. 86% have an ideal board size of 5 to15 members. Where available, the results obtained by Aggarwal et al. (2007) are juxtaposed in parentheses. Please refer to table A4.

ACCESS TO INFORMATION
1 Does the company website provide information about its governance system? 95%
2 Does the company have an English version of its website where results and corporate governance related information are promptly updated (no later than one business day)? 65%
3 Does the company have an Investors Relation Department? 88%
4 Does the company disclose enough information or analysts' presentations with what any investor can make projections for the company? 60%
5 Does the company disclose information about its next or three-year *ROA* or *ROE* targets? 0%
6 Does the company publish/announce quarterly reports within two months of the end of the quarter? 91%
7 Are public announcement of results promptly published in the web page of the company? 97%
BOARD STRUCTURE
8 Are the audit committee and the nominating committee exclusively composed of independent outside directors? 28% (9% for audit committee).
9 Is the Chairman an independent, non executive director? 9%
10 Does the *CEO* serve on no more than one additional board of other public company? 40%
11 Is the board composed by no less than 5 and more than 15 members? 86% (69).
12 Is shareholder approval required for changing the board size? 100%
13 Has the Board approved any Golden Parachute Provision for the senior executives? 45%
14 Does the board not include direct representative of banks and other large creditors of the company? 80%
15 Do independent, non-executive directors account for more than 50% of the board? 32% (7%)
16 Are board members elected annually (do they have a unified mandate of one year and the re-election is not automatic?) 1% (2%).
OWNERSHIP AND CONTROL
17 The Chairman and the *CEO* are not represented by the same person. 41% (63%)
18 Do directors receive part of their remuneration in stocks/stock options? 16%
19 Is directors' stock ownership at least 1% but not over 30% of total outstanding shares? 30%
20 Does the Chairman have Casting Vote? 39%
PROGRESSIVE PRACTICES
21 Does the company offer tag along to the minority shareholders? 3%
22 Does the company publish the "Corporate Governance Annual Report" (as stated by the Aldama Code)? 91%
23 Does the board have outside advisors? 84%
24 Do directors' term limits exist? 71%
25 Does mandatory retirement age for directors exist? 48%

Appendix A2.4: Empirical studies on corporate governance and performance

This appendix covers tabularised empirical studies on the corporate governance – performance relationship. The first table reports on 51 empirical studies of corporate governance that covers aspects of ownership, board of directors and corporate governance indices from 1972 to 2007. The emphasis is on studies effective from 1990. The study is biased towards the structure of ownership as that seems to be the most researched and yet still provides inconclusive evidence. The publication year, data type and country, research objective, statistical methods, ownership, performance, board (when applicable), governance indices (when applicable) and control variables that affect the relationships are all reported. The results of the studies are also reported.

The second table compares three *EU* countries (Belgium, Spain and the *UK*) along the lines of seven research questions by Klaus Gugler (2001). The third and fourth tables compare ownership concentration and identity in some Western European countries and the *US* as researched by Bohren and Odegaard (2000). These tables group countries into legal origins following La Porta et al. (1998) and provide shareholding and owner type averages for the countries and their different legal origins.

Table A12: 51 empirical studies on corporate governance and performance

Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1972/ Elliot/ Journal of Financial and Quantitative Analysis/ 88 firms of 840 firms from *S&P*'s Compustat Data for 1964 to 1967.	**Method**: Variance analysis. **Ownership variables**: Management control ≤ 5% single block of voting control; Ownership control ≥ 10% and evidence of active control, or, ≥ 20%. **Performance variables**: Change in sales; Change in assets; Dividends; Return on stocks; Profits; *ROE*; Growth in spending. **Control variables**: None **Other variables**: Stock of liquid assets; Cash flow; Debt/Equity; Non-equity financed assets; Discretionary income; Capital expenditures/ Net plant size; Size by sales; Growth in sales.	No significant effects between owner controlled and manager controlled firms except with regard to change in cash flow.
1973/ Boudreaux/ Southern Economic Journal/ 72 firms of the 500 largest *US* industrial firms (data from 1952 to 1963).	**Methods**: Analysis of variance and covariance analysis. **Ownership variables**: Management control ≤ 5% single block of voting control; Ownership control ≥ and evidence of active control, or, ≥ 20%. **Performance variable**: Observed *ROE* for the 1952 to 1963 period. **Control variables**: Industry type by major product; Size of firm by sales.	Owner controlled firms are significantly (strong) more profitable than manager controlled firms; Time and industry type are also significant; Size is not. Firm risk is also considered.
1980/ Bothwell/ Journal of Industrial Economics/ 150 large industrial *US* firms from Fortune 500 (1960 to 1967 data).	**Methods**: Binary regression equivalent of a two-way analysis of variance with interactions. The sample is classified in order to control for monopoly power. **Ownership variables**: Management control ≤10% single block of common stock; 30%>Weak owner control >10%; Strong owner control ≥30%; All owner control = Weak owner control + Strong owner control. **Performance variables**: A risk adjusted return on sales; *ROE*. **Control variable**: Monopoly power by barriers to entry or market share.	Among firms with a large degree of monopoly power, 'weak owner control' and 'all owner control' firms are significantly more profitable than manager controlled firms if risk adjusted measure of return is used, otherwise not.
1985/ Demsetz & Lehn/ Journal of Political Economy/ 511 large *US* firms including Utilities and Financials using 1976 to 1980 data.	**Methods**: *OLS* regression. **Ownership variables**: Log of Herfindahl index; Log of combined holdings by 5 largest shareholders; Log of holding by 20 largest shareholders; Holdings by 5 largest families and individuals; Holdings by 5 largest institutional investors. **Performance variables**: *ROE*, Standard error of market model regressing firm return on market return. **Control variables**: Firm size by market value of equity; Standard deviation of Stock return; Standard deviation of accounting return on equity; Industry dummies for Utilities, Financials and Media; Capital expenditure/total sales; Advertising/Total sales; *R&D*/Total Sales.	Performance by accounting return is insignificantly decreasing with ownership by 5 or 20 largest shareholders or by the Herfindahl index. Ownership by 5 or 20 largest shareholders (or Herfindahl or family/individual or institutional ownership) increases significantly by standard error of market return. Market value and all measures of industry and standard deviation are significant control variables.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1986/ Cubbin & Leech/ Managerial and Decision Economics/ 43 large industrial *UK* firms for the 1969-1974 period.	**Methods**: *OLS* and *2SLS* regressions. Ownership variables: Dummy for external control that is control by non-directors and managers; Degree of control of largest shareholder. **Performance variable**: Average profit rate. **Control variables**: Size by net assets; Diversification; Beta risk; Profit salary trade-off for internally controlled firms; Asset growth rate; Internal assets growth rate; Industry subgroup average profit rate. **Dependent variables**: Growth; Profits. Checks for simultaneous effect of internal versus external control, and degree of control by including interacting terms.	It is more of a study on the relationship between growth and profits than on ownership and performance. Positive relation between asset growth and profit but none for ownership and profits. Industry subgroup average profit and Beta risk are significant control variables.
1988/ Holderness & Sheehan/ Journal of Financial Economics/ 101 majority held and 101 diffusely held large *NYSE* and *AMEX* listed firms for the period 1979-1984.	**Methods**: Standard *t*-tests. The sample is further classified in order to control for identity of majority-held control: majority-held by individuals and ownership control by entities. **Ownership variables**: 95%> majority-held >50%, % ownership by any single individual or entity (other than corporation or fund); Diffusely-held <20% ownership by any shareholder. **Performance variables**: Tobin's *Q* by firm's market value to replacement cost of plants and inventories; *ROE*. **Control variables**: Each of the 101 majority-held firms are paired with a diffusely-held firm with approximately same size by total assets, and two-digit *SIC* code.	Finds no significant difference in performance between majority-held and diffusely-held firms.
1988/ Morck, Shleifer & Vishny/ Journal of Financial Economics/ 371 of the largest *US* industrial firms (Fortune 500) with 1980 data.	**Methods**: *OLS* regression; Piecewise linear regression. **Ownership variables**: Combined shareholdings by all members of the board in the ranges: 0-5%, 5-25%, 25-100%; Combined shareholding by top two officers; Dummy for presence of founder on board. Data from Corporate Data Exchange. **Performance variables**: Tobin's *Q* by market value of stock; Preferred stock and debt to replacement cost of plant and inventories; Profit rate by net cash flow to replacement cost of capital. **Control variables**: Size by replacement cost of assets; *R&D* cost to size; Advertising to size; Long-term debt to size; Industry by 3-digit *SIC*.	Profitability is significantly increasing for both ownership in the 0-5% range and significantly decreasing firm the 5-25% range and if the founder is present on the board of all firms. Significant controls are: *R&D* to size and debt to size. Similar results for top two officers.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1990/ Agrawal & Mandelker/ Journal of Financial and Quantitative Analysis/ 365 *US* listed firms who announced adoption of antitakeover charter amendments (data from 1979-1985).	**Methods**: Event study; *OLS* regression checks for simultaneous effect type of amendment and % of institutional ownership by including interaction terms. **Ownership variables**: % of all institutional share owners; Concentration of institutional ownership by a Herfindahl index; % of ownership by two largest 5% blockholders; Insider ownership by managers and directors. **Performance variable**: 41-days cumulative abnormal return (*CAR*) by the firm over the interval (*AD*-40, *AD*+1) where *AD* is the announcement date. **Control variables**: Size by log of stock value; Dummies for the different types of anti-takeover amendments.	*CAR* decreases significantly with the adoption of antitakeover amendments; *CAR* increases for increasing institutional ownership, concentration of institutional ownership, and ownership by 5% blockholders. However, there is no evidence of a difference in *CAR* for different levels of insider ownership. The *OLS* regression confirms the above results regarding institutional and insider ownership. It also shows a higher decrease in *CAR* the more entrenching the amendments.
1990/ McConnell & Servaes/ Journal of Financial Economics/ 1173 firms in 1976 and 1093 in 1986. *US* firms listed on *NYSE* or *AMEX*.	**Methods**: *OLS* regression. Test for roof-shape relation by including the square of insider ownership (or insiders plus blockholders) and using piecewise linear regression. **Ownership variables**: Insider stock ownership by managers and directors; Institutional ownership; Blockholders as combined ownership by non-insiders who have more than 5% ownership; Largest single blockholder; Dummy for presence of blockholders; Insiders plus all blockholders; Insider ownership in the ranges: 0-5%, 5-25%, 25-100%; Insiders plus all blockholders in the ranges: 0-5%, 5-25%, 25-100%. **Performance variables**: Tobin's *Q* by market value of stock, preferred stock and debt to replacement value of asset; Return on assets by earnings before depreciation, interest and taxes divided by replacement value of assets. **Control variables**: For a limited set of tests industry has been accounted for by subtracting average industry differences in Tobin's *Q* from each observation of Tobin's *Q*; Size by replacement cost of assets; *R&D* cost to size; Advertising to size; Long-term debt to size.	Both measures of profitability are significantly increasing with ownership by managers and directors, and this relationship is significantly roof-shaped with a performance peak for 69% ownership in 1976 and 41% in 1986. Defining ownership as insiders plus all blockholders produce similar results. Performance increases significantly ith institutional ownership, but no measure of blockholder ownership seems to have any effect. All control variables are significant. Using piecewise linear regression, `profitability significantly increases for insider (all insiders plus blockholders) ownership in the 0-5% range.
1990/ Zeckhauser & Pound/ Asymmetric Information, Corporate Finance and Investment/ 286 large non-financial *US* firms with data from 1988 and 1989.	**Methods**: Standard *t*-tests are applied. The sample is classified in order to control for asset specificity. **Ownership variables**: Management controlled ≤15% of cohesive stock ownership; owner-controlled ≥15% of cohesive voting stock ownership. **Performance variable**: Earnings/ Price ratio. **Control variables**: Asset specificity by *R&D*/ Sales. **Other variables**: Dividend payout by dividend/ Earnings; Leverage by debt/ debt plus market value of equity.	Among firms with high asset specificity, owner-controlled firms have significantly lower *E/P* ratios than management controlled firms do. Firms with low asset specificity have no significant *E/P* difference. There is no significant difference in leverage or dividend between owner-controlled and management controlled firms.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1991/ Hermalin & Weisbach/ Financial Management/ 134 firms listed on the *NYSE* with 1971, 1974, 1977, 1980 and 1983 data.	**Methods**: *OLS* regression pooling with pooled data of the five periods. Instrumental variable regression using lagged values of stock ownership as instruments; Piecewise linear regression on *CEO* ownership, outside director proportion of board, and *CEO* tenure. Use Hausman's specification test. **Ownership variables**: Combined stock ownership by present *CEO* and all former *CEO*s on the board in the range of 0-1%, 1-5%, 5-20%, 20-100%. **Performance variables**: Tobin's *Q* by market value of stock, preferred stock and debt to market value of capital stock, inventories, and other assets; Return on assets by *EBIT* to replacement value of assets. **Control and other dependent variables**: Industry controlled by subtracting average industry differences in Tobin's *Q* from each observation of Tobin's *Q*; Size is by log of replacement cost of assets; *R&D* cost to size; Advertising cost to size; Proportion of outside directors in the ranges of 0-40%, 40-60% and 60-100%. Tenure by *CEO* in the ranges of 0-4, 5-9, 10-14, and above 15 years; Median tenure of inside or outside directors on board; Dummy for family relation between any two board members.	Performance increases significantly with *CEO* ownership in 0-1% range and decreases significantly in the 1-5% range; Significant controls are R&D to size and advertising to size. Apart from these two, the regressions present insignificant or contradicting evidence. The Hausman test rejects the hypothesis that there is no simultaneity at the 5% level.
1991/ Leech & Leahy/ The Economic Journal/ 470 large *UK* industrial firms with data from 1983-1985.	**Methods**: Multivariate regression; Simultaneous equations model; Multiple regression analysis. Each performance variable is regressed individually. A specification search is made over pairs of ownership structure variables (concentration and type) that report the specification yielding the highest significance. **Ownership variables**: 5 ownership concentration indices: Herfindahl index and combined holding of 1, 5, 10 and 20 shareholders; 6 control type indices for management controlled or owner-controlled: owner-controlled ≥5%, 10%, and 20% of cohesive stock ownership or zero if largest cohesive stockholding has 90%, 95% or 99% chance of winning a majority vote; management controlled otherwise. **Performance variables**: Historic market value / ordinary share capital; Return on sales; Return on equity. **Control variables**: Size by log of sales; Product diversification; Export intensity or sales; Capital to labour ratio; Age of firm; Beta risk; Standard deviation of return; Industry dummies. **Other dependent variables**: Sales growth; Asset growth; Salary of highest paid director.	Owner-controlled firms are significantly (weak) more profitable than management controlled firms with regards to return on equity, return on sales, growth of sales and growth of net assets. Rules based on owner-controlled ≥5%, 10%, and 20% were never significant. More concentration caused significantly less performance in terms of historic market value / ordinary share capital and return on sales. Significant controls are size, export intensity, beta risk, and standard risk.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1993/ Kole/ Working Paper/ 371 of the largest *US* firms (Fortune 500) in 1980. Data is same as Morck, Shleifer & Vishny (1988)	**Methods**: *OLS* regression; Piecewise linear regression; Use of sub sample of low and high *R&D* firms to check directly for *Q* bias due to *R&D*. Use of lagged performance variables to test for causality. **Ownership variables**: Combined shareholdings by board members in the ranges of 0-5%, 5-25%, and 25-100%. **Performance variables**: Tobin's *Q* by market value of stock, preferred stock and debt to replacement cost of plant and inventories; Return on assets; Change in Tobin's *Q*; Change in return on assets. **Control variables**: Size by replacement cost of assets; *R&D* costs to size; Advertising to size; Long-term debt to size; Firm growth as average growth in sales from 1977 to 1980; Stock performance as market adjusted abnormal return.	Starts reproducing the model of Morck et al. (1988). When that model is run on a sub-sample of low *R&D* firms – a better way to correct for *Q* bias due to *R&D* – profitability only significantly increases for board ownership in the 0-5% range. Same result is produced running a full sample less outliers (*Q* > 4.5) and including two more controls – firm growth and stock performance. In this model, all the controls become significant and the adjusted R-square reaches 55%. Finally, a series of lagged *OLS* regressions are run to indicate the endogeneity of ownership.
1994/ Curcio/ Discussion Paper, Centre for Economic Performance, London School of Economics/ 39 quoted *UK* manufacturing firms with 1972 to 1986 data.	**Methods**: OLS regression and a heteroscedasticity consistent technique. Test for roof-shaped relation by including the squared insider ownership and by using piecewise linear regression. **Ownership variables**: Combined equity or voting ownership by board members from 0-5%, 5-25%, 25-100%; Equity or voting ownership by the board of directors; Disparity between board stock and voting ownership observed in 1981. **Performance variables**: Tobin's *Q*; *TFP* growth or real value added by employee remuneration plus interest payments, depreciation, amortisation and profits. **Control variables**: None on Tobin's *Q* regression; For *TFP*: Log of average hours worked; Log of capital stock; Time; Industry; Market share and its growth; Market share by 5 largest firms; Import penetration; Leverage and its growth; Small firm dummy; Union density.	Profitability is significantly decreasing with board ownership from 25-100% with regards to Tobin's *Q*. Profitability is significantly decreasing with the disparity between equity and voting ownership both with regards to Tobin's *Q* and productivity growth (*TFP*).The controls that are significant are import penetration, average hours worked and leverage.

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Table A12 continued: 51 empirical studies on corporate governance and performance

Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1994/ Denis & Denis/ Journal of Corporate Finance/ 72 *US* firms with above 50% insider ownership by managers and directors with 1985.	**Methods**: Standard t-tests are applied to test for differences between the main sample and an industry paired control sample. **Ownership variables**: Majority ownership - >50% insider ownership by managers and directors; Institutional ownership; Dummy for outside blockholders; Dummy for family or founder involvement in management or board of directors. **Performance variables**: *ROE*; *ROA*; Operating income to assets; Tobin's *Q*; Market-to-book ratio. **Control variables**: Fraction of outside board members; Board size; Dividend yields; Debt asset ratio; No. of public securities offerings; Size by market value of equity; Variance of stock returns; *R&D* to sales; Dummy for dual class shares.	No difference in performance between the majority controlled firms and other firms; The likelihood of majority control increases significantly with family or founder involvement; 80% of majority controlled firms have substantial family or founder involvement. Majority controlled firms have significantly: less outside directors; less outside blockholdings; less institutional shareholdings; pay less dividends; Dual class shares; All other controls are insignificant.
1994/ Keasey, Short & Watson/ Small Business Economics/ 72 *UK SMEs* with 1986-1988 data.	**Methods**: OLS regression and the Halbert-White technique to correct for heteroscedasticity; Test for roof-shaped relationship by squaring board ownership and use of piecewise linear regression. **Ownership variables**: Equity ownership by the board of directors; management controlled ≤*Y*% of equity ownership by directors, *Y* ϵ (10, 20, …….., 90). Owner controlled ≥ *Y*% of equity by directors; Equity ownership by the board of directors in the ranges of 0-68% and 68-100%. **Performance variable**: Return on assets. **Control variables**: Remuneration of directors divided by assets; Dummy for perceived need for management systems; Size by assets; Leverage; Dummy for secured debt or not; Growth in assets; Industry dummies; Firm's age; Directorships in other firms or not.	Performance is significantly increasing with board ownership and this relation is significantly roof-shaped. This is also confirmed using piecewise linear regression. Performance also increases if directors are represented in other firms' boards. Significant controls are need for management systems and director remuneration.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
1996/ Agrawal & Knoeber/ Journal of Quantitative and Financial Economics/ 383 large *US* firms (from Forbes 800 using 1987 data).	**Methods**: *OLS* and *2SLS* regressions. Test for a roof-shaped relation by including the square of insider ownership. **Ownership variables**: % insider ownership by directors and officers; Dummy for presence of founding *CEO*; % of shares held by above 5% blockholders. **Performance variable**: Tobin's *Q* by market value of stock, preferred stock and debt to book value of assets. Ownership variables: % of insider ownership by directors and officers; Dummy for presence of founding *CEO*; % of shares held by large blockholders with more than 5%. **Control variables**: Size by assets; Standard deviation of stock return; Dummy for regulated firms; Years of *CEO* tenure; Number of officers and directors; *R&D* to assets; Number of institutional shareholders; Dummy for *NYSE* listing; Firm diversification; No. of *CEO* job opportunities; Cash flow return; Control activity by % of acquired firms in each two-digit *SIC*; Advertising/assets. **Other dependent variables**: Insider ownership; Blockholder ownership; Institutional ownership; Fraction of non-officers on the board. Years of *CEO* employment; Leverage by debt to firm value.	*OLS* on Tobin's *Q*: Tobin's *Q* decreases significantly with board outsiders, leverage, and corporate control activity. It increases significantly with insider ownership. *2SLS* on Tobin's *Q*: Tobin's *Q* decreases significantly with board outsiders. *2SLS* without Tobin's *Q*: Shareholdings by blockholdings and institutional investors increases significantly by corporate control activity; Institutional ownership decreases significantly with blockholder ownership and vice versa; Leverage increases significantly with insider ownership and outside board membership but not vice versa. Years of *CEO* employment decreases significantly with institutional and blockholder ownership, but not vice versa.
1996/ Galve Górriz & Salas-Fumás/ Managerial and Decision Economics 17 (6), 575-586/ Two years of data for 81 non-financial firms quoted on the Spanish stock market. *Family-owned firms are smaller than non-family owned firms. They are more efficient but not more profitable.*	**Method**: *OLS* regression. **Ownership variable**: Ownership types. **Performance variables**: Size (value added per worker, capital stock and sales). **Control variables**: Debt-to-equity ratio, scale economies and market power. **Other variable**: Capital to labour ratio Agency theory is supplemented with classical managerial theory in this study.	Family-owned firms have higher productive efficiencies than non-family owned firms. Family-owned firm sizes are smaller. Family-owned firms are not more profitable due to their size constraints.
1996/ Thomsen & Pedersen Management International Review, 36 (2), 149-166/ 600 firms selected among the 100 largest non-financial companies in 6 European countries with data from 1990 to 1993.	**Method**: *OLS* regression **Ownership variable**: % of ownership share by largest owner. **Performance variables**: Return on equity; Sales growth. **Control variables**: Size by log of assets and log turnover of market share; Standard deviation of return on equity; Industry dummies; Dummies for nation effects.	Among others, they hypothesise and support; that ownership differences differ across industries that cannot only be explained by size; that political, institutional and cultural differences between countries also explains ownership patterns in addition to size and industry; that there are no significant differences in economic performance (measured by profitability and growth) between ownership categories.

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Table A12 continued: 51 empirical studies on corporate governance and performance
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Year/Author/Journal/Sample	Statistical methods and variables	Main results
1997/ Nickell, Nicolitsas & Dryden/ European Economic Review 580 *UK* manufacturing firms with data from 1985 to 1994. *External shareholder with a high degree of control can enforce a higher productivity performance*	**Methods**: Cobb-Douglas production function for productivity growth. Regression technique by Arellano and Bond (1991) for dynamic panel data models. Checks for substitution effects between financial pressure, monopoly power and shareholder control by including interaction terms. **Ownership variables**: Dummies [for a financial firm; a person, a family, a group of linked individuals, a company pension fund or charity; a non-financial company] equal to 1 if largest shareholder has 90% or 95% chance of winning a majority vote. **Performance variables**: Productivity growth as change in log of real sales. **Control variables**: Lagged productivity growth; Change in log of employment; Change in log of capital stock; Change in index of industry overtime hours; Monopoly power by change of market share, or industry concentration or industry import penetration or rent/ value added; Size by log of employment; Financial pressure by interest payments/ cash flow; 22 industry dummies (for industry-specific technological factors) and time dummies.	Productivity increases significantly with financial firms and decreases significantly with non-financial companies. Significant substitution effect between financial pressure and monopoly power, financial firms and monopoly power. Significant controls: Employment, index of industry overtime hours, market share, and rent/ value added. Firms with a dominant external shareholder from the financial sector have higher productivity growth rates.
1998/ Cho/ Journal of Financial Economics 47, 103-121/ 326 of 500 large *US* firms (Fortune 500) using 1991 data. *Ownership structure has an effect on investment. Ownership structure is endogenous.*	**Methods**: *OLS* regression – tests for non-monotonic relationship by piecewise linear regression and fix the breakpoints by a grid search technique that maximises significance; *2SLS* and *3SLS* regressions. Estimates 3 equations with ownership, performance and investments as the dependent variables. **Ownership variables**: Inside ownership as share ownership by officers and directors of the board; Insider ownership from 0-7%, 7-38%, and 38-100%. **Performance variable**: Tobin's *Q*. **Control variables**: Corporate investment by capital expenditure, and by *R&D* expenditure; Size by log of replacement cost of assets or market value of equity (to control for managerial wealth constraints and risk aversion); Financial leverage by the market value of long term debt to replacement cost of assets; Two-digit industry dummies; Liquidity by cash flow to replacement cost of capital; Volatility by standard deviation of profit rates (1986-1991).	In 2 separate *OLS* regressions, Tobin's *Q* and capital expenditure is significantly increasing for inside ownership (0-7%) and significantly decreasing from (7 to 38%). The *2SLS* regression reveals that insider ownership increases significantly with Tobin's *Q*; and Tobin's Q increases insignificantly with inside ownership; Performance increases significantly by capital expenditure and vice versa. Market value of equity and liquidity are significant control variables. The author argues that inside ownership determines investment which in turn determines performance, then performance determines insider ownership.

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Table A12 continued: 51 empirical studies on corporate governance and performance
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Year/Author/Journal/Sample	Statistical methods and variables	Main results
1998/ Eckbo & Smith/ Journal of Finance/ 18,301 insider trades on Oslo Stock Exchange for 247 securities at 197 firms for the period 1985-1992.	**Methods**: Event/ portfolio study. Compares various measures of *AMAR* (average monthly abnormal return) on various definitions of insider portfolios. **Ownership variables**: Insiders are top-directors and directors; the firm's auditor and investment advisor; and close family members of these. **Performance variables**: *AMAR*1 using equal weighted *CAPM*; *AMAR*2 using conditional multifactor model with value weights; *AMAR*3 using conditional multifactor model with ownership weights. **Control variables and dependent variables**; *AMAR*2 and *AMAR*3 adjusts abnormal returns for: Return spread between Norwegian interbank rate and change in World stock index; Real Norwegian interbank rate; Interest spread between interbank rate and ten-year government bonds; Return spread between Norwegian interbank rate and change in World stock index lagged one period; World stock dividend less Norwegian interbank rate lagged one period; Real Norwegian interbank rate lagged one period; Dummy for month of January.	*AMAR*1 produce conflicting evidence on insider earnings; *AMAR*2 and *AMAR*3 do not produce any significant evidence on insider trading. No systematic evidence on insider profits could be found on insider portfolios sorted after: Size of trades; % size of insider ownership; Value of insider ownership. Insider portfolios are unable to outperform mutual funds.
1998/ Gugler/ Empirica 25, 285-307/ 1996 data on 600 largest Austrian firms, 1991-1995 data on 214 of these firms and a further 1975-1994 data on 94 of these firms. *Hypotheses* *Ownership concentration is linked to efficient governance.* *Identity of large controlling shareholders has a link with efficient governance.* *Entrenchment and expropriation are associated with large controlling shareholders.*	**Methods**: *OLS* regressions **Ownership variables**: Identity (Banks, Non-bank domestic, Foreign, State, Individual or family, Public or dispersed ownership); Direct ownership; Ultimate ownership, and; Largest ultimate shareholder. **Performance variable**: Internal rate of return **Control variables**: Industry dummies; Size by book value of assets; Investment in capital stocks and financial assets; Standard deviation of profit margin.	Ownership concentration is higher in Austria than in other western European countries. Although ownership concentration enhances firm performance, because of the very high levels of ownership in Austrian firms, a negative relationship with profitability is observed due to entrenchment. Expropriation of minorities is also reported. Foreign owners enhance profitability while State ownership decreases profitability.
1998/ Li & Simerly/ Strategic Management Journal 19 (2), 169-179/ Four years of data for 90 large companies in the *US IT* and Food and Beverages sectors. *Environmental dynamism moderates positively on the insider-ownership performance relationship*	**Method**: *OLS* regression **Ownership variable**: *CEO* stock ownership. **Performance variables**: *ROA*, *ROI*, *OROA*, *ROE*. **Control variables**: Market value of *CEO*'s stockholdings; Long-term debt to total equity (leverage); Herfindahl index to control for diversification; Degree of institutional ownership; Size; Firm age; *CEO*/Chairman duality.	Increased insider ownership may lead to better returns under conditions of greater environmental dynamism.

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Table A12 continued: 51 empirical studies on corporate governance and performance
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Year/Author/Journal/Sample	Statistical methods and variables	Main results
1999/ Himmelberg, Hubbard & Palia/ Journal of Financial Economics/ Panel data from Compustat; Small and Large *US* firms. 398 (1982), 425 (1983) and 427 (1984).	**Methods**: *OLS* and *IV* regressions. Use of panel data fixed-effects estimator to avoid inconsistent estimates because of endogeneity of managerial ownership caused by unobserved determinants of ownership and performance as opposed to reverse causality; Test for roof-shaped relation by using quadratic and piecewise linear regression; Use dummies to control for bias and missing values regarding *R&D*, Advertising and return volatility; Use a Hausman test for endogeneity testing. **Ownership variables**: % of common equity holdings by all top-level managers (*Y*) transformed to log(*Y*/(*Y*-1)); Log of average % of equity ownership per top-level managers. **Performance variables**: Tobin's *Q* by market value of stock plus estimated market value of preferred stock plus book value of total liabilities to book value of total assets; Return on assets. **Owner determinants**: Standard deviation of stock return; Firm size by log of sales and the square of size; Capital expenditures to capital stock; *R&D* to capital; Advertising to capital; Free cash flow by operating income to sales; Capital to sales ratio and the square of capital to sales ratio; Time and industry dummies. **Performance determinants**: Managerial ownership; A vector of variables equal to the owner determinants.	Find evidence of endogeneity of managerial ownership caused by unobserved heterogeneity as opposed to reverse causality supported by a Hausman specification test. **Performance regression**: They find some evidence of a roof-shaped relation, but after controlling for firm characteristics and firm fixed effects, they find no relation between managerial ownership and performance even for sub-samples of large and small firms. Significant controls are size, square of size, return variation, income to sales, and capital expenditure to capital. **Ownership regression**: They do not test the effect of performance. Significant control variables are: Size, capital to sales ratio; returns variability (only for sample of small firms); Results for both measures of ownership are almost similar.
1999/ Holderness, Kroszner and Sheehan/ Journal of Finance/ Full sample: 1419 listed *US* firms in 1935 and 4202 listed *US* firms in 1995. Limited sample: 120 largest firms in 1935 and in 1995.	**Methods**: Descriptive statistics and *OLS* regressions. Test for roof-shaped relation by using piecewise linear regression. **Ownership variables**: % and dollar ownership by the officers and directors both directly and indirectly; % and dollar ownership by *CEO*; Combined shareholdings by officers and shareholders in the ranges of 0-5%, 5-25%, and 25-100%. 1935 data by the Security Exchange Commission. 1995 data by Compact Disclosure and ExecuComp. **Performance variables**: Tobin's *Q* by market value of stock and book value of debt to book value of assets. **Control variables**: Size by total assets; Leverage by debt to assets; Industry by one digit *SIC* codes.	Full sample: Mean (median) shares by managers and directors increased from 13% (7%) in 1935 to 21% (14%) in 1995. For any given size, shares are higher in 1995 than in 1935. Using the value-weighted mean, shares increase insignificantly from 4.2% in 1935 to 5.9% in 1995, and median shares of the 10 largest firms fell from 2.1% to 1.5%. Full sample *OLS* regressions: Profitability significantly increased for management ownership in the 0-5% range and significantly decreasing in the5-25% range in the 1935 sample. For the 1995 sample, Tobin's *Q* significantly increased for management ownership in the 0-5% range. Significant control is size. Limited sample: Mean (median) ownership by *CEO* is 1.25% (0.09%) in 1935 and 1.25% (0.06%) in 1995. In $ millions, the mean (median) ownership increased by $23.6 ($1.5) in 1935 to $386.5 ($11.9) in 1995.

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Table A12 continued: 51 empirical studies on corporate governance and performance
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Year/Author/Journal/Sample	Statistical methods and variables	Main results
1999/ Lauterbach & Vaninsky/ Journal of Management and Governance 3, 189-201/ Three years of data for 280 Israeli public firms traded on Tel Aviv Stock exchange during 1994. *Diffused ownership firms perform better than closely held firms.*	**Method**: *DEA* and *OLS* regression. **Ownership variables**: Non-majority firms; Business-controlled firms; Business partnerships' controlled firms; Individuals' partnerships' controlled firms; Family-controlled firms. **Performance variables**: Net income as output for *DEA* and dependent variable for *OLS* regression. **Control variables**: Most are used as inputs in *DEA*: Ratio of equity to net income; Total firm asset; *CEO* pay; Pays of four other top managers; Leverage (debt to equity ratio). One more variables is used in *OLS* regression with *DEA* inputs which is; professional non-owner manager dummies. Size and leverage are included again (as authors argue that the size and leverage used in computing *DEA* scores do not completely purge out those effects).	Owner-managed firms are less efficient in generating net income than outsider-managed firms. Concentrated ownership is less efficient than diffuse ownership. *DEA* and regression give similar results. Larger and more leveraged firms achieve higher performance scores. Professional management increases firm performance.
1999/ Pedersen & Thomsen/ Journal of the Economics of Business/ 518 firms selected among the 100 largest non-financial companies in 12 EU countries with data from 1990 to 1993.	**Methods**: *OLS* regression. **Ownership variables**: Ownership concentration by logistic transformation of percentage voting ownership by largest owner. **Performance variables**: Return on equity. **Control variables**: Size by total assets; Standard deviation of return on equity; Dummy for public utilities; Dummy for media companies; Dummies for nation effects; Dummy for dual class shares; Size of economy by *GDP*; Capital intensity by asset to sales; Dummy for *R&D* above 1% of corporate turnover; Stock market capitalisation; Bank sector concentration.	Return on equity is insignificantly decreasing with ownership concentration. Significant controls are capital intensity and return variability. Ownership concentration is not regressed against performance. Significant controls are: Firm size, standard deviation of return on equity: Nation effect; *GDP*; Stock market capitalisation, and Bank sector concentration.
1999/ Short & Keasey/ Journal of Corporate Finance/ 225 *UK* firms at the London Stock Exchange with data from 1988-1992.	**Methods**: Heteroskedasticity corrected *OLS* regression. Performance is regressed as a third degree polynomial of director ownership. **Ownership variables**: % of shares held by directors; % of shares held by institutions with more than 5% ownership; % external ownership. **Performance variables**: Return on equity; Tobin's *Q* by market value to book value. **Control variables**: Size by sales; Growth by sales growth; Leverage by debt to total assets; *R&D*/ total assets.	Director ownership and cubic ownership is significantly positive and squared ownership is significantly negative. The polynomial reaches its maximum at 16% and its minimum at 42% ownership. Significant controls are: Size, growth and *R&D*. Because of institutional differences, *UK*'s entrenchment levels are higher than that for the *US*.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2000/ Bøhren & Ødegaard / Policy Paper/ All non-financial firms listed on the Oslo Stock Exchange from 1989-1997. *Corporate ownership identity and concentration*	**Methods**: Univariate analysis; *OLS* regression; Kendall Rank correlation **Ownership variables**: Herfindahl index (also dependent variable); Identity of largest owner; Number of owners; Ownership size. **Performance variables**: None **Other variable**: Firm type **Controls**: Firm size; Log of Equity value.	Positive relationship between firm size and fraction of non-voting shares. International investors own 54% of non-voting equity (market capitalisation; other countries with high foreign investors are Belgium, Finland, Spain, Sweden).
2000/ Claessens, Djankov & Lang/ Journal of Financial Economics 58, 81-112/ 2980 publicly-listed firms in the nine East Asian countries with Worldscope database for 1998. *If there is a separation of ownership from control in East Asian countries and whether there are within-country differences. Whether differences depend on firm age and size. What is the extent of concentration of corporate control in the hand of families?*	**Methods**: Univariate and bivariate analyses. **Ownership variables**: Control is set at 20% of voting rights; Identity of shareholders. **Performance variables**: None **Control variables**: None	Concentration of control rights is similar to concentration of cash flow rights in their survey. There are large differences across countries when distribution of ultimate control is set to 10%. At the 20% cut-off level the differences across countries widen. Differences arise from different country company laws and size of firms. Overall, the concentration of control seems to diminish with the level of economic development of the country. Correlation analysis reveals that the older the firm, the bigger its size in 8 of the 9 countries.
2000/ Sarkar & Sarkar/ International Review of Finance 1 (3), 164-194/ Two years of data for 1567 Indian private and foreign manufacturing firms. *Block holder activism increases corporate performance but depends on the identity of the shareholder.*	**Method**: Linear piecewise regression with two splines; *OLS*; DFFITS statistics by Belsley et al. (1980) for outliers' detection; Weighted least squares regression by Welsch (1980) for heteroscedasticity (used for cross-sectional regression with firms having different sizes), and; White (1980) for specification tests. **Ownership variable**: Fraction of equity share by directors and relatives, and the square of this value; Indian corporate bodies; Government-owned insurance firms and mutual funds – proxy for institutional investors, Government-owned development financial institutions including banks and; Foreign entities **Performance variables**: Market to book value ratio (*MBV*)[12] and a proxy for Tobin's Q; return on sales; Return on net worth. **Control variables**: Leverage by long-term debt to total equity plus reserves; Size by log of sales; Export intensity by exports to total sales; Advertising intensity by advertising to total sales (for intangible assets); Diversification; Age; Capital or depreciation intensity by depreciation expenditure to total sales; Industry dummies.	*OLS* regressions are deemed efficient after heteroscedasticity and specification tests. Time stability checks of regressions since ownership variables are for one year are confirmed apart from government holdings. Director holdings increase with performance from 0 to 24%, just below the threshold of 26% required in India to block a special resolution by any blockholder. Foreign ownership is non-linearly related to performance. All categories of large shareholders increase firm performance. Institutional investors do not take active part in corporate governance. Size. Leverage, advertising intensity and depreciation intensity are significantly positive controls. Convergence of interest effect is weaker in Indian companies than in *US* firms comparing this study to that of Morck et al. (1988).

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[12] *MBV* is calculated as the ratio of the product of the number of equity shares and the closing price of the share of the last day of the financial year to the book value of equity and reserves. This proxy for Tobin's Q uses book values for assets and debt instead of replacement and market values.

Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample/ Hypotheses	Statistical methods and variables	Main results
2000/ Renneboog/ Journal of Banking & Finance 24, 1959-1995/ /All Belgian firms listed on the Brussels Stock exchange from 1989 (186 firms) to 1994 (165 firms). Other data are provided by *Generale Bank* and the National Bank of Belgium. Ownership, managerial control and control. *Hypotheses* *Top management discipline is triggered by poor firm performance; More non-executive board directors are able to do more monitoring; CEO and Chairman separation leads to higher turnover;* *Large shareholders lead to increased firm performance but their identity matters;* *The ultimate shareholder at the top of a pyramid decides on managerial discipline.* *Poor firms with high leverage and poor liquidity lead to higher monitoring of management;* *Future performance increases after management and board restructuring.*	**Methods**: Logit; *GLS* & *OLS* models with log transformation of dependent variables. Estimation is done with heteroscedasticity consistent covariance matrix estimator; Tobit models used when executive and committee turnover which is censored is the dependent variable. **Performance variables**: Lagged market adjusted returns; Lagged changes in earnings after tax; Lagged earning losses; Lagged *ROE*; Lagged *ROE* – industry median *ROE* (with earnings after tax); Lagged *ROA*; Lagged *ROA* – industry median *ROA* (earnings from operations before interest and taxes); Lagged changes in dividends; Lagged changes in *ROE*; Lagged changes in *ROE* – industry median of *ROE* changes; Lagged changes in cash flow on equity; Lagged changes in cash flow on equity – industry median of changes; Lagged changes in cash flow margin; Lagged changes in cash flow margin equity. **Ownership variables**: A) Ownership concentration (%) by class owner: Holding companies; Banks; Investment companies; Insurance companies; Industrial and commercial companies; Families and individual investors; Federal pr regional authorities; Realty investment companies. B) Ultimate shareholder by owner category; Herfindahl indices of the three largest shareholders by category of owner. C) Purchases of share stakes (in %) by category of ultimate owner. **Control variables**: Debt variables (debt to equity ratio, current ratio, quick ratio, interest coverage – *EBIT*/interest expenses. Gearing included to avoid multicollinearity); Size (log of total assets or of total employees); Industry and time dummies; corporate dummies and innovations (for firm-specific effects). **Board variables**: % of board outsiders; separation of *CEO*/Chairman function, board size (used as a control variable); tenure of *CEO*. Lagged data for ownership, performance and debt policy are used to address endogeneity problems. Industry peers are used to correct over or underperformance.	There is a high degree of ownership concentration; Control is levered by pyramidal and complex ownership structures; There is a market for stake shares; large shareholders and ≥ 5% blockholders on the average hold 65% of total shares. Largest shareholder holds an average shareholding of 43%; Holding companies hold 43% of voting rights. Average board size is 10. There is little evidence of the corporate control role of large shareholders. Unless performance is extremely good or bad, management turnover models have very little predictive value. The poorer the performance, the higher the turnover of the executive board. The presence of large share blocks is not related to board restructuring. There is a partial market for corporate control. Substantial cuts in dividends precede board restructuring. The ultimate owner exerts corporate control albeit through a cascade of intermediate holdings but the larger the intermediate holding ties, the weaker is this exertion. There is enhanced creditor monitoring when performance is poor but this is when the firm is in danger of bond covenant violation. Board structure is instrumental in the monitoring efficiency of internal governance mechanisms. Higher non-executives on the board lead to a higher replacement of management when performance is poor. Board size does not seem to have an effect on managerial disciplining. The presence of large shareholders in some industries is correlated to *CEO* replacement for poor performance. The lack of active corporate control in some industries is due to the limitation of strategic freedom of holding companies' subsidiaries not to compete strongly with each other is not in the interest of minority shareholders and investors of a firm through a Stock exchange

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2000/ Thomsen & Pedersen/ Strategic Management Journal 21 (6), 689-705/ 6 years of data for 435 of the largest European non-financial companies in 12 countries. *Company performance is a bell-shaped function of the largest shareholder* *Shareholder value is higher if largest owner is a non-bank financial firm.* *Sales growth is lower if largest owner is a financial firm.*	**Methods**: Duncan grouping; Autocorrelation test for 6-year data using generalised Durbin-Watson statistics; Autoregressive error model. **Ownership variables**: Ownership concentration by votes of largest owner; Ownership types; Interaction effects. **Performance variables**: *MBV* by market capitalisation / equity; Total sales; *ROA*; Sales growth. **Control variables**: Nation; Industry; Debt-to-equity ratio by total debt to equity; Growth of equity; Dividend payout by common dividends / (net income before preferred dividends – preferred dividends requirement); Beta for 23-35 months; Effective interest rate; Liquidity ratio by cash / assets.	Ownership structure (over a 5-year period is stable) is seen as an exogenous variable with economic performance. Evidence of a bell-shaped effect of ownership share on *MBV* and *ROA* but not sales growth (particularly strong *MBV* for institutional investors**).**
2001/ Demsetz & Villalonga/ Journal of Corporate Finance 7, 209-233/ 5 years of data on 223 *US* firms. *Ownership structure is endogenous.* *The fraction of management shares and that of the 5 largest shareholders might represent conflicting interests.*	**Methods**: *OLS* and *2SLS* regressions. **Ownership variables**: % of shares owned by management; % of shares owned by the largest shareholder; % of shares owned by the 5 largest shareholders. **Performance variable**: Tobin's *Q*; Accounting profit rate (net income to book value of equity). **Control variables**: Advertising expenditures as a fraction of sales; *R&D* as a fraction of sales revenue (*FoSR*); Fixed plant & equipment expenses as a *FoSR*; Value of debt as a fraction of book value of assets, Four-firm market concentration ratio; Industry dummies; Market risk of stock; Firm-specific risk; Firm size measured by book value of assets. **Equation 1:** Dependent variable; Firm performance measured by Tobin's *Q*. Ownership variables: % of shares owned by management; % of shares owned by the 5 largest shareholders Controls: Advertising expenditures as a fraction of sales; *R&D* as a fraction of sales revenue (*FoSR*); Fixed plant & equipment expenses as a *FoSR*; Value of debt as a fraction of book value of assets, Four-firm market concentration ratio; Industry dummies. **Equation 2:** Dependent variable; Fraction of shares owned by management. Independent variable: Firm performance by Tobin's *Q*; Controls: Market risk of stock; Firm-specific risk; Firm size measured by book value of assets; Industry dummies.	Ownership structure is endogenous. Biases in previous empirical study might be due to failing to account for the complexity of interest in ownership structure. Markets succeed in bringing out ownership structures in different kinds of firms such as scale economies, regulation and environmental stability.
2002/ Dimelis & Louri / Oxford Economic Papers 54, 449-469/ 4056 Greek manufacturing firms. *Is labour productivity influenced by the degree of foreign ownership? Does the degree of foreign engagement affect the extent of productivity spillovers? Is the effect of foreign involvement different at various points on the productivity distribution?*	**Methods**: Stochastic frontier analysis, *OLS* and Quantile regressions. **Ownership variables**: Foreign vs. domestic; majority vs. minority. **Performance variable**: Labour productivity Output variable: Sales. Input variables: Labour, Capital. Total assets. **Control variables**: Log of Capital intensity; Leverage; Liquidity; Size; Age.	There is a positive effect on labour productivity by foreign ownership. Institutional theory and neoclassical production theory and not agency theory are used in the theoretical framework.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2003/ Gompers, Ishii & Metrick/ The Quarterly Journal of Economics, February, 107-155. Data: 1990, 1993, 1995 and 1998 data on 24 governance provisions published by the Investor Responsibility Research Centre (*IRRC*) for about 1500 *US* firms. *Hypothesis* *Corporate governance is related to higher equity prices.*	**Methods**:[13] Pairwise correlations; Four-factor regression; Poisson regression; Tobit regression; *OLS* and Ordered logit regressions; Fama-Macbeth return regression. **Governance index:** Governance provisions were categorised into Delay, Protection, Voting, Other, and State.[14] **Performance variables**: 5-year return; Tobin's *Q*; Net operating margin; Return on equity; One-year sales growth. **Control variables**: Percentage of institutional shares; Book value to market value of common equity; Dollar volume of trading in month *t*-2; Dummies for stock exchanges; Share price at the end of month *t*-2; Compounded gross returns for months *t*-3 and *t*-2; Compounded gross returns for months *t*-6 and *t*-4; Compounded gross returns for months *t*-12 and *t*-7; Sales growth; Market capitalisation month *t*-2; trading volume in month *t*-2; Dividend yield to market capitalisation.	The authors build strong and weak shareholder rights' portfolios. In their correlation analysis, their governance index is positively related to (and more so for firms with weaker shareholder rights): *S&P* 500 inclusion, Tobin's *Q*, dividend yield, book-to-market ratio, firm size, share price, monthly trading volume, and percentage of institutional ownership, and; negatively related to past 5-year sales growth, and past 5-year stock return. For their regression results; good governance has a positive relationship with stock returns, but a negative relationship with Tobin's *Q*, Net operating margin, One-year sales growth, and Return on equity. They argue that governance provisions affects firms in three ways: 1) They may create higher costs of agency when a reduction in shareholder rights allows managers to engage in inefficient investments, reduced operational efficiency or self-dealings. 2) That, protective provisions for management lead them to engage in insider trading that forecasts returns. 3) That, omitted-variable bias drives such governance test results. They argue that the corporate culture might also have an effect on the level of governance. They find partial support for higher costs of agency in 1) above and unobservable characteristics in 3) above.

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[13] All variables except stated otherwise are in natural logarithm form and defined below. Book value of equity is the sum of book common equity and deferred taxes (additional explanatory variable). 5-year return: Compounded return from month *t*-61 to *t*-2.
Shares held by institutions over total outstanding shares (not in log form). Dollar volume of trading in month *t*-2: product of stock price at end of month *t*-2 and share volume in month *t*-2. Dummies are created for the different stock exchanges. Share price at the end of month *t*-2. *Q* is the market value of assets divided by the book value of assets: market value is calculated as book value of assets plus market value of common stock less the sum of the book value of common stock and balance sheet deferred taxes. Book value at fiscal year *t* and market value at calendar year *t*. Compounded gross returns for months *t*-3 and *t*-2. Compounded gross returns for months *t*-6 and *t*-4. Compounded gross returns for months *t*-12 and *t*-7. The growth in sales over the previous fiscal years (not in log) Market capitalisation at the end of month *t*-2. The volume of trading in month *t*-2 on a stock exchange. The yield of dividends in the previous fiscal year to market capitalisation measured at calendar year-end (not in log). Net operating margin: Income divided by sales. Return on equity; income divided by book equity.

[14] For delay, most of the firms have provisions for Blank check and Classified Board. For Protection, most firms have provisions for *Compensation plans*, *Golden parachutes* and *Liability*. For Voting, firms (less than 40%) have provisions for *Supermajority* and to a lesser extent *bylaws* and *cumulative voting*. For other governance provisions, *Poison pill* and *Fair price* seem to matter. For State, *Business combination law* scored more over 85% (the most governance provision that all firms have), while *Fair price law*, and *Control share acquisition law* averaged around 34% and 28% respectively.

Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2004/ Bauer, Günster & Otten/ Journal of Asset Management/ *EU*-15 study. 249 (2000) and 269 (2001) firms in the *FTSE* Eurotop 300. *Effect of corporate governance on stock returns, firm value and performance.*	**Governance index**: Data on governance has about 300 criteria under four broad categories of: rights and duties of shareholders; range of takeover defenses; governance disclosure, and; board structure and functioning, using the Deminor corporate governance ratings. The *UK* sample is separated from the European Monetary Union (*EMU*) sample. **Methods**: ***Corporate governance and stock returns***: Carhart (1997) four-factor model using Fama and French (1993) method. ***Governance and firm value***: Yearly cross-sectional multivariate regression. **Performance variable**: Tobin's *Q* **Control variables**: Firm size by (logarithm of) book value of assets; firm age; previous and current years *ROEs*. ***Governance and operating efficiency***: **Performance variables**: Net profit margin (*NPM*) and *ROE*. **Control variables**: Firm size by log of book to market value, sector dummies. The annual regressions are from 1996-2001 and compute time-series mean and *t*-statistic.	With the exception of shareholder rights and duties, the other three broad categories are correlated. The governance standards persist across the dimensions and also over time hence they extend the 2000 year ratings backwards for 3 years.[15] Governance rating differences within industrial sectors are small while that within countries are large and statistically significant. Good governance ratings have a positive although insignificant relationship on stock returns for both *EMU* and *UK*. Firm value is positively associated with quality of governance but the relationship becomes weak when adjustments are made for country effects. *ROE* and *NPM* results show a negative relationship with governance ratings for *EMU* and a statistically insignificant negative relationship for the *UK* sample. They therefore argue that reported accounting numbers are biased performance measures when companies have bad corporate governance.
2004/ Bøhren & Ødegaard / Working Paper/ All non-financial firms listed on the Oslo Stock Exchange from 1989-1997. *Corporate governance and performance*	**Methods**: Univariate analysis; Pooled data full model *OLS*; *GMM*; Partial *OLS* regressions; Simultaneous equation model (SE). **Ownership variables**: Ownership concentration; owner type; Insider ownership; **Performance variables**: Tobin's *Q*, *ROA* and *ROE* (annual and five-year returns). **Other variables**: Board characteristics; Security design; Financial policy; Market/competition. **Control variables**: Log(Equity value), Investments to income, stock volatility; stock turnover; stock beta.	Insider ownership contributes to firm value; outsider ownership reduces firm value; direct ownership values more than indirect. Firm value decreases with board size, leverage, dividend payout, and fraction of non-voting shares. Governance mechanisms are independent and may be analysed individually. The above results depend on the performance measure used and the specifications of instruments in simultaneous equations. Endogeneity tests do not indicate significant relationships. The theory relating governance to performance may be underdeveloped.

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[15] Bauer et al. (2004) admit that this backward extension may introduce look-ahead and survival simple biases but data constraints makes it second best when the extension is only for a few years.

Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2004b/ Drobetz, Gugler & Hirschvogl/ Working Paper/ 2002 data on 91 German firms. *Governance is non-linearly related to ownership.* *Governance is negatively related to board size.* *Governance is positively related to option-based remuneration plan.* *Governance is sensitive to the accounting principles used.*	**Methods**: Piecewise linear regression, *2SLS* regression **Governance variables**: **Ownership variables**: 25% if voting right of the largest shareholder □25%; Voting rights of the largest shareholder □25%; 25% □Voting rights □50%; Voting rights of the largest shareholder □50%. **Board variables**: Board size. **Control variables**: In a robustness test, Tobin's *Q* is used as an explanatory variable for corporate governance rating in the first stage of a *2SLS* regression and industry dummies, firms' betas and natural logarithm of firm age used as instruments for test of endogeneity.	A non-linear relationship exists between governance and ownership concentration. Larger boards score lower governance ratings. Option-based remuneration is positively associated with good governance and performance.
2004/ Frick/ KLYKOS 57 (3), 357-386/ Three years of non-financial data for 305 German wineries. *Owner-managed firms are more efficient than outsider-managed firms because of monitoring.* *In terms of knowledge and skills, managers of private firms are successful than public firms.* *Organizational form has no impact on performance.*	**Methods**: *OLS*, Simultaneous Equation and *2SLS* regressions. **Ownership variables**: Insider vs. outsider Ownership **Performance variable**: Price per bottle of wine and Jury grade. **Control variables**: Annual production, geographic region, membership in professional associations, acreage, and firm size.	The higher the foreign ownership, the higher the efficient production of the firm. Employee-managed firms are more efficient than owner-managed firms attributable to human capital advantage.
2005/ Bøhren, Priestley & Ødegaard/ Working Paper/ All firms listed on the Oslo Stock Exchange from 1989 to 1999. *Ownership duration and firm performance*	**Methods**: Unique time series. Transformation of Survival Function to Hazard Function. **Ownership variable**: Ownership types, 1st 5 large shareholders. **Performance variable***:* Percentage of market capitalisation **Control variables** for different models: Log(Market value of assets); Depreciation over long term assets; Earnings surprise.	High concentration of outsiders reduces value, insiders add value to a point and conflicts set in. Firms' largest owners stay less than three years but longer than small investors. Individuals and industrial firms' shareholding types stay longer than financial institutions and foreign shareholders. There is a negative relationship between longer duration and firm performance but this varies across shareholding types where Individuals actually give a positive effect.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2005/ Earle, Kucsera & Telegdy/ Corporate Governance: An International Review 13 (2), 254-264/ 6 years of data on 168 Bulgarian publicly listed firms. *A group of block holders decrease firm performance as opposed to a single large block holder.*	**Methods**: Logit regression: Piecewise linear logit regression. **Ownership variables**: Largest blockholder; Largest 2 block holders; Largest 3 blockholders; All block holders; Second largest blockholder; Third largest block holder; Interaction blockholding terms. **Performance variables**: *ROE* (ratio of before-tax income to value of equity; Log of operational efficiency (ratio of sales to number of employees). **Control variables**: Lagged performance level; Lagged employment; Time effects.	Only the largest blockholder has a systematic effect on improved corporate performance. Effects of total block holdings are much smaller and statistically insignificant.
2**005**/ Galve Górriz & Salas-Fumás/ ECGI Working Paper/ 15 years of data on 53 of both Spanish publicly listed family- and non-family-owned firms (1990 to 2004). *Family firms grow at a slower rate, choose less capital-intensive technologies and more efficient. Same profits, financial structure and capital cost.*	**Method**: Parametric estimation of productivity with Cobb-Douglas. **Ownership variables**: Listed family and non-family-owned firms. **Performance variables**: *TFP* (ratio of assets to employees); Growth/size constraint (asset, age and average growth – *ROA* and invested capital); Profitability – *ROA* (controlling for debt structure); Tobin's *Q*. **Control variables**: Long-term debt to total debt ratio, debt to assets ratio; Dummy for listed firm.	Differences in family and non-family owned firms are as a result of the objective function of decision-makers and constraints in productive efficiency. Unlike most studies, institutional theory and transaction cost theory are used in this study.
2005/ Seifert, Gonenc & Wright/ Journal of Multinational Financial Management 15, 171-191/ Five years of data for 2198 firms from *US*, 319 firms from Germany, 674 firms from *UK*, and 1015 firms from Japan. *A positive relationship between managerial ownership and performance at low levels of managerial ownership occurs across different governance regimes. The relationship at higher levels of managerial relationship will be unclear. Block holders or institutional ownership should improve performance.*	**Methods**: *OLS* and *2SLS* regressions; Hausman tests. **Ownership variables**: Insiders; Blockholders and institutions **Performance variable**: Tobin's *Q* by ratio of the firm's market value to the replacement cost of its physical assets. **Control variables**: Leverage; Capital expenditures scaled by total assets to control for investments; Sales growth; Industry dummies; Size; Cash flow by assets as a proxy for liquidity; Risk. **Equation 1**: Dependent variable; Tobin's *Q*. Independent variable: Ownership by insiders; ownership by blockholders and institutions. Controls: Leverage, Capital expenditures, Sales growth, and Industry. **Equation 2**: Dependent variable: Insider ownership. Independent variable: Tobin's *Q*. Controls: Leverage, Capital expenditures, Size, Cash flow, and Risk.	There is no universal relationship between ownership equity by insiders and performance. Positive for *UK* and Germany, negative for *US* and *UK*. Ownership structure therefore matters with specific local laws, i.e. good minority shareholder protection. Ownership does not appear to be an endogenous variable. No significant differences between *OLS* and *2SLS* regression results. The effects of control variables on performance are fairly consistent across different countries in the study. Leverage has a negative effect, sales growth (investment proxy) has a positive effect, capital expenditures has mixed effect, Block holders and institutions have a very mixed effect on performance, with only a positive impact in Germany. Foreign ownership has a positive influence in Japan while employee ownership is negative. Risk has a negative effect, size has a negative effect, and the higher the insider ownership, the higher the performance.

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Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2005/ Sheu & Yang/ *Managerial and Decision Economics* **62**, 307-318/ Six years of data on 416 Taiwanese listed electronic firms. *Total insider holding has an association with technical efficiency. The composition of insider ownership has different effects on technical efficiency.*	**Methods**: Stochastic frontier analysis (*SFA*) regression. **Ownership variables**: Total insider holding ratio; Executive-to-insider holding ratio; Board-to-insider holding ratio; Block holder –to- insider ratio. **Performance variable**: Technical efficiency derived from: *Outputs*: Annual net sales deflated by wholesale price index. *Inputs*: Labour (number of workers); Capital (net fixed assets); Materials. **Control variables**: Firm age; Firm size (book value of total assets); *R&D*.	Raising executive-to-insider holding ratio first causes a decrease, then an increase in technical efficiency. Board-to-equity holding ratio is negatively associated with technical efficiency. *R&D*, firm size and age all positively influence technical efficiency. Technical efficiency increases with time.
2008/ Dahya, Orlin & McConnell / Journal of Financial Economics/ Initial sample of 1455 firms in 22 countries with 2001 or 2002 ownership data years and between 2001 to 2004 data years for performance and other variables.	**Methods**[16]: *2SLS* instrumental regression for endogeneity robustness. **Performance variables**: Prior year's Tobin's *Q*. **Ownership variable**: % cash flow rights **Board variables**: Board size; % of board independence. **Investor protection variable**: Legal environment **Control variables**: Industry dummies; Log of prior year sales; 2-year sales growth; Ratio of intangible assets to total assets; Need for external financing (*ROE* over 1-*ROE*) measured over two years; The variance of stock returns (as monthly returns over 24 months).	Based on this instrumental regression, firm value seems to depend on board composition, size and legal environment although board composition does not seem to depend on firm value.
2007/ Kapopoulos & Lazaretou/ Corporate Governance: An International Review 15 (2), 144-158/ Year 2000 data for 175 listed Greek firms. *Ownership structure is endogenous Concentrated ownership has a positive effect on profitability.*	**Methods**: *OLS* and *2SLS* regressions. **Ownership variables**: Log value of managerial shareholdings, log values of other important shareholdings. **Performance variables**: Tobin's *Q* and accounting profit rate. **Control variables**: Distribution (advertising and marketing) expenses as a fraction of sales revenues; Debt to book value of total assets (leverage); Market concentration ratio (top four firm concentration ratio and a Herfindahl measure of market structure); Firm size by book value of total assets.	For the *OLS* regression, profitability is always statistically dependent. External important shareholders are positively related to profitability. This significant level is higher than for that of managerial shareholdings effect on profitability. *2SLS* regressions confirm the *OLS* results. Leverage in both regressions is negatively related to profitability. Distribution to sales ratio is insignificantly positive. Top four firm concentration ratio is positive but Herfindahl indicator is insignificantly positive. Size does not seem to explain variations in ownership structure.

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[16] For the Tobin's *Q* equation, Dahya et al. (2008) use industry dummies as the instrument following Doidge and Karolyi (2005), and Lins (2003) argument that this variable affects Tobin's *Q* but not corporate governance. For the equation with the percentage of independent directors on the board, they follow Demsetz and Villalonga (2001), Doidge and Karolyi (2005) and Lins (2003) and use the alpha and beta of a firm's stock returns as instruments. When the data for these instruments are unavailable, they use OLS regressions and 24 monthly returns to estimate these values. The predicted values from the first stage are used as regressors in the second stage with the control variables as previously mentioned aside from substituting country dummies for industry dummies in the board composition equation.

Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2006/ Pindado & de la Torre/ European Financial Management 12 (5), 661-687/ Unbalanced panel from 1990 to 1999 of 135 listed firms with data for at least 6 consecutive years. Data sources are from *CNMV* and Daily Bulletin of the Madrid Stock Exchange. Roles of investment, financing and dividend decisions in explaining ownership structure. *Hypotheses:* *Higher debt levels lead to lower levels of insider ownership.* *Higher debt levels lead to lower levels of ownership concentration.* *Higher dividends lead to higher insider ownership levels.* *Higher dividends lead to higher levels of ownership concentration.* *Higher investment leads to higher levels of insider ownership.* *Higher investment leads to higher levels of ownership concentration.* *Higher free cash flow levels lead to higher levels of inside and outside ownership concentration.* *Higher Tobin's Q leads to higher levels of inside and outside ownership concentration.* *Larger firms exhibit lower levels of inside and outside concentration.*	**Methods**: Use of extended models of corporate ownership with interaction effect between insider ownership and ownership concentration. *OLS* and Piecewise linear regressions; *GMM* estimation (rather than Maximum Likelihood, *2SLS* or *3SLS* because these do not entirely eliminate unobservable heterogeneity); Variance Inflation Factors (*VIF*) to control for multi-collinearity; Sargan test and *m2* statistic (using Arellano & Bond, 1998 for panel data estimation); Wald tests. **Ownership** (dependent) **variables**: Insider ownership (% of all common shares held by board members) and the square of this variable; Insider ownership (*IO*) dummy (= 1 if $IO \leq 0.35$ or $IO \geq 0.70$ and zero otherwise); ownership concentration (% of common shares held by significant shareholders), ownership concentration (*OC*) dummy (= 1 if $OC \leq 0.87$, and zero otherwise) **Performance variable**: Tobin's *Q*[17] **Control variables**[18]: Debt ratio; Dividends; Investment opportunities; Size; Free cash flow; Share repurchases; New equity issues; Total payout (including share repurchases).	The hypotheses are supported. Non-linear relationship exists for both insider ownership and ownership concentration. A firm's ownership structure explains its investment, financing and dividend decisions. Debt and dividends are the major determinants of a firm's inside and outside shareholdings. Insiders reduce their holdings when debt increases. The monitoring role of large outside shareholders substitutes for the disciplinary role of debt. As higher dividends prevent insiders from undertaking negative net present value projects, insiders are prone to increase their holdings in view of higher payout in order to offset their lower potential of shirking by receiving a greater fraction of the dividends paid. Higher dividends also encourage outside owners to hold higher stakes in the firm. If the firm undertakes a new investment project, both inside and outside owners are prone to increase their holdings. Insiders are aware of a firm's free cash flow and investment opportunities, so they reduce their stakes in the firm when free cash flow rises and then over invest the stakes. Outside owners choose their stakes in the firm regardless of its free cash flow and investment opportunities because of a lack of access to information.

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[17] Tobin's *Q* is calculated as: (Market value of equity + Market value of Long-term debt + Book value of short-term debt) / Replacement value of total assets.
[18] *Replacement* value of total assets (is measured as) = Replacement value of tangible fixed assets + Replacement value of inventories + (Book value of total assets – Book value of tangible fixed assets – Book value of inventories). *Debt ratio* is the Market value of long-term debt to the Market value of long-term debt and Market value of equity. *Dividends*' is the total amount of dividends based on the current year's net income / Replacement value of total assets. *Investment* is calculated as: (Net fixed assets as measured by the book value of tangible assets minus the accumulated book depreciation for year *t*) – (Net fixed assets as measured by the book value of tangible assets minus the accumulated book depreciation for year *t*-1) + (Book depreciation expense corresponding to year *t*) / Replacement value of total assets. *Size* is calculated as the log of replacement value of total assets. *Free cash flow* is calculated as: Cash flow (1 / *Q*); Cash flow = [*EBIT* (earnings before interest and tax) + Depreciation + Different provisions reported in the Profit and Loss account] / Replacement value of total assets. *Share repurchases* is calculated as the product of the number of shares repurchased and the market value per share. The number of shares is derives as (Book value of equity in previous period / Par value in previous period - Book value of equity / Par value), and the market value per share is calculated as: (Market value of equity in previous period / (Book value of equity in previous period / Par value in previous period)). Equity issue dummy equals 1 if there is an equity issue and 0 otherwise. *Total payout* is the sum of dividends and share repurchases which are calculated as from above.

Table A12 continued: 51 empirical studies on corporate governance and performance
Sources: Encyclopaedia on Corporate Governance - http://www.encycogov.com; Nanka-Bruce, 2006; Candidate's compilation.

Year/Author/Journal/Sample	Statistical methods and variables	Main results
2007/ Dittmar & Mahrt-Smith/ Journal of Financial Economics 83 (3), 531-792/ 1990-2003 data on 1,952 *US* firms with data from COMPUSTAT and *IRRC*. *Badly governed firms waste more cash holdings than well-governed firms.*	**Methods**: Unconditional pairwise correlations; *OLS* and *OLS* return) regressions by long-run event study. **Governance variables**: Governance measure using Gompers et al., 2003 and Bebchuk et al.'s (2005) entrenchment index. **Ownership variables**: Sum of the 5% block holdings of common equity by institutions; Pension Holdings. **Independent variable**: Cash (COMPUSTAT item 1) by way of change in cash [normalised by (market value of equity, *M*) the beginning-of-period equity value x shares which are COMPUSTAT items 199 x 25]. **Performance variables**: Stock return (by excess return for firm *i* during fiscal year *t* less the return of stock *i*'s benchmark portfolio during fiscal year *t*); Cash/Assets; Assets adjusted for inflation; Cash flow/Assets; Net working capital/Assets; *PP&E*/Assets; 3-year compound sales growth; Market value/Assets; Industry adjusted *ROA*. **Control variables**: Earnings before Extraordinary Items (COMPUSTAT items 18+15+50+51); Net assets (6-1); *R&D* expenses (46, set to zero if missing); Interest expense (15); Common dividends (21); Leverage by long term debt plus short term debt (9+34) to Long term debt plus short term debt plus market value of equity *M*; Net new equity issues (108-115) + Net new debt issues (111-114); Bond ratings: Lagged industry-adjusted *ROA*. These variables control for profitability, financial policy and investment policy. **Interaction variables**: Gompers et al. index times Cash; Bebchuk et al. index times Cash; Block holders times cash; Pension holdings times Cash; Lagged cash times Change in cash; Leverage times Change in cash; High payout dummy times change in cash.	All ratios are winsorised at 1% and 99% levels for outliers' check. Assets are in the natural logarithm form. Institutional blockholders have an impact on value of cash holdings by 0.39$ for every dollar as against low or no institutional block ownership. Using Bebchuk et al. (2005) entrenchment index, a dollar of cash is $1.43 more valuable in a well-governed firm. Governance and firm value are endogenously determined. Even for firms that do not undertake acquisitions, governance remains an important determinant for the value of cash.

Table A13: Comparing corporate governance and economic performance in Belgium, Spain and the *UK*

BELGIUM	SPAIN	*UK*
	1. Relationship between direct shareholder monitoring and performance	
Disciplinary actions against management are taken when market-adjusted share returns are negative and when the company generates operating earnings' losses or resorts to substantial cuts in dividends in the years prior to the restructuring. There is also evidence that companies with changes in *ROE* and cash flows below those of the industry peers are subjected to increased monitoring. Shareholder monitoring is beneficial, but it is not the shareholders owning the direct equity stakes which monitor but the ultimate shareholder in a control chain.	There is no significant empirical evidence that family majority-controlled firms have better performance than non-concentrated ownership firms. There is empirical support for higher efficiency levels for non-concentrated ownership firms as well, as well as limits on size and risk concentration of family-controlled firms.	The *UK* evidence is inconclusive. Some studies find a relationship between performance and managerial ownership and others do not. There is no agreement on the form of the link that has been reported in the studies that have found a relationship.
	2. Block holding benefits, entrenchment and rent extraction	
Control is usually levered by pyramidal and complex ownership structures and there is an important market for share stakes. However, little relation is found between ownership structures and the disciplining of top management in listed industrial and commercial companies. The presence of large industrial shareholders (and to some extent of family shareholdings) is related to high executive board turnover when performance is poor, whereas no evidence is found for a monitoring role by large holding companies.	Only indirect empirical evidence supports that (block holder supported) management entrenchment holds. Powerful anti-takeover provisions, large cross shareholdings, golden parachute contracts, and lack of transparency of board compensations are examples of this trend.	Managers, as important most important type of shareholder in listed *UK* firms, use their votes to entrench their position on boards in the wake of bad financial performance.
	3. Importance of takeovers and their benefits	
Since 1989 hostile takeovers are virtually ruled out. Legislation allows for the use of poison pills. Furthermore, given the high concentration of ownership in most companies, hostile takeovers without an ex ante toehold stake are almost impossible.	There is some important number of registered takeovers. However, only a few of them are hostile. There is evidence on higher board turnover around large block transfers (including takeovers). Their disciplinary role is not confirmed because those transfers are not a consequence of bad firm performance.	The performance between the targets of hostile takeovers and that of friendly takeover targets, non-merging firms and the targets of failed takeovers are not significantly different. This suggests that targets of hostile takeovers are taken over for other reasons other than bad performance.
	4. Relationship between pay and performance	
There is no systematic evidence due to lack of data.	There is a positive relationship between total board compensation and company performance. The relationship is very weak for market performance measures and slightly stronger for accounting performance.	Empirical evidence on the *UK* suggests that managerial compensation is not very sensitive to financial performance, but is highly sensitive to firm size. Similarly, there is no evidence of a link between top executive remuneration and ownership structure.

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Table A13 continued: Comparing corporate governance and economic performance in Belgium, Spain and the *UK*

BELGIUM	SPAIN	*UK*
5. Identity of firm ownership and importance of institutional investors		
Companies controlled by industrial companies (and families) are more closely monitored. Institutions do not directly interfere with governance actions. The presence of large holding companies in the ownership structure seems to have a detrimental effect on performance and is not related to any monitoring.	The Spanish ownership structure has changed in composition rather than in concentration during the last ten years. The decrease of State participation, the growing importance of foreign companies as shareholders, and the listing of new companies need to be related to performance.	Given the high dispersion of ownership in the *UK*, most studies focus on managerial ownership or use general indices of ownership concentration. One empirical study focused on the different types of shareholders and there was no link between the types and performance.
6. Relationship between board structure and performance		
The role of the non-executive directors is important in the disciplining process: a high proportion of non-executive directors leads to increased executive board turnover. Furthermore, a higher probability of *CEO* replacement is found when the tasks of *CEO* and chairman are separate.	One study found a non-monotonically increasing relationship between board size and performance. Board composition through the monitoring of external board members influences company performance. Another study finds that board composition explain board turnover and poor performance relationship.	One study finds that there is a link between board structure and the incidence of certain types of corporate recovery actions. Another study finds that the higher the proportion of outside directors on the board the lower will be the use of earnings management to disguise losses or reduced earnings.
7. Major conflict: owner vs. managers or large vs. small shareholder		
There is substantial legal shareholder minorities protection although there has been evidence of (controlling) shareholder groups developing (or failing to develop) a long-term corporate strategy. The major agency problem is between large and small shareholders.	The primary conflict is between majority vs. minority shareholders. In a context of concentrated ownership the monitoring problem of managers by shareholders is not the main issue: there are no incentives to free ride. Precise knowledge about the ways of rent expropriation is needed.	The classic owner-manager conflict is the main concern.

This is an abridged table from Klaus Gugler's (2001: 206-212) book on empirical surveys carried out by several authors in some western European countries addressing the same research questions. The results for Belgium, Spain and *UK* are reported to bring out differences attributable to the differing institutional contexts.

Table A14: The aggregate holding by ownership types in 11 European countries

		Owner type				
Country	Year	State	International	Individuals	Financials	Nonfinancials
UK	1997	0	16	25	58	2
Mean of English legal origin						
Austria	1996	10	16	57	9	8
Germany	1997	3	12	17	37	31
Mean of German legal origin		*6.5*	*14*	*37*	*23*	*19.5*
Belgium	1997	0	34	25	15	27
France	1993	6	22	32	23	16
Italy	1994	24	7	26	22	22
Spain	1997	6	37	29	23	6
Mean of French legal origin		*9*	*25*	*28*	*20.75*	*17.75*
Finland	1997	21	32	16	12	19
Iceland	1996	11	2	33	25	30
Norway	1997	16	31	8	20	25
Sweden	1997	8	32	15	31	15
Mean of Scandinavian legal origin		*14*	*24.25*	*18*	*22*	*22.25*

Aggregate holding is by fraction of market capitalisation held in percentages. Scandinavian legal origin countries have the highest ownership by the State, followed by the French, German and English legal origins respectively. English firms have financial companies as the dominant shareholders with individual owners being less than half of financial owners. For German legal origin firms, companies own more firms than individuals. The State has no significant shareholdings in the *UK* and Belgium. 58% of *UK* firms have a financial company as the dominant shareholder while this ownership type accounts for only 15% in Belgium. Sources: Bohren and Odegaard (2000), and La Porta et al. (1998).

Table A15: The average fraction of firm's outstanding voting equity

Country	No. of firms	Year	Owner size rank			Relative owner size		
			1	2	3	1/2	1/3	2/3
UK	250	1992	14	7	6	5.6	11.5	2.1
USA	2831	1997	3	1	1	3	3	1
Mean of English legal origin			*8.5*	*4*	*3.5*	*4.3*	*7.25*	*1.55*
Austria	50	1996	54	8	3	6.8	18	2.7
Germany	372	1996	50	3	1	16.7	50	3
Mean of German legal origin			*52*	*5.5*	*2*	*11.75*	*34*	*2.85*
Belgium	135	1995	56	7	5	8	11.2	1.4
France	674	1996	52	10	4	5.2	13	2.5
Italy	214	1996	48	10	4	4.8	12	2.5
Netherlands	137	1996	43					
Spain	193	1995	40	11	6	3.6	6.7	1.8
Mean of French legal origin			*47.8*	*9.5*	*5.25*	*5.4*	*10.73*	***2.05***
Norway	130	1997	29	11	7	2.6	4.1	1.6
Sweden	304	1998	38	11	6	3.6	6.7	1.8
Mean of Scandinavian legal origin			*33.5*	*11*	*6.5*	*3.1*	*5.4*	*1.7*

The concentration of voting rights in Europe and the *USA* are in percentages.The table shows the average fraction of outstanding voting equity held by largest, second largest and third largest owners with equally weighted fractions across firms and countries as Owner Size rank and the ratio between the corresponding ownership fractions as "Relative Owner Size". The firms in countries of German legal origin have an average of 52% shareholdings by largest owner followed by French legal origin at 48%, Scandinavian legal origin at 35% while firms in English legal origins have only 8%. Austria has the largest concentration of shareholding ownership. The *USA* has the lowest shareholding concentration. Sources: Bohren and Odegaard (2000), and La Porta et al. (1998).

Appendix A2.6: Investor protection components

Text box A3: Definitions of variables used in investor protection

Variable	Description
INVESTOR RIGHTS	
Origin	Identifies the legal origin of the company law or commercial code of each country. Equals one if the origin is English common law, two if the origin is the French commercial code, three if the origin is the German commercial code, and four if the origin is Scandinavian civil law
One share–one vote	Equals one if the law explicitly mandates or sets as a default rule that: (a) proxy solicitations paid by the company include a proxy form allowing shareholders to vote on the items on the agenda; or (b) a proxy form to vote on the items on the agenda accompanies notice to the meeting; or (c) shareholders vote by mail on the items on the agenda (i.e. postal ballot); and zero otherwise.
Proxy by mail allowed	Equals 1 if the law rule does not require, nor explicitly permits companies to require, shareholders to deposit with the company or another firm any of their shares prior to a general shareholders meeting.
Shares not blocked before meeting	Equals one if the law explicitly mandates or sets as a default rule that shareholders owning 10% or less of the capital may cast all their votes for one board of directors or supervisory board candidate (cumulative voting) or if the law explicitly mandates or sets as a default rule a mechanism of proportional representation in the board of directors or supervisory board by which shareholders owning 10% or less of the capital stock may name a proportional number of directors to the board, and zero otherwise.
Cumulative voting or proportional representation	Index of the difficulty faced by (minority) shareholders owning 10% or less of the capital stock in challenging (i.e. by either seeking damages or having the transaction rescinded) resolutions that benefit controlling shareholders and damage the company. Equals one if minority shareholders may challenge a resolution of both the shareholders and the board (of directors or, if available, of supervisors) if it is unfair, prejudicial, oppressive, or abusive; equals one-half if shareholders are able to challenge either a resolution of the shareholders or of the board (of directors or, if available, of supervisors) if it is unfair, prejudicial, or oppressive; equals zero otherwise.
Oppressed minorities mechanism	Equals one when the law or listing rules explicitly mandate or set as a default rule that shareholders hold the first opportunity to buy new issues of stock; equals zero otherwise.
Preemptive rights	The minimum percentage of share capital [or voting power] that the law mandates or sets as a default rule as entitling a single shareholder to call a shareholders' meeting (directly or through the court). Define capital to equal one when capital to call a meeting is less than or equal to 10 percent and zero otherwise.
Percentage of share capital to call an extraordinary shareholders' meeting	Equals one if the law explicitly mandates or sets as a default rule that: (a) proxy solicitations paid by the company include a proxy form allowing shareholders to vote on the items on the agenda; or (b) a proxy form to vote on the items on the agenda accompanies notice to the meeting; or (c) shareholders vote by mail on the items on the agenda (i.e. postal ballot); and zero otherwise.
Antidirector rights	An index aggregating the shareholder rights labelled as ''anti-director rights.'' The index is formed by adding 1 when (1) the country allows shareholders to mail their proxy vote to the firm, (2) shareholders are not required to deposit their shares prior to the general shareholders' meeting, (3) cumulative voting or proportional representation of minorities in the board of directors is allowed, (4) an oppressed minorities mechanism is in place, (5) the minimum percentage of share capital that entitles a share-holder to call for an extraordinary shareholders' meeting is less than or equal to 10 percent (the sample median), or (6) shareholders have pre-emptive rights that can be waived only by a shareholders' vote. The index ranges from zero to six
Mandatory dividend	Equals the percentage of net income that the company law or commercial code requires firms to distribute as dividends among ordinary stockholders. It takes a value of zero for countries without such a restriction

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Text box A3 continued: Definitions of variabes used in investor protection

Variable	Description
	CREDITOR RIGHTS
Restrictions for going into reorganization	Equals one if the reorganization procedure imposes restrictions, such as creditors' consent, to file for reorganization; equals zero if there are no such restrictions
No automatic stay on secured assets	Equals one if the reorganization procedure does not impose an automatic stay on the assets of the firm on filing the reorganization petition. Automatic stay prevents secured creditors from gaining possession of their security. It equals zero if such a restriction does exist in the law
Secured creditors first paid	Equals one if secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm. Equals zero if non-secured creditors, such as the government and workers, are given absolute priority
Management does not stay in reorganization	Equals one when an official appointed by the court, or by the creditors, is responsible for the operation of the business during reorganization. Equivalently, this variable equals one if the debtor does not keep the administration of its property pending the resolution of the reorganization process. Equals zero otherwise
Creditor rights	An index aggregating different creditor rights. The index is formed by adding 1 when (1) the country imposes restrictions, such as creditors' consent or minimum dividends to file for reorganization; (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay); (3) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm; and (4) the debtor does not retain the administration of its property pending the resolution of the reorganization. The index ranges from zero to four
Legal reserve requires percentage of capital	The minimum percentage of total share capital mandated by corporate law to avoid the dissolution of an existing firm. It takes a value of zero for countries without such a restriction
	RULE OF LAW
Efficiency of judicial system	Assessment of the ''efficiency and integrity of the legal environment as it affects business, particularly foreign firms'' produced by the country risk rating agency Business International Corp. It ''may be taken to represent investors' assessments of conditions in the country in question.'' For four years. Scale from zero to 10; with lower scores, lower efficiency levels
Rule of law	Assessment of the law and order tradition in the country produced by the country risk rating agency International Country Risk (*ICR*). Average of the months of April and October of the monthly for 14 years. Scale from zero to 10, with lower scores for less tradition for law and order (the authors changed the scale from its original range going from zero to six)
Corruption	*ICR*'s assessment of the corruption in government. Lower scores indicate that ''high government officials are likely to demand special payments'' and ''illegal payments are generally expected throughout lower levels of government'' in the form of ''bribes connected with import and export licenses, exchange controls, tax assessment, policy protection, or loans.'' Average of the months of April and October of the monthly index for 14 years. Scale from zero to 10, with lower scores for higher levels of corruption (we changed the scale from its original range going from zero to six)
Risk of expropriation	*ICR*'s assessment of the risk of ''outright confiscation'' or ''forced nationalization.'' Average of the months of April and October of the monthly index for 14 years. Scale from zero to 10, with lower scores for higher risks
Repudiation of contracts by government	*ICR*'s assessment of the ''risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down'' due to ''budget cut-backs, indigenization pressure, a change in government, or a change in government economic and social priorities.'' Average of the months of April and October of the monthly index for 14 years. Scale from zero to 10, with lower scores for higher risks
Accounting standards	Index created by examining and rating companies' annual reports on their inclusion or omission of 90 items. These items fall into seven categories (general information, income statements, balance sheets, funds flow statement, accounting standards, stock data, and special items). A minimum of three companies in each country were studied. The companies represent a cross section of various industry groups; industrial companies represented 70 percent, and financial companies represented the remaining 30 percent

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Text box A3 **continued: Definitions of variables used in investor protection**

Variable	Description
	RULE OF LAW - continued
GNP and *GNP* per capita	Gross national product and gross national product per capita in constant currency of data year
Gini coefficient	Gini coefficient for income inequality in each country
	OWNERSHIP
Ownership, 10 largest private firms	The average percentage of common shares owned by the three largest shareholders in the 10 largest non-financial, privately owned domestic firms in a given country. A firm is considered privately owned if the state is not a known shareholder in it

Variables identified by La Porta et al., 1998: 1122-1125 in their study of Law and Finance in 49 countries. The revised anti-director rights index (Djankov et al. 2008) is formed by adding 1 when (1) the country allows shareholders to mail their proxy vote to the firm, (2) shareholders are not required to deposit their shares prior to the general shareholders' meeting, (3) cumulative voting or proportional representation of minorities in the board of directors is allowed, (4) an oppressed minorities mechanism is in place, (5) the minimum percentage of share capital that entitles a share-holder to call for an extraordinary shareholders' meeting is less than or equal to 10 percent (the sample median), or (6) shareholders have pre-emptive rights that can be waived only by a shareholders' vote. The index ranges from zero to six. The rule of law does not support the view that the quality of law enforcement compensates or substitutes the quality of law unless *GNP* per capita is controlled for.

Table A16: Measured values of investor protection for 17 countries

Country	Ex-ante private control of self-dealing (0 -1)	Ex-post private control of self-dealing (0 - 1)	Anti-self-dealing index (0 -1)	Revised Anti-director Index (0 - 6)	Investor Protection Index (0 - 10)
Austria	0.00	0.43	0.21	2.5	3.7
Belgium	0.39	0.70	0.54	3.0	7.0
Denmark	0.25	0.68	0.46	4.0	6.3
Finland	0.14	0.78	0.46	3.5	5.7
France	0.08	0.68	0.38	3.5	5.3
Germany	0.14	0.43	0.28	3.5	5.0
Greece	0.08	0.35	0.22	2.0	3.0
Ireland	0.78	0.80	0.79	5.0	8.3
Italy	0.17	0.68	0.42	2.0	5.0
Netherlands	0.06	0.35	0.20	2.5	4.7
Norway	0.42	0.43	0.42	3.5	6.7
Portugal	0.14	0.75	0.44	2.5	6.0
Spain	0.22	0.53	0.37	5.0	5.0
Sweden	0.17	0.50	0.33	3.5	4.3
Switzerland	0.08	0.45	0.27	3.0	3.0
UK	1.00	0.90	0.95	5.0	8.0
USA	0.33	0.98	0.65	3.0	8.3

Three measures used in investor protection are given here. The investor protection index considers investor rights, creditor rights and the rule of law. Ireland, *USA* and the *UK* with a common legal origin have the highest protection. 164 countries are used for the ranking. Data for 17 countries that are relevant to this study are reported here. The methodology used is found in Djankov et al. (2008). Data year is 2005 and is available from the World Bank Doing Business Group website.

Appendix A2.9: Derivation of DEA models

Text box A4: Derivation of the simple *DEA* models

Ratio form of CCR model

Construction of virtual firms for all the actual firms in the sample leads to a production possibility frontier and subsequent computations of performance scores for individual firms. This is achieved by dividing actual output with virtual output. This ratio shows how (in)efficient a firm is, given the resources it currently engages in its production processes. The firm is said to be fully efficient when both its actual and real outputs are the same. In reality however, this virtual firm might not exist due to market imperfections, competition and agency costs. Charnes et al. (1978) building on Farrell's (1957) notion of technical efficiency applies this to several firms with similar production inputs and outputs which we represent in the equations below.

Consider a set of n *DMUs*, with *DMU* k having a production function (X_k, Y_k). $X_k = (x_1, x_2 \ldots x_m)$ inputs and $Y_k = (y_1, y_2, \ldots.., y_z)$ outputs. Let $U = (u_1, u_2 \ldots u_m)$ and $V = (v_1, v_2 \ldots v_z)$ be weight vectors. We define these variables as follows:

a = *DMU* being evaluated

x_{ik} = quantity of input i used by *DMU* k

y_{jk} = quantity of output j produced by *DMU* k

u_i = weight assigned to input i

v_j = weight assigned to output j

ε = infinitesimal positive number

$$\text{Maximise } \sum_{j=1}^{z} v_j y_{ja} \Big/ \sum_{i=1}^{m} u_i x_{ia}$$

$$\text{Subject to } \sum_{j=1}^{z} v_j y_{jk} \Big/ \sum_{i=1}^{m} u_i x_{ik} \leq 1, \qquad k = \{1, 2, \ldots.. ,n\} \qquad \text{(A2.9.1)}$$

$$u_i \geq \varepsilon, \qquad i = \{1, 2, \ldots.. ,m\} \qquad \text{(A2.9.2)}$$

$$v_j \leq \varepsilon, \qquad j = \{1, 2, \ldots\ldots ,z\} \qquad \text{(A2.9.3)}$$

From the above, the DMU_a is evaluated as the ratio of the composite of outputs to a composite of inputs (sum of the respective weights).

Primal form of CCR model

Previous programmes are non-linear, and this complicates the estimation of the efficiency coefficients. The ratio form of the *CCR* model can be linearised in a programme using $z + m$ variables and n +1 constraints formulated as:

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Text box A4 continued: Derivation of the simple *DEA* models

Maximise $\sum_{j=1}^{z} v_j y_{ja}$

Subject to $\sum_{i=1}^{m} u_i x_{ia} = 1$ (A2.9.4)

$\sum_{j=1}^{z} v_j y_{jk} - \sum_{i=1}^{m} u_i x_{ik} \leq 0,$ $k = \{1, 2, \ldots, n\}$ (A2.9.5)

$-u_i \leq -\varepsilon,$ $i = \{1, 2, \ldots, m\}$ (A2.9.6)

$-v_j \leq -\varepsilon,$ $j = \{1, 2, \ldots, z\}$ (A2.9.7)

Dual form of CCR model

In its primal form, every *DMU* must be computed separately implying having as many constraints as the *DMUs*. The dual form of this uses the inputs and outputs as constraints and is thus preferred when analysing many firms. Since there are usually less inputs and outputs than *DMUs*, the dual problem can be more easily solved.

Minimise θ_a

Subject to $\theta_a x_{ia} - \sum_{k=1}^{n} b_k x_{ik} \geq 0,$ $i = \{1, 2, \ldots, m\}$ (A2.9.8)

$\sum_{k=1}^{n} b_k y_{jk} \geq y_{jk},$ $j = \{1, 2, \ldots, z\}$ (A2.9.9)

$\theta_a, b_k \geq 0,$ $k = \{1, 2, \ldots, n\}$ (A2.9.10)

where:

θ_a = the radial measure of technical efficiency

b_k = the activity levels of the *DMU* k's inputs and outputs.

Θ_a^*, the optimal solution to the *CCR* dual form above is the efficiency of DMU_a with an input orientation. The variable $b = (b_1, b_2, \ldots, b_k)$ is a weight vector that is included in the dual formulation and is the activity level different for each *DMU*. It represents the optimum (or virtual) *DMU*s to which DMU_a is being compared. It does this by constructing virtual values (b_k) of the more efficient *DMUs* with which DMU_a is being compared with. In the case that DMU_a has a similar result to these other *DMUs*, then it is also regarded as efficient and appears on the best-practice frontier.

Slacks can be introduced in the *CCR* dual model after construction of the virtual frontier. The virtual frontier can be rewritten to set targets by which inefficient units can reduce inputs or increase outputs to become efficient. The rewritten form of the dual model that includes the slacks is derived as below.

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Text box A4 continued: Derivation of the simple *DEA* models

Minimise $\theta_a - \varepsilon(\sum_{i=1}^{m} g_i + \sum_{j=1}^{z} h_j)$

Subject to $\sum_{k=1}^{n} b_k x_{ik} + g_i = \theta_a x_{ia}$, $i = \{1, 2,\ldots ,m\}$ (A2.9.11)

$\sum_{k=1}^{n} b_k y_{jk} - h_j = y_{ja}$, $j = \{1, 2,\ldots ,z\}$ (A2.9.12)

$\theta_a, b_k, g_i, h_j \geq 0, \quad \forall i, j, k$ (A2.9.13)

where g_i and h_j are the slack variables to change the inequality constraints to equalities and the DMU_a being efficient when θ_a equal to unity and the slacks are equal to zero. DMU_a is thus inefficient when θ_a^* is less than or equal to unity and/or g_i and h_j are greater than zero.

The BCC model

Introducing an additional constraint in the *CCR* model to control for scale effects, the *BCC* model is presented by the following input-oriented mathematical programme.

Minimise $\theta_a - \varepsilon(\sum_{i=1}^{m} g_i + \sum_{j=1}^{z} h_j)$

Subject to $\sum_{k=1}^{n} b_k x_{ik} + g_i = \theta_a x_{ia}$, $i = \{1, 2,\ldots ,m\}$ (A2.9.14)

$\sum_{k=1}^{n} b_k y_{jk} - h_j = y_{ja}$, $j = \{1, 2,\ldots ,z\}$ (A2.9.15)

$\sum_{k=1}^{n} b_k = 1$ (A2.9.16)

$\theta_a, b_k, g_i, h_j \geq 0, \quad \forall i, j, k$ (A2.9.17)

θ and ε above are both included in the equation. The additional constraint is what appears as equation (A2.9.16) which is imposed for convexity.

Appendix A3.4: Institutional theory

This section in the appendix is a detailed write-up on institutional theory and developments that have been done in this theoretical field. It should be read in conjunction with section 3.4 of Chapter Three where the theory of institutions is introduced and section 3.5 of the same chapter where corresponding hypotheses have been drawn from the institutional framework.

Text box A5: Institutional theory

Institutions and institutionalisation

There is the need to define what an institution is before the theory of institutions is reviewed. A high degree of institutionalisation enables actors to provide accurate information that serves to decrease the costs of agency. March and Olsen (1989) write that taking action in organisations are usually based on normatively appropriate behaviour than in calculating the expected returns from alternative choices. “Because of the “social fact” quality, indicators of institutionalisation are more indirect” than” most of the other theories of organisation and economics (Zucker, 1987: 447).

The advocates of institutional theory consider institutions as “algorithms that direct individuals with contrary objectives toward a common purpose” (Brown, 2005: 920). In other words, institutions represent a social order or pattern that has attained a certain state or property [and] institutionalisation denotes the process of such attainment (Jepperson, 1991: 145). The literature generally agrees in defining institutions as the humanly devised constraints that shape human interactions. In North’s (1990: 25) reasoning, institutions “predict the complex mix of motivations that shape choices” and are a vital vessel that aid in the processing of information by individuals. North’s theory of institutions combines the theory of human behaviour and the theory of transaction costs.

Institutions are unnecessary in a world of instrumental rationality. Ideas and ideologies do not matter and efficient markets – both economic and political – characterise economies” (North, 1992: 3). The treatment of institutions is therefore due to the fact that we live in an uncertain world and institutions exist to reduce uncertainties since they guide human interactions to create a stable environment aiming for the most efficient choice alternatives. They are constraints that limit the behaviour of humans and may be formal or informal. Rules are formal constraints and codes of behaviour and conventions are informal ones. Actors that deviate from these norms are penalised depending on the severity of these deviations.

In economic organisations, the stakeholders might decrease the value they put on the offending entity. Humans impose constraints on their interactions in their quest for structural exchanges. This can lead to inefficient results. In other words, institutional effects which are a result of human interaction explain some aspects of firm productive inefficiency (*X*-efficiency). Human ideas generate choices which results in both costs of agency, resource misallocation and sub-Pareto optimal outputs.

Institutions as formal and informal constraints

Continuous repeated social interactions lead to the development of informal constraints (e.g. routines, customs, traditions, conventions) to enhance exchanges while reducing the costs associated with the moral hazard problem. It is often ideal to engage in exchange with agents you have been dealing with than a new agent. What the new agent may offer is a new way of looking at an issue that has been done in a routinised way (which is non-optimal but has become a

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Test box A5 continued: Institutional theory

routine because of informal institutional pressures). Social norms from a stakeholder approach might not always act in the long-term economic survival of firms. Informal institutions make us deal with irrational choices that decrease productivity. Complexity of processes and the number of agents also makes it worthwhile to pen down formal rules that create the organisational formalisation experienced in big corporations.

Part of the enforcement of agreement between an agent and principal can be achieved through a firm's codes of conduct or by informal sanctions that is part of an organisation's culture. Firms are heterogeneous in that formal constraints produce different outcomes in different firms. This is as a result of informal constraints that can be pervasive in nature. North (1990: 40) lists three aspects of informal constraints that arise as a result of repeated human interaction as: extensions, elaborations and modifications of formal rules; socially sanctioned norms of behaviour, and; internally enforced standards of conduct.

Formal constraints or rules can complement and increase the effectiveness of informal constraints. They lower informational, monitoring, and enforcement costs and hence make informal constraints possible solutions to more complex exchange (Ibid, 1990: 46-47). They can also replace informal constraints when every agent is familiar with them or new arrangements make their formalisation imperative. Formal rules make some form of exchanges possible and monitor the performance of agents in complying with desired attributes of some goods and services. Informal constraints working together with formal rules lead to marginal bargaining between agents that are party to an exchange and agency costs obtain. Because transactions are costless and information is asymmetrical, opportunistic tendencies of appropriating more economic rents than pertains in the equilibrium sense lead to costs of agency and sub-optimal levels of cooperation as observed in the social trap of game theory. Incompleteness of economic contracts leaves gaps for deceptive behaviour by parties.

Institutional and technical environments

In Scott's (1991) write-up on *unpacking institutional arguments*, he makes mention of conceptually distinguishing technical environments from institutional environments. Scott (1991: 167) citing Scott and Meyer propose that "technical sectors are those within which a product or service is exchanged in a market such that organisations are rewarded for effective and efficient control of the work process" while institutional environment is "characterised by the elaboration of rules and requirements to which individual organisations must conform if they are to receive support and legitimacy from the environment." This implies two contrasting forms of organisations. These two forms are complementary in giving value to a firm. Scott and Meyer (1991) argue that these two forms are negatively correlated albeit in a weak sense. The two are strongly correlated in regulated environments such as banks, airlines and utilities. In the manufacturing sector however, there is a strong technical environment and weak institutional environment. These authors further suggest that with time, technical environments become institutionalised.

Oliver (1997b) distinguishes institutional and technical environments along seven dimensions; environmental context, key demand factor, type of pressure, and key constituents. The others are; organisational success factor, mechanisms of

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Test box A5 continued: Institutional theory

external control, and dominant threat to autonomy. She argues that the technical environment thrives on competitive pressure resulting from scarce environmental resources and strategises to acquire and control these input resources while managing the problems encountered in exchange dependencies. There is a neoclassical rationale behind this environment.

On the other hand, institutional environments respond to coercive, mimetic and normative pressures. It places value on the survival of firms by conforming to institutional rules and norms of their environment. By adapting to the rules, regulations and enforcements of these, firms are rewarded with social legitimacy. Oliver (1997a) compares economic (technical) rationality to normative (institutional) rationality along seven dimensions in the selection of resources that is presented in table A17.

We consider the technical environment as the techniques and processes used in maximising outputs from inputs in a firm's production possibility set. The institutional environment, according to Scott, involves rules and social patterns of behaviour. The institutional environment is required in technical environments because of the human side of production creating agency problems and technical inefficiencies. This is because agents may bend patterns in the institutional environment for their private benefits. This organisational (x)-inefficiency is considered in the context of technical inefficiency in a later section when the concept of technical efficiency is introduced.

Margolis (cited in North 1990) argues that individuals have two types of utility functions; group oriented (that fosters teamwork) and individuality (which fosters selfishness) and is one of Hofstede's dimensions. Individuals supposedly make a trade-off between these two which can be moderated by external reward incentives (not necessarily monetary). It also explains why some individuals take some decisions that have the potency of redistributing or decreasing the economic performance of their organisations. The malleability of decision agents in an organisation to respond to institutional pressures and price fluctuations determines the organisation's efficiency.

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Table A17: Rationalising the resource selection process

	Type of rationality	
Characteristics of the resource decisions	*Economic rationality*	*Normative rationality*
Nature of the decision process	Systematic, deliberate, and oriented towards economic goals	Habitual, unreflective, and embedded in norms and traditions
Key decision constraints	Information uncertainty and cognitive biases	Historical and normative context of decisions
Resource allocation process	Value-maximising	Value-laden
Decision objective	Optimisation of resource choices	Justification of resource choices
Nature of sunk costs	Economic	Cognitive (social and psychological)
Key resource attributes	Efficiency	Long-term survival and social legitimacy
Decision outcomes	Systemic assessment and choice of optimal resources	Suboptimal resource allocation and resistance to resource changes

Source: Oliver (1997a: 701)

Test box A5 continued: Institutional theory

Powell (1991) attribute the continued existence of some firms to the achievement of high standards of technical efficiency while others do so as a result of conformity to normative codes of the firm's environment. One measure then is from an internal point of view that stresses on economic output efficiency while the other stresses on a firm's social fitness. The author however acknowledges the embeddedness of economic activity in social relations. Successful pioneers in an industry can arguably be said to be the most technically efficient, early followers as in pursuit of technical efficiency challenges while late followers do so for normative efficiency. Successful followers can therefore be inferred as being normatively effective in pursuing technical efficiency.

Neo-institutional theory

The old institutional approach has been challenged because it gives little credit to the role of managers to organisational changes and adaptations creating the sensation that organisations are inert and persistent (Fernández-Alles & Valle-Cabrera, 2006). The new institutional approach has addressed some shortcomings of the old approach but in the view of Baretto and Baden-Fuller (2006), some gaps still remain unexplained. In addressing mimetic isomorphism, they identify three gaps as to: who imitates whom, as if there is a generic framework to explain heterogeneity in imitation; whether imitation is selective, and; whether there are some financial effects pertaining to organisational mimicry. They actually report that mimetic isomorphism leads to under-performance.

Institutional theory no longer only looks at persistence and homogeneity of organisations but at institutional change (North, 1990) or deinstitutionalisation through functional, political and social sources (Oliver, 1992; Dacin et al., 2002). The functional source comes through problems with performance which stems from internal questionable utility through resource misallocation or external competition. The concepts of institutional change and deinstitutionalisation are now reviewed.

Institutional change and deinstitutionalisation

We draw from the analytical lens of North (1990) for reviewing the theory of institutional change. Institutional change is usually slow and incremental rather than in discontinuity. The history of an organisation is therefore important than cross-sectional analysis. Some changes can be usually discontinuous – such as in Schumpeterian creative destruction – but the embeddedness of informal constraints in organisational settings leave traces of the old institutional setting. Formal constraints are easy to change and enforce but informal constraints are not easy to dispense with as a result of cultural persistence. Thus different organisations respond differently to institutional changes. Institutional change has the opportunities to increase productivity or redistribute the rents depending on the organisational unit concerned. North (1990) further argues that the difference between institutions and organisations and their interactions account for why there is differential performance between firms and why poorly performing firms continue to stand the test of time without being eliminated. Institutions and the constraints posed by neoclassical orthodoxy determine the opportunities that organisations can choose from. Organisations are formed to utilise the advantages of these opportunities and as they change, they change institutions too. North (1990) gives two reasons as to how this change is shaped: a lock-in that

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Test box A5 continued: Institutional theory

occurs when organisations react with institutions taking advantage of incentives offered by the former, and how agents analyse and synthesise these changes that are presented by the interaction.

Institutional change structures the evolution of organisations and hence relevant to the performance of firms today and in the future since it affects choices and effective utilisation. The difficulty that still needs to be addressed is effectively integrating institutional analysis into economic performance. North (1990) builds a general analytical framework that seeks to integrate economic and institutional theories by individual choices as a foundation block. He argues the appropriateness of a choice theoretic approach because of its logical consistency constructed on a theory of human behaviour. Economic performance is affected by institutions because of production (technology for transformation) and exchange (transaction) costs which make up total costs. Exchanges are bedevilled with information asymmetry problems that call for the efficient structure of incentives.

Although North (1990) uses the term *institutional change*, Oliver (1992: 563)) is even bolder to term it deinstitutionalisation – "the erosion or discontinuity of an institutionalised organisational activity or practice" by identifying organisational and environmental factors that serve to make organisations embrace or reject change. She further laments about the absence of inquiries to challenge factors that make organisations change due to the emphasis on social legitimacy and organisational conformity. The antecedents of deinstitutionalisation are captured by Oliver (1992) from pressures due to politics, function and society at the organisational and environmental levels of analysis. This is summarised in table A18. Kraatz and Moore (2002) add executive migration to agents of institutional change/deinstitutionalisation while mentioning others from several other authors. These include technical changes, network externalities, internal discontent, financial hardships, and increased competition.

Institutional theory and productive efficiency

External evaluators assume that organisations in a particular industry conform to legitimate patterns. They use those that provide the legitimacy for benchmarking. The productivity of firms is therefore compared to these benchmarking organisations to assess conformity and legitimacy. Even when firms think that choices of benchmarking peers are not optimal -because of significant uncertainty- they sometimes adopt these actions in order to seek legitimate conformity. Institutionalists have argued that normative rationality based on social justification can lead to inappropriate resource decisions as opposed to economic rationality that increases productivity. Firms still persist in normative rationality because conformity to social norms increases the chances of survival.

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Table A18: Antecedents of deinstitutionalisation

Level of Analysis	Political Pressures	Functional Pressures	Social Pressures
Organisation	Mounting performance crisis	Changing economic utility	Increasing social fragmentation
	Conflicting internal interests	Increasing technical specificity	Decreasing historical continuity
Environment	Increasing innovation pressures	Increasing competition for resources	Changing institutional rules and values
	Changing external dependencies	Emerging events and data	Increasing structural disaggregation

Source: Oliver (1992: 567)

Test box A5 continued: Institutional theory

Economic rationality can also increase the chances of firm survival but the trade-offs between these two ensure the continued survival of firms. In the event of adverse environmental conditions, economic rationality cannot ensure the survival of firms. Normative conformity that serves to decrease some value to economic performance will then ensure survival. Institutional changes create incentives that foster learning and knowledge development leading organisations to evolve to a different state (North, 1990). Rules encouraging the development and use of tacit knowledge lead to an entrepreneurial culture for organisational and productive efficiency. Early adopters of institutional change are driven by technically-competitive reasons while late adopters do so through conformity to best practice by succumbing to coercive pressures for fear of losing social legitimacy (Tolbert & Zucker, 1983; Sherer & Lee, 2002). Initial and early adopters are argued to be existent benchmarking peers (Rogers, 1995), so less successful peers are therefore coerced into adopting later as a necessity to survive.

Institutional theory and economic performance

Economic performance according to North (1990) is affected by the degree of interaction between informal norms, rules and enforcing behaviour which define the set of choices. The difficulty is with ascertaining the varying level of mix that obtains the best performance. The formal constraints are imitable; the informal constraints within firms in a single cultural setting are remarkably similar. How contracts are enforced then plays a very important role in organisational persistence. The structure and frequency of enforcing imperfect mechanisms leads to differing outcomes. These mechanisms are not perfect since the costs involved in determining the best alternative for enforcement is overwhelming and agents/principals settle for second-best that satisfy their utility functions.

Enforcing contracts at lowest cost is the impractical link. When norms of behaviour determine the enforcement of contracts rather than formal rules, agents know shirking, opportunism and cheating do not help since enforcing contracts are expensive and self-enforcement is best for all. Knowledge about parties to the exchange is an important consideration, and in its absence, a third enforcer, usually the state, acts to coerce albeit at some high transaction cost. Djankov et al. (2008) and La Porta et al. (2000, 2002 & 2006) in their study of investor protection have empirical support for this argument. For example, in La Porta et al.'s (2006) *What works in securities law,* private rather than public enforcement of securities laws are identified to prevail in their cross-country study.

Institutional theory ascribes to path dependency. Historically, Spain and England have evolved through different informal institutional constraints. England has an institutional framework that allows impersonal exchanges that enables it to harvest gains from technological improvements. Spain on the other hand utilises very personal relationships in economic exchanges that does not allow it to fully harness the potentials granted through technological development (North, 1990). In terms of corporate ownership England has a preponderance of diverse shareholdings and Spain has a concentration of ownership. The institutional framework of England (an Anglo-Saxon model) allows the separation between ownership and control while Spain (a Continental model) encourages insider ownership.

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Test box A5 continued: Institutional theory

Some institutional theorists agree that institutionalisation enhances the long-term survival of firms but at the expense of short-term performance and efficiency because of the increase in transaction and agency costs of compliance with standards. Implementation of codes of good corporate governance (as required by some stock exchanges) has cost related firms a lot of financial resource and institutional reorganisation. Others too argue that social legitimisation of the organisation enhances output by increased rapport with clients while garnering the required financial and human capital necessary for enhanced competitive performance. The overall benefits (according to Oliver, 1997b) exceed the costs of institutional transactions and agency. She therefore proposes a positive relationship of both institutional and production frameworks on firm performance. These two frameworks are seen as complementary rather than substitutable.

Corporate governance in an institutional framework

Corporate governance principles need to be part of a firm's institutional environment if it is to be effective. This means that the board of directors have to ensure compliance and accountability to the principles they adopt, and that these seep into all the facets of the organisational structures and layers of the staff. Aguilera and Jackson (2003) use an actor-centred institutional approach to explain variations in international corporate governance systems in terms of labour, management and capital. In terms of labour, they argue that the development of skills, representation rights and how unions are organised in a country all affect its role in governance. They also argue that a country's management ideology and career development affect the contribution of management. They also offer insights as to how the inter-firm networks, property rights and financial system of a country affect the availability, acquisition and utilisation of both financial and strategic capital.

The institutional approach that they refer to as actor-centred institutionalism looks at institutions and actors within an organisation. They suggest this gap links agency and institutional approaches as agency theory does not explicitly provide for institutional embeddedness. In the same respect, institutional theory leans too much on social legitimacy underscoring the importance of conflicts and coalitions in organisations.

Aguilera and Cuervo-Cazurra (2004) suggest that no matter how technically efficient a firm is, isomorphic pressures push firms to practice good governance so as to be a legitimate part of an industry. The nature of the institutional pressure determines the code issuer. They identify six issues of codes of good governance: the stock exchange; the State; directors' associations; managers' associations; accounting or law professional associations; and investors' associations. They further argue that although extant research reveals that institutional investors issue codes first, their findings support more countries rather having the stock exchange (Securities and Exchange Commission) as code issuers.

The stock exchange issuers result in coercive isomorphism as publicly listed firms are required to satisfy most of these codes. Coercive isomorphism also exists in the case of investors since institutional investors require conformity to the existing governance codes. Managers' associations result in mimetic isomorphism due to peer pressures while the rest of the issuers result in normative isomorphism as legitimacy is achieved through conformity to the norm. In Spain for instance, managers' association issued the first governance code followed by the government (see table of Aguilera and Cuervo-Cazurra, 2004: 423).

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Test box A5 continued: Institutional theory

Aguilera (2004) points to the fact that the Olivencia Code (1998) borrowed extensively from the Cadbury Report (1992) mainly because of legitimacy reasons. This also serves to bring the continental model of governance closer to the Anglo-Saxon model. Most recent codes of *EU* countries have factored in recommendations from the *OECD* report which makes it reasonable to compare corporate governance mechanisms across member countries. For the effects of governance recommendations in the Spanish case, Aguilera (2004: 203) writes about the Olivencia report as follows:

> The *CNMV* surveys all listed companies in order to assess their degree of adoption of the Code of Good Governance's recommendations. The conclusions of these annual surveys (1999-2002) are as follows: (1) the average firm fully adheres to approximately 75 per cent of the twenty-three recommendations listed in the code (although there is no indication that listed firms are increasingly adopting the Code recommendations); (2) firms with large free-float tend to comply more; (3) the least used recommendations are those related to transparency of remuneration, age limits for directors, and the establishment of control commissions composed solely of external directors; (4) there seems to be a significant increase in the presence of independent directors, and this is directly related to the presence of floating capital……. .

Adoption of quality management techniques (*ISO* 9000) in Germany for instance has been found to be carried out by firms not because of technical efficiency considerations alone but because it has become a necessary precondition for earning market share (Beck & Walgenback, 2005). Thus mimetic isomorphism has given way to normative and in some industries, and countries, coercive compliance. Very large companies insist their suppliers adopt several mechanisms of extended corporate governance like being quality and environmentally conscious (*ISO* 9000 and 14000 certifications), corporate citizenship and corporate social responsibility, compliance to new accounting standards and codes of good governance.

Recent institutional theory reasoning presents "nation" as a meaningful unit of analysis "in that it embodies a coherent institutional logic that evolves through on-going interplay between its informal…… and formal…. institutions and its firm-level actors (Lubatkin, 2007: 62). Thus even within nations, there are differences in perceptions, attitudes and behaviours in the relationship between principal and agents leading to systematic differences within firms. These firm-level differences are however higher between than within nations (Lubatkin et al., 2005). The behaviour and decisions of corporate decision makers is partially determined by interacting elements in a firm's social context. Lubatkin (2007) therefore comments about the ever changing nature of a firm as management and owners attempt to develop more effective monitoring and incentive mechanisms.

Support for the role of institutions in corporate governance

O'Connell et al. (2003) use institutional theory to explain corporate governance and disclosure reforms in the post-Enron era. They argue that most of the initiatives taken on by corporations are an attempt to legitimise their roles to other stakeholders as practitioners of good governance. Managers try to legitimise with financial markets by embarking on

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Test box A5 continued: Institutional theory

short-term profit growth. In the *US*, the passage of the Sarbanes-Oxley Act of 2002 requires additional financial disclosure of firms. In another study, Ocasio (1999) argue that *CEO* succession follows an institutionalised pattern which creates inertia in corporate governance. This can be the reason why non-staggered boards are evaluated in a positive light in governance indices.

The *OECD* principles of good corporate governance in 2004 recognised the need of tailoring the recommendations to specific country's cultural, economic and legal contexts as a result of the global variation of institutional settings. The institutional environment (that measures the degree of investor protection) does matter (Shleifer & Vishny, 1997; La Porta et al., 1998; 1999; 2000; Pedersen & Thomsen, 1999; Denis & McConnell, 2003; Durnev & Kim, 2005), and depending on political and socio-cultural factors, different countries have reported different effects of corporate governance on firm value (Pagano & Volpin, 2001; Klapper & Love, 2004).

In an empirical survey of block holding purchases of 88 non-financial Spanish listed firms, Crespí-Cladera and Gispert (2002: 235) found partial support about agency theory predictions about disciplinary roles of partial takeover activity and attributed the other support as "contingent on institutional characteristics of the corporate governance system." The institutional setting in Spain, as seen from the discussion of Crespí-Cladera and Gispert, does not treat majority and minority shareholders equally, hence minority shareholders are expropriated more than in the case of the *UK* where the external market for corporate control are designed with instruments that favour minority stock purchases. We also observe in Aggarwal and Kyaw's (2006) study about the role of institutions in shaping the relationship between value and leverage, given the investment opportunity set. This asserts the imporance of complementing agency theory with institutional theory in explaning the effect of leverage on firm value.

Appendix A4.3: Detailed efficiency and productivity results

The first part of the tables in this appendix report on *VRS* technical efficiency results for the five industries for every year from 2000 to 2005. The second part reports on Malmquist index and components using the years 2000 and 2005. The five industries for 16 *OECD* countries are:

Communications Equipment Manufacturing
Industrial Machinery Manufacturing
Navigational, Measuring, Medical, and Control Instruments Manufacturing
Pharmaceutical and Medicine Manufacturing
Semiconductor and Other Electronic Component Manufacturing

Legend for all efficiency and productivity tables using an input orientation

DMU	Decision making unit (in this case individual firms)
VRS Efficiency	Technical efficiency using a variable returns to scale technology
Bias-corrected efficiency	Bias corrected values for *VRS* technical efficiency using 2000 replications
BIAS	Bias in technical efficiency resulting from the bootstrap method using the *FEAR* software developed by Paul W. Wilson
Lower bound	The lower value of the confidence interval for *VRS* efficiency using 2000 replications
Upper bound	The upper value of the confidence interval *VRS* efficiency using 2000 replications
Malmquist index indicating total factor productivity	
Lower bound for Malmquist index (or pure technical change or technical change) confidence interval at 95% (i.e. at 5% significant level) using 200 replications	
Upper bound for Malmquist index (or pure technical change or technical change) confidence interval at 95% using 200 replications	

Note: Confidence intervals have only been reported for bias-corrected *VRS* efficiency, Malmquist index, pure technical efficiency change, and technical efficiency change which are of more concern to the study.

Table A19: Technical efficiency results for communications equipment manufacturing industry

Statistic	*VRS* efficiency	Bias-corrected efficiency	Bias	Standard Deviation	Lower Bound	Upper Bound
			Year 2000	***N=154***		
Mean	1.6565	1.8283	-0.1717	0.0181	1.6770	2.0000
Minimum	1.0000	1.1168	-1.3730	0.0000	1.0139	1.1607
1st quartile	1.2056	1.3028	-0.1909	0.0017	1.2144	1.4475
Median	1.4013	1.5079	-0.1336	0.0039	1.4227	1.6246
3rd quartile	1.7775	1.9083	-0.0833	0.0082	1.7901	1.9768
Maximum	7.3490	8.7220	-0.0394	0.7120	7.4410	10.4200
			Year 2001	***N=147***		
Mean	1.4973	1.6304	-0.1329	0.0075	1.5133	1.7702
Minimum	1.0000	1.0399	-0.4990	0.0000	1.0060	1.0722
1st quartile	1.1072	1.2443	-0.1680	0.0008	1.1179	1.3562
Median	1.2970	1.3887	-0.1041	0.0027	1.3101	1.5255
3rd quartile	1.6632	1.7828	-0.0677	0.0070	1.6786	1.8760
Maximum	4.4749	4.7953	-0.0371	0.0950	4.5194	5.1349
			Year 2002	***N=144***		
Mean	1.6236	1.7851	-0.1614	0.0094	1.6455	1.9429
Minimum	1.0000	1.0535	-0.7670	0.0000	1.0118	1.1025
1st quartile	1.2373	1.3451	-0.2075	0.0013	1.2518	1.4729
Median	1.3904	1.4873	-0.1236	0.0033	1.4023	1.6219
3rd quartile	1.7137	1.8474	-0.0755	0.0097	1.7367	2.0275
Maximum	4.8056	5.3050	-0.0330	0.1540	4.8927	6.0690
			Year 2003	***N=144***		
Mean	1.6130	1.7745	-0.1613	0.0116	1.6338	1.9441
Minimum	1.0000	1.0653	-0.9010	0.0000	1.0128	1.1165
1st quartile	1.1735	1.3059	-0.1807	0.0017	1.1910	1.4310
Median	1.4153	1.5388	-0.1286	0.0036	1.4397	1.6777
3rd quartile	1.6817	1.8242	-0.0883	0.0088	1.7011	1.9540
Maximum	5.4810	6.0530	-0.0460	0.2880	5.5780	7.0110
			Year 2004	***N=157***		
Mean	1.6512	1.8133	-0.1619	0.0119	1.6716	1.9816
Minimum	1.0000	1.0669	-1.0950	0.0000	1.0080	1.1403
1st quartile	1.2455	1.3320	-0.1927	0.0017	1.2600	1.4837
Median	1.4519	1.5814	-0.1288	0.0038	1.4643	1.7044
3rd quartile	1.7359	1.8922	-0.0800	0.0089	1.7634	2.0187
Maximum	6.1510	7.0130	-0.0310	0.2460	6.2540	7.9470
			Year 2005	***N=151***		
Mean	1.5162	1.6397	-0.1234	0.0058	1.5316	1.7653
Minimum	1.0000	1.0527	-0.7160	0.0000	1.0123	1.0930
1st quartile	1.2150	1.2983	-0.1580	0.0010	1.2278	1.4175
Median	1.3350	1.4222	-0.0959	0.0022	1.3460	1.5512
3rd quartile	1.5862	1.6580	-0.0621	0.0054	1.5979	1.7641
Maximum	4.6870	5.4040	-0.0260	0.1320	4.7390	6.0270

Level of significance for bias-corrected efficiency scores (measured with distance functions with an input orientation) under variable returns to scale technology is 5%.

Table A20: Technical efficiency results for industrial machinery manufacturing industry

Statistic	*VRS* efficiency	Bias-corrected efficiency	Bias	Standard Deviation	Lower Bound	Upper Bound
		Year 2000	***N=62***			
Mean	1.2371	1.3233	-0.0861	0.0029	1.2437	1.4233
Minimum	1.0000	1.0795	-0.1846	0.0003	1.0079	1.1455
1st quartile	1.1570	1.2440	-0.1093	0.0009	1.1663	1.3243
Median	1.2535	1.3182	-0.0769	0.0021	1.2607	1.4029
3rd quartile	1.3205	1.4021	-0.0487	0.0041	1.3261	1.5058
Maximum	1.4868	1.5584	-0.0261	0.0086	1.4907	1.7132
		Year 2001	***N=66***			
Mean	1.1245	1.1785	-0.0540	0.0016	1.1284	1.2562
Minimum	1.0000	1.0417	-0.1091	0.0001	1.0028	1.0817
1st quartile	1.0000	1.0919	-0.0616	0.0003	1.0046	1.1692
Median	1.0743	1.1265	-0.0485	0.0007	1.0781	1.2208
3rd quartile	1.1754	1.2005	-0.0337	0.0020	1.1794	1.2750
Maximum	1.7017	1.7931	-0.0210	0.0084	1.7079	1.9105
		Year 2002	***N=64***			
Mean	1.1068	1.1531	-0.0462	0.2925	1.1103	1.2177
Minimum	1.0000	1.0187	-0.0973	0.0001	1.0028	1.0418
1st quartile	1.0000	1.0859	-0.0512	0.0002	1.0039	1.1296
Median	1.0735	1.1145	-0.0411	0.0005	1.0760	1.2004
3rd quartile	1.1488	1.1948	-0.0307	0.0011	1.1525	1.2676
Maximum	1.5851	1.6455	-0.0146	9.6303	1.5893	1.7140
		Year 2003	***N=74***			
Mean	1.1286	1.1808	-0.0522	0.0014	1.1326	1.2498
Minimum	1.0000	1.0442	-0.1155	0.0001	1.0033	1.0800
1st quartile	1.0040	1.0971	-0.0623	0.0002	1.0078	1.1585
Median	1.1012	1.1357	-0.0442	0.0005	1.1042	1.2366
3rd quartile	1.2080	1.2362	-0.0323	0.0014	1.2113	1.2978
Maximum	1.5445	1.5985	-0.0172	0.0072	1.5510	1.6454
		Year 2004	***N=71***			
Mean	1.1362	1.1888	-0.0526	0.1216	1.1401	1.2566
Minimum	1.0000	1.0384	-0.1148	0.0001	1.0028	1.0717
1st quartile	1.0023	1.1116	-0.0630	0.0003	1.0067	1.1924
Median	1.1202	1.1589	-0.0450	0.0006	1.1225	1.2384
3rd quartile	1.2255	1.2621	-0.0337	0.0017	1.2304	1.3025
Maximum	1.5495	1.6076	-0.0154	8.5367	1.5561	1.6697
		Year 2005	***N=74***			
Mean	1.1487	1.2016	-0.0529	0.9338	1.1515	1.2724
Minimum	1.0000	1.0206	-0.1250	0.0001	1.0031	1.0439
1st quartile	1.0687	1.1246	-0.0807	0.0004	1.0701	1.2121
Median	1.1456	1.1926	-0.0470	0.0017	1.1483	1.2484
3rd quartile	1.2035	1.2545	-0.0250	0.0039	1.2052	1.3333
Maximum	1.4013	1.4728	-0.0088	9.9358	1.4068	1.5675

Level of significance for bias-corrected efficiency scores (measured with distance functions with an input orientation) under variable returns to scale technology is 5%.

Table A21: Technical efficiency results for navigational, measuring, medical, and control instruments manufacturing industry

Statistic	*VRS* efficiency	Bias-corrected efficiency	Bias	Standard Deviation	Lower Bound	Upper Bound
		Year 2000		***N=158***		
Mean	1.6863	1.8455	-0.1591	0.0140	1.7058	2.0088
Minimum	1.0000	1.0560	-1.0110	0.0000	1.0104	1.0980
1st quartile	1.1662	1.2725	-0.1787	0.0010	1.1800	1.3725
Median	1.3295	1.4217	-0.1158	0.0026	1.3454	1.5171
3rd quartile	1.6745	1.8003	-0.0680	0.0082	1.6968	1.9100
Maximum	7.0730	8.0540	-0.0370	0.3750	7.1920	9.0130
		Year 2001		***N=166***		
Mean	1.5947	1.7244	-0.1295	0.0113	1.6094	1.8704
Minimum	1.0000	1.0340	-1.1600	0.0000	1.0092	1.0580
1st quartile	1.1181	1.2224	-0.1634	0.0004	1.1308	1.3107
Median	1.2537	1.3236	-0.0907	0.0019	1.2635	1.4355
3rd quartile	1.5203	1.6299	-0.0450	0.0070	1.5353	1.7357
Maximum	7.7620	8.9230	-0.0230	0.4000	7.8550	10.2100
		Year 2002		***N=173***		
Mean	1.5751	1.7005	-0.1253	0.0065	1.5900	1.8317
Minimum	1.0000	1.0810	-0.6720	0.0000	1.0030	1.1230
1st quartile	1.1132	1.2313	-0.1650	0.0008	1.1260	1.3539
Median	1.3007	1.3764	-0.1000	0.0023	1.3123	1.4840
3rd quartile	1.5910	1.6645	-0.0671	0.0066	1.5975	1.7620
Maximum	6.8527	7.2244	-0.0262	0.1520	6.9207	7.5876
		Year 2003		***N=180***		
Mean	1.6091	1.7490	-0.1397	0.0083	1.6257	1.8926
Minimum	1.0000	1.1020	-0.6990	0.0000	1.0090	1.1560
1st quartile	1.1517	1.2518	-0.1620	0.0010	1.1637	1.3625
Median	1.2986	1.3911	-0.1040	0.0025	1.3114	1.5041
3rd quartile	1.5700	1.6560	-0.0706	0.0070	1.5862	1.7724
Maximum	7.2920	7.9910	-0.0323	0.1160	7.4070	8.6470
		Year 2004		***N=184***		
Mean	1.4508	1.5650	-0.1139	0.0050	1.4642	1.6831
Minimum	1.0000	1.0602	-0.5150	0.0000	1.0080	1.1040
1st quartile	1.1098	1.2250	-0.1431	0.0007	1.1190	1.3336
Median	1.2878	1.3785	-0.0948	0.0020	1.2986	1.4687
3rd quartile	1.4536	1.5250	-0.0640	0.0050	1.4668	1.6108
Maximum	6.0940	6.4180	-0.0291	0.0970	6.1410	6.7230
		Year 2005		***N=190***		
Mean	1.5437	1.6679	-0.1241	0.0086	1.5590	1.7966
Minimum	1.0000	1.0492	-0.9950	0.0000	1.0086	1.0989
1st quartile	1.1071	1.2126	-0.1398	0.0008	1.1180	1.3233
Median	1.2563	1.3420	-0.0891	0.0017	1.2670	1.4437
3rd quartile	1.5037	1.5720	-0.0673	0.0050	1.5138	1.6507
Maximum	8.3250	9.3200	-0.0396	0.3200	8.4220	10.6300

Level of significance for bias-corrected efficiency scores (measured with distance functions with an input orientation) under variable returns to scale technology is 5%.

Table A22: Technical efficiency results for pharmaceutical and medicine manufacturing industry

Statistic	*VRS* efficiency	Bias-corrected efficiency	Bias	Standard Deviation	Lower Bound	Upper Bound
		Year 2000		***N=156***		
Mean	2.0521	2.2789	-0.2266	0.0232	2.0835	2.5072
Minimum	1.0000	1.0771	-1.1588	0.0000	1.0139	1.1535
1st quartile	1.1410	1.2664	-0.2490	0.0023	1.1563	1.4306
Median	1.4436	1.5903	-0.1643	0.0054	1.4659	1.7589
3rd quartile	2.5865	2.8387	-0.1163	0.0161	2.6213	3.0141
Maximum	8.8620	9.8160	-0.0469	0.4132	9.0170	10.7300
		Year 2001		***N=163***		
Mean	2.2225	2.4886	-0.266	0.0244	2.2628	2.7305
Minimum	1	1.101	-1.309	0	1.0169	1.171
1st quartile	1.2062	1.3348	-0.3082	0.0036	1.2269	1.4806
Median	1.5589	1.6934	-0.191	0.008	1.5845	1.8578
3rd quartile	2.608	2.9524	-0.1348	0.0213	2.6548	3.312
Maximum	8.8079	10.09	-0.065	0.396	9.0263	11.31
		Year 2002		***N=176***		
Mean	2.0803	2.3429	-0.2624	0.0227	2.1221	2.5808
Minimum	1.0000	1.1060	-1.1030	0.0010	1.0153	1.1707
1st quartile	1.2433	1.4029	-0.3122	0.0035	1.2640	1.5810
Median	1.5105	1.6833	-0.2002	0.0074	1.5377	1.8517
3rd quartile	2.3528	2.6143	-0.1320	0.0213	2.4000	2.8690
Maximum	7.9160	9.0190	-0.0796	0.3440	8.1420	9.7930
		Year 2003		***N=193***		
Mean	2.1993	2.4815	-0.2820	0.0274	2.2473	2.7247
Minimum	1.0000	1.0799	-1.3870	0.0000	1.0210	1.1363
1st quartile	1.2330	1.4080	-0.3137	0.0037	1.2645	1.5582
Median	1.5270	1.6822	-0.2003	0.0070	1.5630	1.8590
3rd quartile	2.2760	2.5395	-0.1465	0.0180	2.3280	2.7690
Maximum	8.5880	9.7230	-0.0680	0.4950	8.7440	10.5900
		Year 2004		***N=211***		
Mean	2.2504	2.5185	-0.2678	0.0264	2.2946	2.7637
Minimum	1.0000	1.1450	-1.4710	0.0000	1.0215	1.2202
1st quartile	1.2476	1.4293	-0.3091	0.0032	1.2726	1.5857
Median	1.5370	1.6830	-0.1791	0.0064	1.5572	1.8362
3rd quartile	2.6082	2.9451	-0.1293	0.0203	2.6504	3.3495
Maximum	9.0120	9.9190	-0.0500	0.6410	9.2280	11.4400
		Year 2005		***N=232***		
Mean	2.1659	2.4247	-0.2586	0.0261	2.2102	2.6521
Minimum	1.0000	1.1242	-1.7610	0.0000	1.0220	1.2027
1st quartile	1.2121	1.3587	-0.2942	0.0030	1.2352	1.5313
Median	1.5375	1.6910	-0.1741	0.0060	1.5686	1.8280
3rd quartile	2.4491	2.7275	-0.1287	0.0160	2.5098	2.9470
Maximum	8.7570	10.4500	-0.0566	0.6940	8.9460	11.9000

Level of significance for bias-corrected efficiency scores (measured with distance functions with an input orientation) under variable returns to scale technology is 5%.

Table A23: Technical efficiency results for semiconductor and other electronic component manufacturing industry

Statistic	*VRS* efficiency	Bias-corrected efficiency	Bias	Standard Deviation	Lower Bound	Upper Bound
		Year 2000		***N =182***		
Mean	1.3564	1.4585	-0.1020	0.0030	1.3690	1.5579
Minimum	1.0000	1.0631	-0.2680	0.0000	1.0089	1.1180
1st quartile	1.1968	1.2854	-0.1298	0.0008	1.2105	1.3863
Median	1.3299	1.4170	-0.0885	0.0016	1.3417	1.5037
3rd quartile	1.4458	1.5440	-0.0602	0.0040	1.4573	1.6308
Maximum	3.2120	3.2970	-0.0250	0.0210	3.2310	3.3930
		Year 2001		***N=201***		
Mean	1.4884	1.6004	-0.1117	0.0043	1.5028	1.7155
Minimum	1.0000	1.0620	-0.5620	0.0000	1.0080	1.1310
1st quartile	1.1490	1.2490	-0.1316	0.0010	1.1660	1.3540
Median	1.3280	1.4130	-0.0961	0.0019	1.3411	1.5052
3rd quartile	1.5400	1.6110	-0.0644	0.0040	1.5430	1.7320
Maximum	5.5060	5.9630	-0.0260	0.0880	5.5760	6.3790
		Year 2002		***N=209***		
Mean	1.5662	1.6828	-0.1163	0.0044	1.5825	1.8036
Minimum	1.0000	1.0830	-0.5030	0.0000	1.0090	1.1640
1st quartile	1.1850	1.2750	-0.1457	0.0010	1.1943	1.3720
Median	1.3540	1.4446	-0.0981	0.0020	1.3690	1.5510
3rd quartile	1.6013	1.7070	-0.0660	0.0049	1.6110	1.8339
Maximum	6.2520	6.6110	-0.0300	0.0530	6.3250	6.9320
		Year 2003		***N=211***		
Mean	1.3493	1.4265	-0.0769	0.1254	1.3590	1.5093
Minimum	1.0000	1.0368	-0.3680	0.0000	1.0050	1.0807
1st quartile	1.1360	1.2035	-0.0984	0.0000	1.1443	1.2732
Median	1.2307	1.2970	-0.0600	0.0007	1.2390	1.3638
3rd quartile	1.3930	1.4550	-0.0395	0.0029	1.4031	1.5460
Maximum	3.6950	3.7510	-0.0150	9.0880	3.7070	4.0120
		Year 2004		***N=226***		
Mean	1.2899	1.3511	-0.0609	0.4800	1.2975	1.4201
Minimum	1.0000	1.0350	-0.2029	0.0000	1.0068	1.0700
1st quartile	1.1029	1.1611	-0.0776	0.0000	1.1067	1.2291
Median	1.2337	1.2825	-0.0453	0.0004	1.2378	1.3407
3rd quartile	1.3550	1.4125	-0.0304	0.0021	1.3628	1.4897
Maximum	2.7330	2.9340	-0.0130	9.8980	2.7590	3.1310
		Year 2005		***N=240***		
Mean	1.3769	1.4719	-0.0947	0.1211	1.3887	1.5675
Minimum	1.0000	1.1058	-0.3260	0.0000	1.0100	1.1984
1st quartile	1.2024	1.2886	-0.1230	0.0002	1.2080	1.4055
Median	1.3645	1.4279	-0.0877	0.0018	1.3740	1.5245
3rd quartile	1.5087	1.5801	-0.0489	0.0033	1.5225	1.6776
Maximum	2.4240	2.5140	-0.0190	9.7460	2.4350	2.6290

Level of significance for bias-corrected efficiency scores (measured with distance functions with an input orientation) under variable returns to scale technology is 5%. The results are in distance functions (the inverse of technical efficiency).

Text box A6: Yearly analysis of technical efficiency by industry

With Communications, the mean distance functions for the six years are:

2000 = 1.66 2001 = 1.50 2002 = 1.62 2003 = 1.61 2004 = 1.65 2005 = 1.52

The highest mean efficiency is in the second year followed by the final year of the analysis. The lowest is in the intial year followed by the penultimate year. For Industrials, the mean distance functions are:

2000 = 1.24 2001 = 1.12 2002 = 1.11 2003 = 1.13 2004 = 1.14 2005 = 1.15

For this industry, mean efficiency for all years are the highest for all the industries. Within the industry, the highest efficiency is in year 2002 followed closely by years 2001, 2003, 2004 and 2005 respectively. The initial year (2000) has the least mean efficiency which is still higher than all the years in the other industries. For Navigationals, the mean distance functions are:

2000 = 1.69 2001 = 1.60 2002 = 1.57 2003 = 1.61 2004 = 1.45 2005 = 1.54

Navigationals have values comparable to Communications. In year 2003 for instance they both have the same mean efficiency. The highest mean efficiency for Navigationals is however in year 2004, higher than the highest for Communications (year 2001). The lowest for this industry is also the initial year, while the final year is the second highest, followed by years 2002, 2001 and 2003 respectively.

For Pharmaceuticals, the mean distance functions are:

2000 = 2.05 2001 = 2.22 2002 = 2.08 2003 = 2.20 2004 = 2.25 2005 = 2.17

The Pharmaceutical industry has the lowest technical efficiency for all years in all the industries. As a matter of fact, its highest mean efficiency is in the initial year (distance function of 2.05). The lowest mean efficiency is in the penultimate year (distance function = 2.25). For this industry, the initial sample size is 570 firms. The 232 firms we use for our analysis of year 2005 are the highest in the final analysis. The summary statistics of the efficiency results also reveal a high quartile range. This industry has very large firms like Abbott, Glaxo Smithkline Beecham, Eli Lilly, etc but have a lot of very small and young firms.

Because of the absence of data for some of the inputs (especially intangible assets and other operating expenses), a lot of firms have been dropped. Additionally, this industry has been subjected to more outlier detection tests than the other industries and the results are a reflection of the size variations. This is even the case after using a variable returns to scale technology. Scale efficiency is useful in this industry but we do not analyse this, although we report scale efficiency changes in our dynamic analysis.

For Semiconductors, the mean distance functions are:

2000 = 1.36 2001 = 1.49 2002 = 1.57 2003 = 1.35 2004 = 1.29 2005 = 1.38

Semiconductors report relatively high mean efficiency, second only to Industrials. The mean highest efficiency is at 1.29 (penultimate year) and the least is the third year of analysis. The second highest is the fourth year followed by the initial year, then the final year and then the second year respectively.

Table A24: Farrell measures of technical efficiency and bias-corrected scores

Industry	Technical Efficiency	2000	2001	2002	2003	2004	2005	All years
Pharmaceutical and medicine	VRS efficiency	0.65	0.63	0.62	0.62	0.61	0.62	0.62
	Bias-corrected VRS efficiency	*0.58*	*0.55*	*0.55*	*0.54*	*0.54*	*0.55*	*0.55*
	5% efficiency	0.53	0.50	0.50	0.49	0.49	0.50	0.50
	95% efficiency	0.64	0.62	0.61	0.61	0.60	0.60	0.61
Industrial machinery	VRS efficiency	0.82	0.90	0.91	0.90	0.89	0.88	0.88
	Bias-corrected VRS efficiency	*0.76*	*0.86*	*0.87*	*0.85*	*0.85*	*0.84*	*0.84*
	5% efficiency	0.71	0.81	0.83	0.81	0.80	0.79	0.79
	95% efficiency	0.81	0.90	0.91	0.89	0.89	0.88	0.88
Communications equipment	VRS efficiency	0.70	0.74	0.69	0.71	0.69	0.72	0.71
	Bias-corrected VRS efficiency	*0.63*	*0.68*	*0.63*	*0.64*	*0.62*	*0.67*	*0.64*
	5% efficiency	0.58	0.63	0.59	0.59	0.57	0.62	0.59
	95% efficiency	0.69	0.73	0.68	0.70	0.68	0.72	0.70
Semiconductor and other electronic component	VRS efficiency	0.76	0.74	0.72	0.78	0.80	0.75	0.76
	Bias-corrected VRS efficiency	*0.71*	*0.68*	*0.67*	*0.74*	*0.77*	*0.70*	*0.71*
	5% efficiency	0.66	0.64	0.62	0.70	0.73	0.65	0.67
	95% efficiency	0.76	0.73	0.71	0.78	0.80	0.74	0.75
Navigational, measuring, medical and control	VRS efficiency	0.71	0.75	0.73	0.73	0.76	0.76	0.74
	Bias-corrected VRS efficiency	*0.65*	*0.69*	*0.67*	*0.67*	*0.70*	*0.70*	*0.68*
	5% efficiency	0.60	0.64	0.62	0.62	0.65	0.65	0.63
	95% efficiency	0.71	0.74	0.73	0.72	0.75	0.75	0.73
All industries	VRS efficiency	0.72	0.73	0.71	0.73	0.73	0.72	0.72
	Bias-corrected VRS efficiency	*0.65*	*0.67*	*0.65*	*0.67*	*0.67*	*0.66*	*0.66*
	5% efficiency	0.60	0.62	0.60	0.62	0.63	0.62	0.62
	95% efficiency	0.71	0.72	0.70	0.72	0.72	0.71	0.72

Scores are for each year and the average of all the years for the five industries. 5% and 95% efficiency denote the lower and upper confidence intervals for the concerned bias-corrected technical efficiencies.

Table A25: Technical efficiency estimates by country

Country	*VRS* efficiency	Bias-corrected *VRS* efficiency	5% Bound efficiency	95% Bound efficiency
Austria	0.86	0.78	0.70	0.85
	0.87	*0.82*	*0.77*	*0.87*
Belgium	0.77	0.70	0.65	0.76
	0.81	*0.73*	*0.68*	*0.80*
Denmark	0.74	0.69	0.65	0.73
	0.73	*0.68*	*0.64*	*0.72*
Finland	0.80	0.75	0.71	0.79
	0.86	*0.81*	*0.76*	*0.86*
France	0.77	0.71	0.66	0.76
	0.80	*0.73*	*0.68*	*0.79*
Germany	0.76	0.71	0.67	0.75
	0.79	*0.74*	*0.69*	*0.78*
Greece	0.82	0.80	0.77	0.81
	0.89	*0.79*	*0.73*	*0.88*
Ireland	0.53	0.47	0.44	0.52
	0.38	*0.33*	*0.30*	*0.37*
Italy			*NA*	
	0.82	*0.77*	*0.72*	*0.81*
Netherlands	0.80	0.73	0.68	0.80
	0.84	*0.77*	*0.71*	*0.83*
Norway	0.81	0.73	0.67	0.80
	0.90	*0.79*	*0.70*	*0.88*
Spain	0.72	0.67	0.64	0.71
	0.67	*0.64*	*0.61*	*0.66*
Sweden	0.76	0.68	0.63	0.75
	0.73	*0.66*	*0.60*	*0.73*
Switzerland	0.83	0.75	0.69	0.82
	0.89	*0.82*	*0.76*	*0.89*
UK	0.68	0.62	0.58	0.67
	0.71	*0.65*	*0.61*	*0.70*
USA	0.71	0.65	0.60	0.70
	0.70	*0.64*	*0.59*	*0.69*
		Legal Origin		
English	0.70	0.64	0.60	0.69
	0.70	*0.64*	*0.59*	*0.69*
French	0.77	0.71	0.66	0.77
	0.81	*0.74*	*0.69*	*0.80*
German	0.79	0.73	0.67	0.78
	0.82	*0.76*	*0.71*	*0.81*
Scandinavian	0.77	0.71	0.66	0.76
	0.79	*0.73*	*0.67*	*0.78*

Upper row is 2005 technical efficiency scores. Lower row (italicised) is 2003 technical efficiency scores. These are just two of the six years that are reported. Scores for years 2000, 2001, 2002 and 2004, although not reported, are equally important.

Table A26: Productivity results for communications equipment manufacturing industry

Statistic	Malmquist index	*TFP* Lower bound 5%	*TFP* Upper bound 95%	Pure eff. change	Pure tech. change	Scale change	Scale of tech. change	Technical change
			Years 2000-2001	***N = 132***				
Mean	1.17	1.13	1.23	0.99	1.12	1.00	1.10	1.19
Minimum	0.50	0.46	0.50	0.46	0.42	0.26	0.67	1.01
1st quartile	0.95	0.92	1.00	0.82	1.07	0.95	1.00	1.11
Median	1.05	1.02	1.10	0.96	1.13	1.00	1.00	1.15
3rd quartile	1.23	1.18	1.30	1.08	1.19	1.00	1.08	1.24
Maximum	6.32	6.62	8.30	2.42	1.66	5.17	2.48	1.50
			Years 2001-2002	***N = 130***				
Mean	1.10	1.07	1.15	1.18	0.91	1.02	1.00	0.91
Minimum	0.60	0.56	0.61	0.64	0.74	0.85	0.90	0.77
1st quartile	0.89	0.88	0.95	0.98	0.90	0.99	0.99	0.89
Median	0.99	0.98	1.03	1.08	0.93	1.00	1.00	0.93
3rd quartile	1.14	1.11	1.16	1.25	0.94	1.01	1.01	0.94
Maximum	4.63	4.63	4.69	4.56	0.98	2.27	1.16	1.04
			Years 2002-2003	***N = 124***				
Mean	0.98	0.95	1.03	1.03	0.92	1.05	1.00	0.92
Minimum	0.51	0.44	0.52	0.52	0.48	0.74	0.79	0.84
1st quartile	0.85	0.81	0.88	0.91	0.89	1.00	0.98	0.89
Median	0.97	0.94	1.00	1.04	0.91	1.01	1.00	0.91
3rd quartile	1.04	1.02	1.08	1.12	0.95	1.02	1.01	0.94
Maximum	2.30	2.20	2.60	2.13	1.23	2.39	1.98	1.01
			Years 2003-2004	***N = 120***				
Mean	1.01	0.97	1.06	1.10	0.93	0.98	1.02	0.94
Minimum	0.59	0.51	0.64	0.70	0.72	0.57	0.56	0.81
1st quartile	0.89	0.85	0.92	0.97	0.90	0.97	1.00	0.93
Median	0.97	0.96	1.00	1.05	0.93	0.99	1.01	0.94
3rd quartile	1.06	1.03	1.09	1.14	0.96	1.00	1.03	0.96
Maximum	2.53	2.22	2.61	2.86	1.57	1.16	1.34	1.00
			Years 2004-2005	***N = 136***				
Mean	1.00	0.98	1.03	0.98	1.02	0.99	1.02	1.03
Minimum	0.51	0.43	0.52	0.41	0.80	0.68	0.87	0.93
1st quartile	0.91	0.90	0.93	0.89	1.01	0.98	1.00	1.03
Median	0.99	0.98	1.01	0.97	1.02	1.00	1.00	1.04
3rd quartile	1.06	1.03	1.08	1.03	1.05	1.00	1.03	1.04
Maximum	2.76	2.76	2.77	2.75	1.19	1.69	1.28	1.08
			Years 2003-2005	***N = 111***				
Mean	0.95	0.92	1.00	1.04	0.93	0.98	1.04	0.95
Minimum	0.51	0.53	0.58	0.50	0.61	0.52	0.78	0.77
1st quartile	0.83	0.82	0.87	0.87	0.87	0.96	0.99	0.87
Median	0.96	0.93	1.00	1.02	0.92	1.00	1.00	0.94
3rd quartile	1.04	1.02	1.09	1.16	0.97	1.01	1.04	1.03
Maximum	1.92	1.65	1.93	2.41	1.24	1.49	1.52	1.16
			Years 2000-2005	***N = 98***				
Mean	1.02	0.98	1.07	1.01	1.01	0.95	1.08	1.07
Minimum	0.53	0.51	0.54	0.53	0.35	0.42	1.00	0.71
1st quartile	0.81	0.80	0.89	0.83	0.96	0.93	1.01	1.02
Median	0.99	0.96	1.02	0.97	1.03	0.98	1.03	1.10
3rd quartile	1.17	1.10	1.20	1.15	1.10	1.00	1.09	1.14
Maximum	2.35	2.35	2.50	2.14	1.18	1.06	2.60	1.22

Table A27: Productivity results for industrial machinery and equipment manufacturing industry

Statistic	Malmquist index	*TFP* Lower bound 5%	*TFP* Upper bound 95%	Pure eff. change	Pure tech. change	Scale change	Scale of tech. change	Technical change
			Years 2000-2001	***N = 55***				
Mean	1.07	1.04	1.08	1.00	1.05	0.99	1.03	1.07
Minimum	0.85	0.84	0.92	0.81	0.69	0.88	0.87	1.03
1st quartile	1.00	0.98	1.01	0.95	1.03	0.97	1.00	1.05
Median	1.02	1.01	1.03	0.98	1.04	1.00	1.01	1.06
3rd quartile	1.07	1.06	1.09	1.01	1.07	1.01	1.03	1.07
Maximum	1.78	1.69	1.81	1.60	1.33	1.23	1.77	1.38
			Years 2001-2002	***N = 60***				
Mean	1.02	1.00	1.04	1.00	1.03	1.01	1.00	1.02
Minimum	0.65	0.63	0.73	0.60	0.84	0.72	0.72	0.91
1st quartile	0.97	0.95	0.99	0.95	0.99	0.99	0.98	1.00
Median	1.00	1.00	1.02	1.00	1.02	1.01	1.00	1.01
3rd quartile	1.05	1.05	1.07	1.02	1.04	1.03	1.01	1.03
Maximum	1.66	1.39	1.66	1.41	1.58	1.25	1.27	1.32
			Years 2002-2003	***N = 61***				
Mean	0.97	0.96	1.00	1.01	0.95	1.01	1.00	0.95
Minimum	0.78	0.76	0.83	0.86	0.77	0.85	0.85	0.78
1st quartile	0.94	0.93	0.96	0.98	0.94	0.99	0.99	0.95
Median	0.97	0.96	1.00	1.00	0.97	1.00	1.00	0.97
3rd quartile	1.02	1.01	1.03	1.05	0.98	1.02	1.01	0.97
Maximum	1.12	1.11	1.24	1.23	1.15	1.11	1.26	1.01
			Years 2003-2004	***N = 64***				
Mean	0.97	0.95	1.00	1.01	0.97	1.00	1.00	0.97
Minimum	0.74	0.72	0.75	0.77	0.81	0.90	0.79	0.92
1st quartile	0.92	0.90	0.94	0.96	0.94	0.99	0.99	0.95
Median	0.96	0.96	0.99	1.00	0.97	1.00	1.00	0.97
3rd quartile	1.02	1.00	1.03	1.05	0.99	1.02	1.01	0.98
Maximum	1.28	1.23	1.29	1.26	1.24	1.11	1.17	1.05
			Years 2004-2005	***N = 67***				
Mean	1.01	0.99	1.02	0.98	1.03	0.98	1.01	1.05
Minimum	0.74	0.73	0.74	0.71	0.77	0.85	0.85	0.93
1st quartile	0.97	0.95	0.98	0.94	1.02	0.96	1.00	1.04
Median	0.99	0.97	1.00	0.98	1.05	0.99	1.01	1.05
3rd quartile	1.03	1.00	1.04	1.00	1.05	1.00	1.03	1.06
Maximum	1.28	1.27	1.28	1.21	1.16	1.13	1.21	1.08
			Years 2003-2005	***N = 63***				
Mean	0.98	0.96	0.99	1.02	1.00	1.00	0.98	0.96
Minimum	0.76	0.74	0.76	0.73	0.62	0.87	0.52	0.84
1st quartile	0.91	0.91	0.94	0.96	0.95	0.98	0.97	0.94
Median	0.98	0.98	1.00	1.00	0.99	1.00	1.00	0.98
3rd quartile	1.03	1.01	1.05	1.11	1.00	1.01	1.00	0.99
Maximum	1.16	1.15	1.16	1.26	1.85	1.23	1.35	1.03
			Years 2000-2005	***N = 52***				
Mean	1.01	0.99	1.05	0.98	1.05	0.99	1.00	1.04
Minimum	0.78	0.78	0.84	0.78	0.85	0.83	0.75	0.84
1st quartile	0.93	0.91	0.97	0.93	1.00	0.97	0.98	1.02
Median	0.99	0.98	1.02	0.98	1.04	0.99	1.00	1.05
3rd quartile	1.05	1.02	1.08	1.00	1.07	1.01	1.03	1.07
Maximum	1.46	1.44	1.48	1.32	1.43	1.25	1.21	1.21

Table A28: Productivity results for navigational, measuring, medical, and control instruments manufacturing industry

Statistic	Malmquist index	*TFP* Lower bound 5%	*TFP* Upper bound 95%	Pure eff. change	Pure tech. change	Scale change	Scale of tech. change	Technical change
			Years 2000-2001		***N = 140***			
Mean	1.28	1.24	1.35	1.02	1.03	1.13	1.03	1.05
Minimum	0.51	0.49	0.52	0.21	0.69	0.40	0.76	0.78
1st quartile	0.93	0.91	0.96	0.90	1.01	0.97	1.00	1.05
Median	1.01	0.99	1.04	0.97	1.05	0.99	1.01	1.07
3rd quartile	1.08	1.06	1.16	1.03	1.07	1.00	1.03	1.09
Maximum	24.75	25.01	28.12	3.47	1.43	10.27	1.40	1.10
			Years 2001-2002		***N = 150***			
Mean	1.04	1.01	1.09	1.04	0.99	1.04	0.97	0.96
Minimum	0.50	0.42	0.50	0.49	0.81	0.44	0.64	0.90
1st quartile	0.93	0.90	0.96	0.94	0.96	1.00	0.96	0.94
Median	0.99	0.97	1.02	1.00	0.96	1.01	0.99	0.96
3rd quartile	1.08	1.05	1.12	1.13	1.00	1.04	1.00	0.96
Maximum	4.46	4.51	5.25	2.18	1.51	3.95	1.21	1.13
			Years 2002-2003		***N = 148***			
Mean	1.03	0.99	1.06	1.08	0.94	1.03	0.99	0.92
Minimum	0.58	0.57	0.62	0.57	0.54	0.59	0.81	0.76
1st quartile	0.89	0.87	0.93	0.97	0.91	0.99	0.96	0.89
Median	0.98	0.96	0.99	1.01	0.95	1.02	0.98	0.93
3rd quartile	1.03	1.01	1.05	1.11	0.98	1.06	1.01	0.94
Maximum	8.01	6.02	8.03	7.23	1.14	1.80	1.40	1.09
			Years 2003-2004		***N = 156***			
Mean	0.98	0.95	1.00	0.99	1.00	0.99	1.01	1.00
Minimum	0.50	0.47	0.52	0.45	0.64	0.46	0.85	0.91
1st quartile	0.89	0.87	0.92	0.89	0.97	0.98	0.96	0.97
Median	0.97	0.96	1.00	0.97	1.01	1.01	0.99	1.00
3rd quartile	1.01	1.00	1.04	1.02	1.04	1.04	1.03	1.04
Maximum	2.26	1.78	2.34	2.29	1.15	1.16	1.64	1.11
			Years 2004-2005		***N = 164***			
Mean	1.04	1.01	1.06	1.04	1.00	0.98	1.03	1.03
Minimum	0.61	0.61	0.62	0.57	0.71	0.65	0.89	0.92
1st quartile	0.94	0.93	0.97	0.96	0.96	0.94	0.99	1.00
Median	1.01	0.99	1.02	1.00	1.00	0.99	1.01	1.03
3rd quartile	1.07	1.04	1.10	1.08	1.03	1.01	1.07	1.05
Maximum	2.78	2.62	2.81	2.59	1.22	1.66	1.45	1.24
			Years 2003-2005		***N = 155***			
Mean	1.00	0.96	1.03	1.04	1.00	0.97	1.04	1.03
Minimum	0.50	0.46	0.55	0.51	0.57	0.06	0.89	0.87
1st quartile	0.88	0.86	0.91	0.88	0.96	0.95	0.99	0.98
Median	0.96	0.95	0.99	0.98	1.00	0.99	1.01	1.04
3rd quartile	1.05	1.01	1.08	1.05	1.06	1.00	1.04	1.08
Maximum	4.54	3.71	4.97	8.33	1.32	1.77	2.06	1.33
			Years 2000-2005		***N = 118***			
Mean	1.03	0.98	1.08	1.05	0.96	1.07	0.99	0.93
Minimum	0.51	0.45	0.51	0.43	0.40	0.35	0.65	0.82
1st quartile	0.84	0.80	0.90	0.88	0.91	1.00	0.89	0.91
Median	0.97	0.94	1.01	0.99	1.00	1.05	0.94	0.93
3rd quartile	1.07	1.04	1.11	1.07	1.04	1.13	1.02	0.96
Maximum	3.16	2.78	3.08	2.54	1.48	2.74	2.24	1.05

Table A29: Productivity results for pharmaceutical and medicine manufacturing industry

Statistic	Malmquist index	*TFP* Lower bound 5%	*TFP* Upper bound 95%	Pure eff. change	Pure tech. change	Scale change	Scale of tech. change	Technical change
			Year 2000-2001	***N = 137***				
Mean	1.17	1.09	1.23	1.18	0.95	1.03	1.00	0.96
Minimum	0.51	0.42	0.54	0.55	0.68	0.36	0.75	0.64
1st quartile	0.88	0.82	0.90	0.94	0.90	0.99	0.97	0.90
Median	0.99	0.96	1.02	1.04	0.95	1.00	1.00	0.94
3rd quartile	1.09	1.06	1.16	1.21	0.98	1.04	1.01	0.98
Maximum	7.73	7.63	8.67	5.48	1.33	3.31	1.46	2.27
			Years 2001-2002	***N = 140***				
Mean	1.15	1.10	1.23	1.12	0.97	1.05	1.03	0.99
Minimum	0.56	0.50	0.59	0.51	0.78	0.63	0.84	0.84
1st quartile	0.86	0.83	0.92	0.89	0.89	0.97	1.00	0.91
Median	0.97	0.96	1.02	1.00	0.97	1.00	1.00	0.98
3rd quartile	1.05	1.02	1.13	1.10	1.03	1.01	1.03	1.09
Maximum	7.65	6.56	7.82	6.40	1.17	8.52	1.23	1.19
			Years 2002-2003	***N = 155***				
Mean	1.19	1.13	1.28	1.13	0.98	1.02	1.04	1.01
Minimum	0.59	0.49	0.61	0.53	0.76	0.58	0.90	0.83
1st quartile	0.88	0.84	0.96	0.89	0.95	0.94	1.00	0.99
Median	0.98	0.96	1.04	1.00	0.99	0.99	1.01	1.02
3rd quartile	1.14	1.08	1.22	1.08	1.02	1.00	1.06	1.05
Maximum	6.09	5.24	6.71	7.30	1.10	4.77	1.39	1.11
			Years 2003-2004	***N = 170***				
Mean	1.21	1.15	1.29	1.05	1.06	1.13	0.97	1.02
Minimum	0.53	0.52	0.59	0.19	0.81	0.47	0.65	0.94
1st quartile	0.92	0.89	0.95	0.90	0.99	0.98	0.95	0.99
Median	0.99	0.96	1.05	1.00	1.03	1.00	0.99	1.01
3rd quartile	1.21	1.11	1.27	1.12	1.09	1.04	1.01	1.04
Maximum	7.95	7.84	7.95	4.05	1.59	5.15	1.25	1.21
			Years 2004-2005	***N = 191***				
Mean	1.20	1.13	1.25	1.06	1.02	1.10	1.01	1.02
Minimum	0.50	0.49	0.55	0.48	0.75	0.30	0.58	0.92
1st quartile	0.91	0.86	0.94	0.91	0.99	0.99	0.98	0.98
Median	1.02	0.97	1.04	0.99	1.02	1.00	1.00	1.02
3rd quartile	1.13	1.06	1.18	1.09	1.06	1.03	1.01	1.06
Maximum	6.25	5.97	6.26	4.04	1.69	6.17	1.44	1.17
			Years 2003-2005	***N = 158***				
Mean	1.20	1.12	1.29	1.05	1.04	1.15	1.00	1.04
Minimum	0.52	0.43	0.56	0.32	0.77	0.62	0.57	0.89
1st quartile	0.90	0.88	0.95	0.88	1.00	0.98	0.98	1.00
Median	1.01	0.97	1.06	1.00	1.04	1.00	1.00	1.03
3rd quartile	1.20	1.12	1.28	1.12	1.07	1.04	1.01	1.07
Maximum	5.34	5.34	6.44	2.84	1.81	11.60	1.33	1.18
			Years 2000-2005	***N = 103***				
Mean	1.08	0.98	1.21	1.20	0.88	1.01	1.01	0.88
Minimum	0.52	0.34	0.53	0.69	0.60	0.52	0.80	0.75
1st quartile	0.80	0.75	0.91	0.93	0.84	0.96	0.97	0.86
Median	0.93	0.87	1.05	1.05	0.89	1.00	1.00	0.88
3rd quartile	1.12	0.98	1.21	1.23	0.92	1.04	1.02	0.91
Maximum	4.63	4.81	6.10	4.23	1.11	2.64	1.39	0.96

Table A30: Productivity results for semiconductor and other electronic component manufacturing industry

Statistic	Malmquist index	*TFP* Lower bound 5%	*TFP* Upper bound 95%	Pure eff. change	Pure tech. change	Scale change	Scale of tech. change	Technical change
			Years 2000-2001		***N = 170***			
Mean	1.20	1.17	1.23	1.03	1.18	1.05	0.96	1.12
Minimum	0.67	0.65	0.73	0.55	0.98	0.85	0.74	0.98
1st quartile	1.01	0.99	1.02	0.86	1.05	1.00	0.92	1.02
Median	1.11	1.08	1.12	1.00	1.16	1.01	0.99	1.07
3rd quartile	1.27	1.23	1.30	1.10	1.26	1.08	1.00	1.19
Maximum	3.23	2.96	3.54	2.23	1.81	1.35	1.16	1.78
			Years 2001-2002	***N = 183***				
Mean	1.09	1.06	1.12	1.07	1.01	0.98	1.02	1.03
Minimum	0.57	0.49	0.58	0.57	0.86	0.79	0.65	0.95
1st quartile	0.96	0.93	0.98	0.94	0.98	0.95	1.00	1.01
Median	1.03	1.01	1.05	1.03	1.01	1.00	1.00	1.02
3rd quartile	1.13	1.09	1.16	1.13	1.03	1.00	1.04	1.05
Maximum	3.47	3.43	3.48	2.72	1.71	1.18	1.22	1.28
			Years 2002-2003	***N = 190***				
Mean	0.94	0.92	0.97	0.93	1.02	0.99	1.02	1.03
Minimum	0.50	0.47	0.51	0.47	0.61	0.82	0.54	0.83
1st quartile	0.85	0.84	0.89	0.85	0.94	0.95	1.00	0.94
Median	0.95	0.94	0.97	0.92	1.00	0.99	1.00	1.06
3rd quartile	1.00	0.99	1.02	1.00	1.09	1.00	1.03	1.13
Maximum	1.67	1.44	1.68	1.71	1.69	1.84	1.60	1.16
			Years 2003-2004	***N = 194***				
Mean	0.95	0.94	0.97	0.99	0.95	0.99	1.02	0.97
Minimum	0.52	0.44	0.51	0.57	0.60	0.79	0.95	0.80
1st quartile	0.87	0.86	0.90	0.91	0.92	0.98	1.00	0.95
Median	0.95	0.95	0.97	0.99	0.96	1.00	1.00	0.97
3rd quartile	1.01	1.00	1.02	1.05	0.98	1.00	1.02	0.99
Maximum	2.46	2.49	2.65	2.20	1.03	1.17	1.44	1.03
			Years 2004-2005	***N = 211***				
Mean	0.99	0.97	1.01	1.02	0.98	1.00	1.00	0.97
Minimum	0.59	0.58	0.60	0.57	0.81	0.60	0.64	0.88
1st quartile	0.94	0.93	0.96	0.96	0.93	0.99	0.99	0.93
Median	1.00	0.98	1.01	1.03	0.96	1.00	1.00	0.96
3rd quartile	1.05	1.03	1.06	1.09	1.01	1.01	1.00	1.01
Maximum	1.70	1.65	1.72	1.78	1.50	1.24	1.14	1.20
			Years 2003-2005	***N = 185***				
Mean	0.95	0.93	0.97	1.03	0.92	0.99	1.01	0.93
Minimum	0.50	0.44	0.55	0.54	0.65	0.79	0.90	0.81
1st quartile	0.86	0.84	0.89	0.93	0.89	0.99	1.00	0.90
Median	0.95	0.94	0.98	1.03	0.93	1.00	1.00	0.93
3rd quartile	1.02	1.01	1.05	1.12	0.96	1.00	1.01	0.96
Maximum	1.63	1.62	1.65	1.75	1.06	1.23	1.36	1.06
			Years 2000-2005	***N = 150***				
Mean	1.05	1.02	1.09	1.00	1.09	0.98	0.99	1.07
Minimum	0.53	0.49	0.59	0.65	0.79	0.62	0.50	0.93
1st quartile	0.92	0.89	0.97	0.89	1.04	0.96	0.98	1.05
Median	1.02	1.00	1.06	0.97	1.08	0.99	1.00	1.07
3rd quartile	1.14	1.10	1.18	1.07	1.10	1.01	1.02	1.10
Maximum	2.02	1.77	2.01	1.74	1.92	1.13	1.31	1.14

Text box A7: Yearly *TFP* changes by industry

It will be a lengthy discussion if we are to consider all components in the year by year productivity tables of the five industries. We only make a short comment here on year to year results. This is also partly because the periods are too short for meaningful dynamics. However, we employ these values in the second stage regression analysis to compare how these perform alongside other year to year growth variables.

For Communications, the mean *TFP* for 2000-2001 is 17%, 2001-2002 is 10%, 2002-2003 is -2%, 2003-2004 is 1% and no remarkable change in 2004-2005. For Industrials, mean *TFP* for 2000-2001 is 7%, 2001-2002 is 2%, 2002-2003 is -3%, 2003-2004 is also -3%, 2004-2005 is 1%. For Navigationals, 2000-2001 is 28%, 2001-2002 is 4%, 2002-2003 is 3%, 2003-2004 is -2% and 2004-2005 is 4%. For Pharmaceuticals, *TFP* change for 2000-2001 is 17%, 2001-2002 is 15%, 2002-2003 is 19%, 2003-2004 is 21% and 2004-2005 is 20%. This thus makes it the only industry to sustain high year to year *TFP* growth over the examined period. For Semiconductors, 2000-2001 *TFP* change is 20%, 2001-2002 is 9%, 2002-2003 is -6%, 2003-2004 is -5% and 2004-2005 is -1%.

We now report the technical changes for these periods. For Communications, the mean technical change for 2000-2001 is 19%, 2001-2002 is -9%, 2002-2003 is -8%, 2003-2004 is -6% and 3% for 2004-2005. For Industrials, mean technical change for 2000-2001 is 7%, 2001-2002 is 2%, 2002-2003 is -5%, 2003-2004 is -3%, 2004-2005 is 5%. For Navigationals, 2000-2001 is 5%, 2001-2002 is -4%, 2002-2003 is -8%, 2003-2004 experiences no change and 2004-2005 is 3%. For Pharmaceuticals, technical change for 2000-2001 is -4%, 2001-2002 is -1%, 2002-2003 is 1%, 2003-2004 is 2% and 2004-2005 is 2%. This thus makes it the only industry to sustain year to year increases in technical change (from -4% to 25%) over the examined period.

For Semiconductors, 2000-2001 technical change is 12%, 2001-2002 is 3%, 2002-2003 is 3%, 2003-2004 is -3% and 2004-2005 is -3%. This indicates year to year decreases in technology improvements or at best, a constant technology. We will examine if such results are statistically significant later in this section by further applying it to the 2003-2005 and 2000-2005 periods which are longer.

We now consider changes in the 2003-2005 period as we indicate in table A31 and 2000-2005 period in table A32. The discussion of these tables is in the main text of the thesis. Readers interested in the components' changes of *TFP* can consult these two tables.

Table A31: Summary statistics of productivity results for all industries for 2003-2005 period

Statistic	*TFP*	*TFP* 5%	*TFP* 95%	Pure Eff. Ch.	Pure Tech. Ch.	Pure Tech. Ch. 5%	Pure Tech. Ch. 95%	Tech. Ch.	Tech. Ch. 5%	Tech. Ch. 95%
Communications Equipment Manufacturing N = 111										
Mean	0.95	0.92	1.00	1.04	0.93	0.86	1.09	0.95	0.80	1.25
Minimum	0.51	0.53	0.58	0.50	0.61	0.39	0.85	0.77	0.39	0.87
1st quartile	0.83	0.82	0.87	0.87	0.87	0.78	0.98	0.87	0.70	1.04
Median	0.96	0.93	1.00	1.02	0.92	0.86	1.07	0.94	0.79	1.19
3rd quartile	1.04	1.02	1.09	1.16	0.97	0.93	1.19	1.03	0.90	1.42
Maximum	1.92	1.65	1.93	2.41	1.24	1.17	2.08	1.16	1.12	2.39
Industrial Machinery Manufacturing N = 63										
Mean	0.98	0.96	0.99	1.02	1.00	0.92	1.06	0.96	0.85	1.09
Minimum	0.76	0.74	0.76	0.73	0.62	0.53	0.74	0.84	0.59	0.97
1st quartile	0.91	0.91	0.94	0.96	0.95	0.88	1.00	0.94	0.79	1.04
Median	0.98	0.98	1.00	1.00	0.99	0.93	1.02	0.98	0.86	1.06
3rd quartile	1.03	1.01	1.05	1.11	1.00	0.97	1.07	0.99	0.93	1.13
Maximum	1.16	1.15	1.16	1.26	1.85	1.57	2.01	1.03	0.97	1.44
Navigational, Measuring, Medical, and Control Instruments Manufacturing N= 155										
Mean	1.00	0.96	1.03	1.04	1.00	0.90	1.15	1.03	0.84	1.33
Minimum	0.50	0.46	0.55	0.51	0.57	0.45	0.71	0.87	0.42	0.97
1st quartile	0.88	0.86	0.91	0.88	0.96	0.84	1.04	0.98	0.78	1.15
Median	0.96	0.95	0.99	0.98	1.00	0.92	1.13	1.04	0.86	1.24
3rd quartile	1.05	1.01	1.08	1.05	1.06	0.99	1.22	1.08	0.93	1.41
Maximum	4.54	3.71	4.97	8.33	1.32	1.25	1.87	1.33	1.23	2.72
Pharmaceutical and Medicine Manufacturing N = 158										
Mean	1.20	1.12	1.29	1.05	1.04	0.81	1.47	1.04	0.66	1.96
Minimum	0.52	0.43	0.56	0.32	0.77	0.29	0.93	0.89	0.12	1.03
1st quartile	0.90	0.88	0.95	0.88	1.00	0.74	1.24	1.00	0.57	1.37
Median	1.01	0.97	1.06	1.00	1.04	0.84	1.39	1.03	0.67	1.67
3rd quartile	1.20	1.12	1.28	1.12	1.07	0.90	1.54	1.07	0.79	2.24
Maximum	5.34	5.34	6.44	2.84	1.81	1.50	5.13	1.18	1.02	9.88
Semiconductor and Other Electronic Component Manufacturing N = 185										
Mean	0.95	0.93	0.97	1.03	0.92	0.86	1.00	0.93	0.82	1.07
Minimum	0.50	0.44	0.55	0.54	0.65	0.53	0.79	0.81	0.42	0.88
1st quartile	0.86	0.84	0.89	0.93	0.89	0.81	0.93	0.90	0.77	0.99
Median	0.95	0.94	0.98	1.03	0.93	0.87	0.99	0.93	0.84	1.03
3rd quartile	1.02	1.01	1.05	1.12	0.96	0.92	1.03	0.96	0.89	1.11
Maximum	1.63	1.62	1.65	1.75	1.06	1.05	1.65	1.06	1.00	2.15

Table A32: Summary statistics of productivity results for all industries for 2000-2005 period

Statistic	*TFP*	*TFP* 5%	*TFP* 95%	Pure Eff. Ch.	Pure Tech. Ch.	Pure Tech. Ch. 5%	Pure Tech. Ch. 95%	Tech. Ch.	Tech. Ch. 5%	Tech. Ch. 95%
Communications Equipment Manufacturing N = 98										
Mean	1.02	0.98	1.07	1.01	1.01	0.96	1.18	1.07	0.93	1.36
Minimum	0.53	0.51	0.54	0.53	0.35	0.26	0.50	0.71	0.47	1.07
1st quartile	0.81	0.80	0.89	0.83	0.96	0.89	1.12	1.02	0.87	1.22
Median	0.99	0.96	1.02	0.97	1.03	0.98	1.18	1.10	0.97	1.33
3rd quartile	1.17	1.10	1.20	1.15	1.10	1.07	1.26	1.14	1.02	1.46
Maximum	2.35	2.35	2.50	2.14	1.18	1.15	1.50	1.22	1.12	2.15
Industrial Machinery Manufacturing N = 52										
Mean	1.01	0.99	1.05	0.98	1.05	1.00	1.14	1.04	0.94	1.19
Minimum	0.78	0.78	0.84	0.78	0.85	0.80	0.94	0.84	0.75	0.96
1st quartile	0.93	0.91	0.97	0.93	1.00	0.95	1.07	1.02	0.90	1.12
Median	0.99	0.98	1.02	0.98	1.04	1.01	1.10	1.05	0.96	1.16
3rd quartile	1.05	1.02	1.08	1.00	1.07	1.04	1.13	1.07	1.00	1.23
Maximum	1.46	1.44	1.48	1.32	1.43	1.31	1.67	1.21	1.05	1.56
Navigational, Measuring, Medical, and Control Instruments Manufacturing N = 118										
Mean	1.03	0.98	1.08	1.05	0.96	0.87	1.11	0.93	0.73	1.16
Minimum	0.51	0.45	0.51	0.43	0.40	0.32	0.47	0.82	0.36	0.87
1st quartile	0.84	0.80	0.90	0.88	0.91	0.79	1.02	0.91	0.69	1.02
Median	0.97	0.94	1.01	0.99	1.00	0.92	1.11	0.93	0.74	1.11
3rd quartile	1.07	1.04	1.11	1.07	1.04	0.97	1.19	0.96	0.80	1.22
Maximum	3.16	2.78	3.08	2.54	1.48	1.10	2.48	1.05	0.88	2.21
Pharmaceutical and Medicine Manufacturing N = 103										
Mean	1.08	0.98	1.21	1.20	0.88	0.63	1.17	0.88	0.53	1.59
Minimum	0.52	0.34	0.53	0.69	0.60	0.34	0.73	0.75	0.15	0.98
1st quartile	0.80	0.75	0.91	0.93	0.84	0.56	1.01	0.86	0.45	1.16
Median	0.93	0.87	1.05	1.05	0.89	0.65	1.06	0.88	0.55	1.32
3rd quartile	1.12	0.98	1.21	1.23	0.92	0.71	1.21	0.91	0.63	1.70
Maximum	4.63	4.81	6.10	4.23	1.11	0.78	2.79	0.96	0.76	5.03
Semiconductor and Other Electronic Component Manufacturing N = 150										
Mean	1.05	1.02	1.09	1.00	1.09	1.02	1.20	1.07	0.95	1.27
Minimum	0.53	0.49	0.59	0.65	0.79	0.67	0.97	0.93	0.56	1.05
1st quartile	0.92	0.89	0.97	0.89	1.04	0.98	1.13	1.05	0.91	1.18
Median	1.02	1.00	1.06	0.97	1.08	1.03	1.17	1.07	0.97	1.24
3rd quartile	1.14	1.10	1.18	1.07	1.10	1.07	1.23	1.10	1.01	1.34
Maximum	2.02	1.77	2.01	1.74	1.92	1.42	2.54	1.14	1.08	1.76

Table A33: Percentage of firms with significant productivity and technical changes

	Malmquist index			Technical change		
Industry / Period	*TFP*>1	*TFP*=1	*TFP*<1	*TC*>1	*TC*=1	*TC*<1
Communications equipment	36.36	21.21	42.42	38.14	61.86	0.00
	31.53	*18.92*	*49.55*	*10.19*	*75.00*	*14.81*
Industrial machinery	32.69	32.69	34.62	30.00	64.00	6.00
	34.92	*15.87*	*49.21*	*0.00*	*90.32*	*9.68*
Navigational, measuring, medical and control	34.75	16.10	49.15	0.00	78.63	21.37
	28.39	*18.06*	*53.55*	*7.79*	*90.26*	*1.95*
Pharmaceutical and medicine	21.78	40.59	37.62	0.00	96.97	3.03
	39.87	*24.68*	*35.44*	*0.00*	*100.00*	*0.00*
Semiconductor and other electronic component	48.99	16.78	34.23	32.43	67.57	0.00
	27.03	*11.35*	*61.62*	*0.54*	*66.13*	*33.33*

Less than one signifies productivity reduction or technical regress, equal to one indicates no change and more than one indicates productivity growth or technical progress. The 2003-2005 periods (italicised) are below the 2000-2005 periods. We use this table to determine if the arithmetic means of the industry averages (being the sum of scores of all firms divided by total number of firms) are statistically representative of the individual firms. This is especially so for industries with technical regress and *TFP* losses.

Table A34: *TFP* growth estimates for the countries

Country	*TFP*	5% *TFP*	95% *TFP*	Pure Eff. Ch.	Pure Tech. change	5% Pure Tech. Ch.	95% Pure Tech. Ch.	Scale Ch.	Scale Tech. Ch.	Tech. Ch.	5% Tech. Ch.	95% Tech. Ch.
Austria	0.85	0.84	0.86	0.92	0.90	0.80	0.97	1.01	1.03	0.92	0.77	1.04
	0.82	*0.79*	*0.89*	*0.91*	*0.99*	*0.90*	*1.06*	*0.98*	*0.99*	*0.99*	*0.86*	*1.08*
Belgium	1.03	0.98	1.07	1.06	0.97	0.82	1.23	1.00	1.01	0.97	0.69	1.78
	1.02	*0.98*	*1.10*	*1.01*	*1.04*	*0.91*	*1.20*	*0.99*	*0.99*	*1.02*	*0.82*	*1.36*
Denmark	0.94	0.92	0.97	0.93	1.03	0.91	1.29	1.04	0.96	0.99	0.75	1.36
	0.93	*0.88*	*1.01*	*1.00*	*0.97*	*0.77*	*1.17*	*0.99*	*0.96*	*0.93*	*0.64*	*1.37*
Finland	0.99	0.98	1.01	1.07	0.92	0.86	1.00	0.99	1.02	0.94	0.83	1.08
	1.00	*0.97*	*1.05*	*0.96*	*1.06*	*1.00*	*1.18*	*0.99*	*0.99*	*1.05*	*0.94*	*1.24*
France	1.01	0.97	1.04	1.05	0.99	0.87	1.16	0.99	1.00	0.98	0.78	1.35
	1.01	*0.96*	*1.06*	*1.05*	*1.02*	*0.90*	*1.18*	*0.95*	*1.03*	*1.04*	*0.83*	*1.40*
Germany	0.98	0.96	1.01	1.01	0.98	0.86	1.15	1.01	1.00	0.97	0.78	1.34
	0.98	*0.96*	*1.04*	*0.99*	*1.03*	*0.91*	*1.19*	*1.00*	*0.98*	*1.00*	*0.82*	*1.33*
Greece	1.11	1.10	1.12	1.12	0.99	0.97	1.11	0.93	1.08	1.07	0.96	1.33
Ireland	1.13	1.12	1.25	1.06	1.08	0.81	1.58	0.97	1.02	1.10	0.62	2.20
	1.31	*1.26*	*1.64*	*1.56*	*0.86*	*0.64*	*1.05*	*0.97*	*1.01*	*0.86*	*0.58*	*1.25*
Italy	0.89	0.89	0.94	0.90	0.97	0.92	1.01	1.03	0.99	0.96	0.89	1.01
Netherlands	0.99	0.97	1.02	1.05	0.93	0.82	1.08	0.98	1.05	0.96	0.75	1.44
	1.02	*1.01*	*1.10*	*1.02*	*0.97*	*0.80*	*1.17*	*0.99*	*1.05*	*1.01*	*0.73*	*1.63*
Norway	0.98	0.94	0.99	1.05	0.96	0.81	1.19	0.98	1.01	0.96	0.71	1.37
	0.87	*0.84*	*0.96*	*0.92*	*0.99*	*0.91*	*1.19*	*0.97*	*0.98*	*0.97*	*0.79*	*1.28*
Spain	1.07	0.99	1.09	1.09	0.99	0.87	1.08	0.99	1.00	0.99	0.82	1.17
	1.29	*1.11*	*1.32*	*1.36*	*1.00*	*0.87*	*1.08*	*0.98*	*0.99*	*0.99*	*0.83*	*1.13*
Sweden	1.05	0.97	1.11	1.04	0.97	0.83	1.17	1.04	1.04	0.99	0.74	1.45
	0.86	*0.81*	*0.95*	*0.99*	*0.92*	*0.81*	*1.11*	*0.92*	*1.06*	*0.96*	*0.75*	*1.35*
Switzerland	1.00	0.99	1.03	1.07	0.93	0.82	1.10	0.97	1.05	0.97	0.77	1.37
	0.96	*0.94*	*1.03*	*0.97*	*0.99*	*0.90*	*1.17*	*1.00*	*1.02*	*1.00*	*0.84*	*1.36*
UK	0.98	0.94	1.02	1.02	0.97	0.86	1.16	0.98	1.01	0.98	0.79	1.34
	1.04	*1.02*	*1.12*	*1.03*	*1.00*	*0.90*	*1.17*	*1.04*	*1.00*	*0.99*	*0.81*	*1.33*
USA	1.04	1.00	1.09	1.04	0.98	0.87	1.18	1.04	1.02	0.99	0.79	1.38
	1.07	*1.01*	*1.12*	*1.08*	*1.00*	*0.90*	*1.16*	*1.01*	*1.02*	*1.00*	*0.81*	*1.31*
Legal origin												
English	1.03	0.99	1.08	1.04	0.98	0.87	1.18	1.03	1.02	0.99	0.79	1.37
	1.07	*1.01*	*1.12*	*1.07*	*1.00*	*0.90*	*1.16*	*1.01*	*1.02*	*1.00*	*0.81*	*1.31*
French	1.01	0.97	1.05	1.05	0.98	0.85	1.15	0.99	1.01	0.98	0.76	1.43
	1.03	*0.98*	*1.09*	*1.05*	*1.01*	*0.89*	*1.18*	*0.97*	*1.02*	*1.03*	*0.81*	*1.41*
German	0.98	0.96	1.01	1.02	0.96	0.85	1.13	1.00	1.02	0.97	0.77	1.33
	0.97	*0.94*	*1.03*	*0.98*	*1.02*	*0.91*	*1.18*	*1.00*	*0.99*	*1.00*	*0.83*	*1.33*
Scandinavian	1.00	0.96	1.04	1.03	0.96	0.86	1.14	1.02	1.02	0.97	0.77	1.30
	0.94	*0.90*	*1.01*	*0.97*	*0.99*	*0.90*	*1.16*	*0.97*	*1.01*	*1.00*	*0.82*	*1.30*

Upper row is 2003-2005 *TFP*. Lower row (italicised) is 2000-2005 *TFP*.

Appendix A4.4: Univariate and bivariate analyses

Table A35: Means of ownership and board variables

	Country								
Variable	*Austria*	*Belgium*	*Denmark*	*Finland*	*France*	*Germany*	*Greece*	*Italy*	*Ireland*
Largest owner (total = direct and indirect) (%)	57.4	42.4	37.2	29	53.3	56.3	43.9	46.3	27.6
Largest direct owner (%)	57.4	44.7	39.1	29.2	50.6	55.6	43.2	45.2	30.7
3 largest owners (%)	70.7	63.2	56.6	48.7	74.7	73.6	56.1	57.8	39.9
5 largest owners (%)	60.4	67.9	64.5	55.4	80.9	75.1	62.5	62.6	50.4
CEO-Board chairman separation (%)	100	77	100	96	53	100	64	64	93
Board size	8.4	8.1	7.3	6.8	7.7	7.4	7.4	9.2	13.3
Board independence (%)	68.6	39.5	52.9	57.9	37.2	46.9	35.4	41.9	47.8
	Netherlands	*Norway*	*Portugal*	*Spain*	*Sweden*	*Switzerland*	*UK*	*USA*	
Largest owner (%)	28.8	25.7	33.8	35.3	23.6	32.4	19.1	18	
Largest direct owner (%)	30.9	24.4	33.6	38.9	26.8	32.6	21	19.1	
3 largest owners (%)	46.6	42.4	57.8	55.1	51.8	43.2	39.6	30	
5 largest owners (%)	52.8	54.4	64.4	63.9	64.2	47.4	50.2	38.1	
CEO-Board chairman separation (%)	96	100	30	55	98.5	76	88	51	
Board size	6.2	6.5	8.1	10.2	6.8	6.9	6.6	6.8	
Board independence (%)	77.3	41.1	30.7	32.8	51.5	68.8	39.1	64.4	

Note that for country-averaged ownership; means of “five largest shareholders” may be lower than the means of “three largest shareholders” or that for total ownership lower than largest direct owner since sub-sample sizes differ. Original sample size is 2339 and some firms do not report values for some ownership variables.

Table A36: Percentage of shares of largest owner by country

	Voting equity for 1990s by Bøhren and Ødegaard –*BO*- (2000)	Direct cash flow equity for 2000s by this study (2009)
Austria	54	57
Belgium	56	42
France	52	53
Germany	50	56
Italy	48	46
Netherlands	43	29
Norway	29	26
Spain	40	35
Sweden	38	24
UK	14	19
US	3	18

Values of ownership are in percentages.

Table A37: Percentage of largest shareholdings among ownership categories by country

Country	Individuals/families		Financials		Public companies		Industrial companies		State		Others	
Austria	*1*	60	*4*	28.3	*7*	61.8	*12*	68.2			*1*	11.0
Belgium	*3*	32.2	*10*	43.3	*9*	39.7	*13*	45.9			*9*	42.7
Denmark	*3*	39	*9*	24.7			*18*	44.9	*1*	3.7	*6*	37.7
Finland	*8*	31.6	*17*	21.5	*1*	44.0	*11*	28.4	*2*	27.9	*7*	43.3
France	*32*	52.6	*25*	47.2	*32*	48.4	*38*	64.4	*2*	32.7	*5*	44.6
Germany	*33*	44.6	*17*	29.0	*41*	61.7	*66*	67.0			*4*	43.4
Greece	*34*	36.6	*3*	37.5	*1*	55.4	*21*	56.0				
Ireland	*2*	25.2	*8*	24.2			*4*	41.2			*1*	4.8
Italy	*12*	39.7	*21*	40.9	*1*	55.0	*40*	51.2	*1*	32.5	*0*	
Netherlands	*10*	27.8	*27*	18.4	*0*		*9*	52.5	*0*		*3*	54.5
Norway	*2*	31.7	*14*	21.8	*0*		*14*	26.9	*0*		*1*	50.0
Portugal	*3*	22.7	*3*	22.7	*0*		*13*	39.5	*0*		*1*	27.4
Spain	*10*	28.5	*12*	21.6	*1*	20.5	*28*	44.9	*0*		*1*	26.0
Sweden	*13*	27.0	*20*	11.9	*1*	21.3	*18*	26.4	*2*	20.3	*7*	44.9
Switzerland	*19*	36.3	*22*	14.4	*2*	54.9	*29*	42.5	*0*		*3*	27.3
UK	*56*	20.4	*143*	15.7	*11*	30.1	*41*	26.0	*2*	30.9	*2*	9.7
USA	*231*	24.1	*572*	12.3	*27*	28.1	*107*	30.8	*16*	26.4	*15*	27.4
n	***472***		***927***		***134***		***482***		***26***		***66***	
N						***2107***						

For every category the first column (italicised) is the number of firms and the second is the percentage of total direct ownership by largest shareholder. Blank cells indicate there are no firms with the indicated ownership categories.

Table A38: Comparison of ownership identity with a previous study

	Bohren & Odegaard *–BO-* (2000) for 1990s			Our study (2009) for 2000s		
Country	Individuals/families	Financials	State	Individuals/families	Financials	State
Austria	57	9	10	4	16	0
Belgium	25	15	0	7	23	0
Finland	16	12	21	17	37	4
France	32	23	6	24	19	1
Germany	17	37	3	20	11	0
Italy	26	22	24	16	28	1
Norway	8	20	16	6	45	0
Spain	29	23	6	19	23	0
Sweden	15	31	8	21	33	3
UK	25	58	0	22	56	1
Denmark				8	24	3
Greece				58	5	0
Ireland				13	53	0
Netherlands				20	55	0
Portugal				15	15	0
Switzerland				25	29	0
USA				24	59	2

Bøhren and Ødegaard (2000) use voting equity and we use cash flow equity. We report on the percentage of firms with the different ownership categories as largest shareholders.

Table A39: Percentages of firms in ownership categories

Country	Individuals/families	Financials	Public companies	Industrial companies	State	Others
Austria	4	16	28	48	0	4
Belgium	7	23	20	30	0	20
Denmark	8	24	0	49	3	16
Finland	17	37	2	24	4	15
France	24	19	24	28	1	4
Germany	20	11	25	41	0	2
Greece	58	5	2	36	0	0
Ireland	13	53	0	27	0	7
Italy	16	28	1	53	1	0
Netherlands	20	55	0	18	0	6
Norway	6	45	0	45	0	3
Portugal	15	15	0	65	0	5
Spain	19	23	2	54	0	2
Sweden	21	33	2	30	3	11
Switzerland	25	29	3	39	0	4
UK	22	56	4	16	1	1
USA	24	59	3	11	2	2
N	22	44	6	23	1	3

Table A40: Comparison of board characteristics with Aggarwal et al.'s study

	Aggarwal et al. –*AESW*- (2007: 34)			Our study (2009)		
Country	Board size	Board independence	Chairman/*CEO* separation	Board size	Board independence	Chairman/*CEO* separation
Austria	84	11	100	81	73	100
Belgium	76	20	68	77	15	77
Denmark	82	68	100	76	31	100
Finland	81	68	100	67	63	96
France	76	29	46	65	29	53
Germany	86	44	100	50	36	100
Greece	91	5	89	83	9	64
Ireland	81	38	81	79	27	93
Italy	65	3	79	86	23	64
Netherlands	74	85	98	39	82	96
Norway	57	71	100	69	25	97
Portugal	71	36	64	75	14	30
Spain	69	7	63	82	18	55
Sweden	98	65	100	67	46	98
Switzerland	81	71	98	67	76	76
UK	91	35	97	67	17	88
USA	82	90	42	72	81	51

The columns present the percentage of firms in each country with board size greater than five and less than 16 members; and board independence as the percentage of firms in a country with more than 50% board outsiders. Aggawal et al. include the presence of a lead director in *CEO*-chairman separation when the *CEO* is the board-chairman; we only consider the case where the *CEO* is not the board chairman even if there is a lead director. This is because for some firms with *CEO*-chair duality, there is still a lead director.

Text box A8: Preliminary bivariate regressions

The next step we undertake after pairwise correlation (in the main text) is *ANOVA* analysis between the predictor variables that are categorical and those that are continuous. *CEO*-board chairman duality is not related to board independence using a one-way *ANOVA* test but it is significantly related to board size as the Bonferroni test does not accept that the means of the two categories are the same. It is therefore desirable (but not required) to introduce an interaction term between these two in a regression analysis. It is not required because including omitted variables for the correct model specification in a regression can lead to different results. We continue our preliminary analysis by running bivariate ordinary least squares (*OLS*) regression estimates of each of the dependent variables (also included is earnings per share measure but not cash flow or dividend yield as we use these as independent variables in this preliminary bivariate regressions). The results are non-robust measures of the performance relationships.

These results give as a rough impression of the signs and statistical significance of the relationship between the dependent and independent variables. Clearly the relationship between Tobin's *Q* (or *MBV*) and ownership concentration as reported is negative. As we shall see throughout our analyses, this relationship holds. We do not have the space to discuss all these results as they are preliminary and some may not hold in the robust multivariate specifications or pooled analysis but this initial estimations guide us in selecting from the variables we gathered after the literature review depending on availability and reliability. After running the bivariate *OLS* regressions, we continue with a multivariate specification where we include all our independent and control variables. In effect, we are trying to avoid *omitted* variables or *included* variables that are not desired.

We also employ truncated regressions for the regression estimations when technical efficiency is the dependent variable. We report initial regression diagnostics for collinearity and heteroskedasticity. We observe that the relationship between ownership concentration and performance have similar signs (although Tobin *Q*'s relationship is insignificant). At this stage we still have liquidity, investor protection (legal origin and anti-director rights index), operating revenue/ turnover and beta still in the model (please refer to notes under table A41). Only the regression with *MBV* satisfies collinearity and homoskedasticity tests. These results suggest the transformation of some variables to pull the sample mean towards a normalised mean. Control variables in the regression with Tobin's *Q* as the dependent variable have been selected with regards to non-collinearity. Variance inflation factors of variables in regression diagnostics should be low, preferably lower than 10 or a mean closer to 1.

Table A41: Preliminary bivariate *OLS* regressions of several performance measures and corporate governance

Governance and control variables	Hybrid market based			Accounting based			Growth			Efficiency	
	Tobin's *Q*	***MBV***	***EPS***	***ROE***	***ROA***	**Profit margin**	**Asset growth**	**Turnover growth**	***TFP***	***VRS TE***	***Corr TE***
Ownership concentration											
Largest total owner	-***	-***	+*	+***	+***	+***	-	-***	-	+***	+***
Largest direct owner (dir)	-***	-***	+*	+***	+***	+***	-	-***	-	+***	+***
2 largest (dir)	-***	-***	+***	+***	+***	+***	-**	-***	-	+**	+***
3 largest (dir)	-***	-***	+***	+***	+***	+***	-*	-***	-	+	+*
4 largest (dir)	-***	-***	+***	+***	+***	+***	-*	-***	-	+	+
5 largest (dir)	-***	-***	+***	+***	+*	+***	-*	-***	-	+	+
Board characteristics											
Log of Board size	+	+***	-	+	+***	+***	+	+	-	+***	+***
Board indep.	+***	+	+	-	-***	-***	-**	+***	-	+	+
Financial policy											
Leverage	-	+***	+	+***	+	+**	-	+	+	-	-
Liquidity	-	-	-	-**	-*	+	+	-	+	-***	-***
Dividends	-***	-**	+***	+	+	+	-**	-***	-	+**	+
Dividends payout	+	+*	-*	-	-	-	-***	-***	-	-	+
Cash flow	-***	+***	+***	+***	+***	+***	+***	+**	-***	+***	+***
Investor protection											
Invest. Prot. Index	+***	+	+	-***	-***	-***	+**	+***	+	-***	-***
Anti-director rights index	+*	+***	-	-	+	+	+**	+	-	-*	-
No. of Gov. codes	+***	+	+	-***	-***	-***	+*	+***	-	-***	-***
Controls											
Log Total Assets	-***	+***	-**	+***	+***	+***	+***	+**	-***	+***	+***
Log Market Capitalisation	+***	+***	-***	+***	+***	+***	+***	+***	-	+***	+***
Age of firm	-***	-***	+***	+***	+***	+***	-***	-***	-	+***	+***
Years since *IPO*	-**	-	-	+***	+***	+***	-	-***	-	+***	+***
Beta	+***	+***	-*	+*	+***	+	+	+	+	+	+
Std. Dev. *EPS*	+***	+**	-	+	+	+	+**	+	+	-	-
Log Investments	-***	+***	-	+***	+***	+***	+	+	-	+***	+***
Log *R&D*	+***	+***	+***	+***	+***	+***	+***	+	-	+***	+***

*|**|*** = significant at the levels of 10%|5%|1%. Governance variables have very low adjusted R^2. *TE* is technical efficiency under variable returns to scale technology. Asset growth rate and operating revenue/ turnover growth rate are from year *t-1* to year *t*. Tobin's *Q* is described as hybrid-market based since book values rather than replacement values are used. Std. Dev. *EPS* is standard deviation of earnings per share, *IPO* is Initial Public Offering and *R&D* is Research and Development. Data year is 2005. In subsequent analyses, we replace both market capitalisation and total assets with sales. Beta and standard deviation of *EPS* are replaced with standard deviation of *ROE* over 4 years to proxy for specific risk (volatility). Investment is replaced with 5-year sales growth to proxy for growth opportunities. Age and age since *IPO* are dropped because a significant number of firms do not have information on these. Liquidity is dropped and only leverage is used as a measure of financial policy. Dividend payout is not used (many firms do not have information) and *EPS* is dropped. Largest direct owner is primarily used. Direct shareholding is shortened to "dir". Total shareholdings = direct and indirect shareholdings.

Appendix A4.5: Cross-sectional multivariate analysis

Text box A9: Preliminary cross-sectional multivariate analysis

For technical efficiency as a dependent variable measuring firm performance, we use the bias-corrected *VRS* efficiency (2000 bootstrapped replications) discussed in section 4.2 of Chapter Four. A truncated regression is run using 500 replications of bootstrapping as the standard error type. This means that the dependent variable undergoes double bootstrapping. We do not use firm beta to control for specific risk primarily because technical efficiency values are all from accounting data and beta is a market-based value. Secondly, more than half of the sample firms have missing betas hence reducing firm size (from 522 to 209). We add splines and squares of ownership concentration to the base model when Tobin's *Q* is the dependent variable in table A41. We observe a strong negative relationship with Tobin's *Q* indicating the relationship is strongly negative with the same slope. The reference legal origin is the civil law code. The results also suggest that most of the firms have the ideal firm size from 5.0 to 12.0 and hence there seem to be no statistically significant relationship between Tobin's *Q* and board size.

Further preliminary analysis of board size and independence

When we run the regression of board size on Tobin's *Q* in a bivariate analysis, we obtain a positive but insignificant result as observed in table A40. We do a logarithmic transformation of the variables and still obtain a positive but insignificant relationship. We then add other board variables of board independence and *CEO*-chairman duality. Board size becomes positively significant ($p<0.05$) with a coefficient of 0.1045, while board independence is positively significant at ($p<0.01$) with a coefficient of 0.1284. The effect of *CEO*-board chairman separation is insignificant while the adjusted coefficient of determination is only 1.5%. We subsequently control for size, investment, leverage, firm volatility by standard deviation of *ROE* over four years, legal origin (country effects) and industry.

Now, literature has it that a board size of between five to16 members is the most ideal. We therefore divide our sample into three parts by creating dummies when the board size is "1-4", "5-16", and "17 to Maximum" and regress these dummies on Tobin's *Q* (equivalent to performing a one-way *ANOVA* test). We find that all dummies are significantly positive at 1% but the coefficients (or rightly put, the *t* values) support the hypothesis that larger boards have a lesser impact on Tobin's *Q*. The adjusted R^2 of the model for the 1694 observations is 77.5% ($p<0.01$) with board sizes of "5-16" having the biggest coefficient at 1.87 (t = 67.17) followed by board sizes less than 5 at 1.705 (t = 35.65) and boards greater than 17 at 1.32 (t = 6.73). We must say here that the majority of the firms (70.17%) have board members between five to 16 while 28.65% have less than 5 members (minimum of one member) and only 1.18% of firms have board sizes more than 16 members (with a maximum of 27 members). We only interpret the standardised beta coefficients to compare the values of board sizes of the various categories and not the strength of their literal relationship on Tobin's *Q* or how they explain its variability which can be done when the beta coefficients are non-standardised.

We do not scale board independence by total assets as this is already a percentage but we follow the procedure described above for board size. Board independence is positively related to Tobin's *Q* at a coefficient of 0.45 (significant at 1%) and the adjusted R^2 of the model for the 1295 observations is 0.8% (significant at 1%). Adding the square of independence indicator still returns a positive and significant result of 0.39 for board independence and an insignificantly negative value of -0.68 when it is squared (with an adjusted R^2 of 1.1%, significant at 1%) indicating it is a linear relationship. In the next section we start with our main cross-sectional analysis for years 2003 to 2005 before we pool the years together and continue with the analysis. This is therefore contained in text boxes A9 and A10. This cross-sectional analysis is necessary as most studies in corporate governance use a data set of a single period (cross-sectional). However, it is not the most robust for this study.

Table A42: Preliminary multivariate regressions of performance and corporate governance

Independent variables	Model							
	Tobin's Q	*MBV*	*ROE*	*ROA*	Cash flow	Dividend yield	*VRS TE*	Biased corr. *TE*
Log Largest owner	-0.069	-0.271**	2.44	0.628	0.149*	0.093	0.029*	0.015
Individuals	0.260	0.450	3.366	1.084	-0.046	-0.216	0.0519	0.047*
Financials	0.313**	0.257	8.733**	4.343*	0.263	-0.207	0.0851**	0.068***
Industrial	0.154	0.314	3.96	0.366	0.114	-0.312***	0.009	-0.0005
State	0.337	-0.031	-9.99	-6.858	-0.711	0.022	0.0922	0.056
Board size	0.117	0.317	12.71***	6.639***	0.715***	0.466***	0.011**	0.010**
Board independence	0.254***	0.313*	-1.41	-2.107	0.064	0.255***	-0.040	-0.030
CEO chair non-duality	0.124	0.255	-1.641	.6700181	0 .050	0.122	0.031	0.027*
Legal origin§	0.353***	-0.015	-13.28***	-9.672***	-1.212***	-0.689***	-0.098***	-0.076***
Anti-director rights index	0.116**	0.249***	1.30	1.304	0.134*	0.152***	-0.015	-0.017
Log Operating revenue by assets	-0.045	-0.02	14.57***	10.336***	0.262***	0.086	.1582***	0.148***
Beta	0.174**	0.332**	0.756	1.953	0.014	-0.105		
Leverage (debt-to-equity)	-0.004	0.171***	1.685***	-0.193***	-0.009	0.011	-0.0009	-0.001
Liquidity (Current) ratio	0.019*	0.025	1.283***	0.899***	0.024	0.101***	0.009*	0.010**
Adjusted R^2	0.105***	0.119***	0.342***	0.334***	0.270***	0.281***		
Mean *VIF*. Collinearity test	1.66	1.66	1.63	1.62	1.71	1.60		
Breusch-Pagan Heteroskedasticity	62.33***	0.65	30.96***	102.97***	57.32***	60.53***		
Sigma							0.165***	0.144
Log likelihood							275.49	328.18
Wald chi^2							151.63***	184.87***
N	502	488	511	540	434	240	476	531

*|**|*** = significant at the levels of 10%|5%|1%. Data year is 2005. § = Legal origin is common law code. *OLS* and bootstrap truncated regression specifications.

Text box A10: Analysis of country and industry variables

Statistical significance of country and industry controls

After going through all the necessary panel regression alternatives in the preliminary stages, the data is revisited and retested again to establish if it makes sense to pool using the full regression specification. This is because deleting some further influential observations in making the panel balanced necessitates this. We look at the country and industry control variables to see if there are significant differences. We try a separation based on common or civil legal origin as discussed in the build up to the empirics. All common origin countries are jointly insignificant indicating they can be given a single intercept. The result for civil law countries is the opposite so we split these down using the extended legal origin (French, German, and Scandinavian). The French origin countries are significantly different from zero, so are the Scandinavian origins.

We therefore test the countries individually. Ireland, Italy, Portugal and Spain are not significantly different from zero. In particular, that for Spain is 2.89 and significant at 10%. We therefore consider it necessary to control for countries individually rather than with legal origin, but we run some further tests. Firstly, we try to run the whole regression again after eliminating the dummies for industry. The joint significance of all country dummies is not significantly different from zero but the joint significance for all significant dummies in the equation are significantly different from null, and so is the insignificant dummies. This is not different from the full model. We are therefore left with whether to keep all the country dummies or remove them. We run a regression without the country dummies and see the R^2s. The one with country is higher although both values are less than 15%. We decide to keep the country dummies as our institutional framework depicts accordingly.

For industry we first test all industry dummies that are significant in the full model and those that are not. These tests are not significantly different from zero so we test all the industry dummies together. The result is not different. We then test the industries in a two-digit *NAICS* industrial classification and still do not reject the null hypothesis. This implies that it makes sense to provide separate intercepts for all industries. Apart from a few firms in the construction industry (from Portugal and Spain) which is negatively significant in the model but not significantly different from zero in the *F*-test, all industries are manufacturers. Typically, in corporate governance studies, financial industries, regulated companies and utilities are commonly controlled for. Another issue with the data has been discussed in the data section and this has got to do with the fact that only five industries have all firms represented in all 17 countries.

Text box A11: Cross-sectional multivariate *OLS* analysis

The final model for the cross-sectional regression analysis is given below in equation A4.5.1. *Q* is the market valuation known as Tobin's *Q* ratio. The predictor variables are self-explanatory. Ownership identity has six dummies, and industry and country have seventeen dummies each (17-1 categories). The independent variables are ownership concentration, board size, board independence, *CEO*-chair separation, ownership type and leverage. Sales, sales growth and standard deviation of *ROE* control for individual firm characteristics, industry dummies control for industries and country dummies for countries. For investor protection (investor protection index, revised anti-director rights index, legal origin, number of corporate governance codes), we follow La Porta et al. (2002) and make its own specification adding ownership concentration in alternative specifications discussed in a later section. We also include investor protection in the main model and report the results in this later section (in the main text).

Tobin's *Q* is used as the dependent variable in this cross-sectional estimation although we have data for several years and pooling is argued to reduce heterogeneity leading to better coefficient estimates. We therefore employ pooling techniques in subsequent analyses. Tobin's *Q* has been the most common proxy for performance used in corporate governance for listed firms and it is necessary to apply this to the data. The other performance variables are analysed in the pooled regressions.

$$\begin{aligned} Q = {} & \beta_0 + \beta_1 LOG\_OWNERSHIP\_CONCENTRATION + \beta_2 LOG\_BOARD\_SIZE + \\ & \beta_3 BOARD\_INDEPENDENCE + \beta_4 CEO\_CHAIRMAN\_SEPARATION + \\ & \sum_{h=1}^{h=6} \beta_h OWNERSHIP\_IDENTITY_h + \beta_6 LOG\_SALES + \beta_7 SALES\_GROWTH + \\ & \beta_8 LOG\_STANDARD\_DEVIATION\_4\_YEAR\_ROE + \beta_9 LOG\_LEVERAGE + \\ & \sum_{j=1}^{j=17} \beta_j INDUSTRY_j + \sum_{k=1}^{k=17} \beta_k COUNTRY_k + \varepsilon \end{aligned} \qquad \text{(A4.5.1)}$$

Aside from the variables used in the preliminary section, all the variables with non-zero or non-negative values have been logarithmic transformed to increase homoskedasticity and normality. Table A43 reports on the regression estimates. Ownership concentration is negatively related to firm value and this is significant at 10% in years 2003 and 2004 but insignificant in 2005. Board size reveals no monotonic linear relationship while board independence increases firm value but only significant in year 2003.

Ownership identity gives different effects on valuation with State being the only one with a negative albeit insignificant effect. Public companies have an insignificantly positive relationship. Individuals/families enhance firm value more than financials who also perform better than industrial companies. *CEO*-chairman separation has no significant effect in all the three years although the direction is negative.

Firm size has a systematic positive effect on valuation whereas firm risk is positive but not significant. Sales growth (growth opportunities) indicates a positive relationship with valuation but this is not significant for one year. Leverage (higher debt-to-equity) impact negatively on firm valuation. Regression diagnostics point to a normal distribution of the residual with no extreme outliers. Although the omitted variables test is significant in two of the three years, that for heteroskedasticity is significant in all years.

------------------*continued on next page*-------------------

Text box A11 continued: Cross-sectional multivariate *OLS* analysis

Our next task is then to correct for heteroskedasticity with robust standard errors. The result of this analysis is reported in table A44. The significant levels essentially remain the same so the signs are not affected. The coefficients for industry are jointly significant. The same applies to the country dummies but we do not report these. Introducing too many dummy variables saps cross-sectional *OLS* estimates of strong predictability. In the next section, we deal with pooled analysis and later panel data analysis. One of the advantages of pooling data is dealing with the reduced prediction of cross-sectional *OLS* estimates with several dummy variables. Using pooled data however has its own disadvantages as for example serial correlation and panel heteroskedasticity and we will consider all these as we develop our analyses.

Table A43: Yearly *OLS* regressions of corporate governance and firm value

Variables	2003	2004	2005
Log Tobins *Q*	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Log Largest owner	-0.064* (0.033)	-0.054* (0.033)	-0.045 (0.033)
Log Board size	0.082 (0.080)	0.022 (0.080)	0.010 (0.079)
Board independence	0.200* (0.107)	0.067 (0.106)	0.090 (0.106)
CEO is not chairman	-0.043 (0.042)	-0.051 (0.041)	-0.053 (0.042)
Individual/ family	0.190* (0.103)	0.283*** (0.102)	0.281*** (0.102)
Financials	0.185* (0.100)	0.253** (0.099)	0.201** (0.098)
Public company	0.140 (0.157)	0.148 (0.155)	0.115 (0.155)
Industrial company	0.135 (0.099)	0.250** (0.098)	0.192** (0.098)
State	-0.023 (0.183)	-0.035 (0.181)	-0.087 (0.181)
Log Sales	0.044*** (0.013)	0.051*** (0.013)	0.058*** (0.012)
Sales growth	0.044** (0.017)	0.034 (0.021)	0.086*** (0.033)
Log std. dev. *ROE*	0.031 (0.023)	0.010 (0.023)	0.011 (0.022)
Log Leverage	-0.097*** (0.024)	-0.081*** (0.026)	-0.075*** (0.024)
Constant	-0.874*** (0.301)	-0.716** (0.302)	-0.694** (0.294)
IQR test for outliers	No extreme outliers	No extreme outliers	No extreme outliers
Pnorm, qnorm of residual	normal	normal	normal
Mean *VIF*	4.31	4.31	4.31
Estat *HETTEST*	24.87***	12.94***	8.31***
LINKTEST R^2 *_hatsq*	.30*** 0.098	.25*** 0.03	.23 0.11
OVTEST *F*-statistic	5.79***	3.23**	1.55
R^2	0.299***	0.241***	0.224***
N		540	

***|**|* = significant at 1%|5%|10% levels. Industry and country dummies are not reported. Standard errors are in parentheses. *R&D* and advertising investments that have been known to impact significantly on Tobin's *Q* are excluded because less than half of the firms report *R&D* and no firm report for advertising in the OSIRIS database. The average of 5 years of sales growth is thus used as a proxy for growth opportunities. This can lead to an increase in omitted variable bias as indicated by the significant coefficients of the Ramsey RESET test (*OVTEST*) for years 2003 and 2004. A simple cross-sectional analysis may therefore lead to biased estimations.

Table A44: Yearly heteroskedasticity-corrected *OLS* regressions of corporate governance and firm value

Variables	2003	2004	2005
Log Tobin's *Q*	Coefficient (robust standard error)	Coefficient (robust standard error)	Coefficient (robust standard error)
Log Largest owner	-0.064** (0.030)	-0.054* (0.030)	-0.045 (0.031)
Log Board size	0.082 (0.083)	0.022 (0.079)	0.010 (0.080)
Board independence	0.200** (0.100)	0.067 (0.098)	0.090 (0.103)
CEO is not chairman	-0.043 (0.044)	-0.051 (0.045)	-0.053 (0.043)
Individual/ family	0.190** (0.092)	0.283*** (0.091)	0.281*** (0.093)
Financials	0.185** (0.086)	0.253*** (0.084)	0.201** (0.087)
Public company	0.140 (0.131)	0.148 (0.118)	0.115 (0.124)
Industrial company	0.135* (0.083)	0.250*** (0.086)	0.192** (0.086)
State	-0.023 (0.152)	-0.035 (0.122)	-0.087 (0.104)
Log Sales	0.044*** (0.015)	0.051*** (0.015)	0.058*** (0.012)
Sales growth	0.044** (0.020)	0.034 (0.021)	0.086*** (0.020)
Log std. dev. *ROE*	0.031 (0.022)	0.010 (0.022)	0.011 (0.022)
Log Leverage	-0.097*** (0.026)	-0.081*** (0.026)	-0.075*** (0.025)
Constant	-0.874*** (0.238)	-0.716*** (0.259)	-0.694*** (0.266)
R^2	0.299***	0.242***	0.224***
N		540	

***|**|* = significant at 1%|5%|10% levels. Industry and country dummies are not reported. Robust standard errors are in parentheses.

Appendix A4.6: Preliminary pooled data regressions

Text box A12: Preliminary pooled data regressions

As part of the preliminary pooled estimations of the relationship between ownership concentration and performance measures, we control the relationship with firm fixed effects, industry, country effects, and firm controls and a combination of these in three specifications of each of the ten performance measures. The results are reported in table A43. For Tobin's *Q*, *MBV*, *ROA*, *ROE*, cash flow and dividends, industry, country and year dummies are significant. For bias-corrected technical efficiency, year dummies are insignificant in the first specification. Country dummies tend not to be significant in the first specification of all dependent variables of growth proxies. The same is true for the third specifications with country dummies only significant when operating turnover/ growth is used as the proxy for growth.

The first specification is with firm fixed effects, industry and year. In this specification, ownership concentration is negative but insignificantly related to market valuation. It is also insignificantly related to profitability but negative and significantly related to both cash flow and dividends yield. It is negative but insignificantly related to technical efficiency and exhibits no relationship with any of the growth measures. This implies that fixed effects must be used alone with the independent variable as firm heterogeneity is already controlled.

The second specification is thus with fixed effects only. Ownership concentration is negatively and significantly related with firm value. In terms of profitability, there is a significantly negative relationship with *ROA* but significantly positive with *ROE*. Cash flow also indicates a positive relationship while dividend yield has a negatively insignificant relationship. There is no significant relationship with all measures of growth and technical efficiency.

The third specification is controlled with financial policy, size, risk and investment opportunities together with industry, country and year dummies when the coefficient of year dummies is jointly significant. Ownership concentration is negatively related with market valuation and this relation is strongly significant. It also exhibits an insignificantly negative relation with both measures of profitability. The relationship with cash flow is significantly positive but dividend yield is not statistically significant (albeit, positive). The relationship between revenue growth and also asset growth is significantly positive while that for *TFP* growth is insignificant and negative. Ownership concentration has a significantly positive association with technical efficiency.

As indicated in the third specification in table A45, leverage negatively affects most performance measures except for asset growth and *TFP* growth where the relationship is significantly positive. The relationship with revenue growth is also positive but insignificant. Of the negative relationships, that with *MBV*, *ROE*, cash flow and technical efficiency is insignificant. Firm size is positively related with valuation, profitability, cash flow, dividend yield, asset growth (but not significant), revenue growth and technical efficiency. It is however negatively related with *TFP* growth.

Firm volatilty (as measured by standard deviation of four-year *ROE*) is positively related to valuation, growth and technical efficiency. The positive relationship with dividend yield is not significant. It is negatively related to profitability and cash flow. Growth opportunities (measured with five years of average sales growth) is positively related with valuation. The positive relationship with profitability is very weak (insignificant for *ROA*). It also exhibits a positive relationship with revenue growth (at 5%) and no relationship with asset growth. It shows a negative relationship with dividend yield (at 10%), *TFP* growth (at 1%) and technical efficiency (at 5%).

Table A45: Alternate regression specifications of ownership concentration and performance proxies

Variables	Log Tobin's *Q*	Log *MBV*	*ROA*	*ROE*	Cash flow
1. Ownership concentration with firm fixed effects, industry, country and year when jointly significant					
Log largest owner	-0.007 (0.025)	-0.009 (0.043)	0.651 (0.625)	-1.064 (3.143)	-0.261***(0.097)
Constant	1.043***(0.198)	-1.420** (0.65)	25.905**(12.93)	81.285 (65.390)	4.389***(0.717)
Adjusted R^2	0.781***	0.751***	0.611***	0.597***	0.745***
2. Ownership concentration with fixed effects only					
Log largest owner	-0.379***(0.04)	-0.618***(0.07)	-2.927** (1.29)	11.731***(2.09)	0.753***(0.16)
Constant	-0.396***(0.15)	-1.113***(0.24)	-2.713 (4.407)	28.621***(3.544)	3.785***(0.547)
Adjusted R^2	0.781***	0.746***	0.586***	0.569***	0.717***
3. Ownership concentration with industry, country and year when any of these three are jointly significant					
Log largest owner	-0.079***(0.01)	-0.131***(0.02)	-0.070 (0.259)	-0.688 (0.491)	0.095** (0.038)
Log sales	0.051***(0.005)	0.081***(0.007)	1.015***(0.097)	1.918***(0.186)	0.246***(0.013)
Log std. dev. *ROE*	0.018* (0.010)	0.015 (0.015)	-1.109***(0.2)	-2.264***(0.385)	-0.234*** (0.03)
Log leverage	-0.075***(0.01)	-0.024 (0.018)	-2.351***(0.23)	-0.583 (0.437)	0.004 (0.029)
Sales growth	0.054***(0.012)	0.057***(0.017)	0.894 (0.592)	1.996* (1.052)	-0.037 (0.026)
Constant	-0.597***(0.10)	-1.043***(0.16)	-4.975** (1.98)	-7.950** (3.800)	0.673* (0.359)
Adjusted R^2	0.231***	0.217***	0.165***	0.193***	0.451***

	Log Dividends	Asset growth	Operating rev/ turnover growth	*TFP*	Technical efficiency
1. Ownership concentration with firm fixed effects, industry, country and year when jointly significant					
Log largest owner	-0.113** (0.053)	-0.025 (0.038)	-0.011 (0.041)	0.033 (0.026)	-0.020 (0.012)
Constant	-2.044***(0.51)	0.046 (0.128)	0.084 (0.141)	1.043***(0.062)	0.840***(0.076)
Adjusted R^2	0.902***	0.181***	0.195***		
Sigma				0.087***	0.071***
Wald chi^2				753.89***	6646.79***
Log likelihood				1308.9	2044.16
2. Ownership concentration with fixed effects only					
Log largest owner	-0.092 (0.168)	-0.025 (0.041)	-0.011 (0.047)	0.036 (0.027)	-0.014 (0.031)
Constant	-0.451 (0.427)	0.008 (0.140)	0.042 (0.159)	1.067***(0.063)	0.740***(0.112)
Adjusted R^2	0.892***	0.021***	-0.025**		
Sigma				0.089***	0.071***
Wald chi^2				674.48***	6646.79***
Log likelihood				1283.41	2044.16
3. Ownership concentration with industry, country and year when any of these three are jointly significant					
Log largest owner	0.046 (0.052)	0.013***(0.005)	0.019***(0.006)	-0.004 (0.004)	0.016***(0.006)
Log sales	0.175***(0.020)	0.003 (0.002)	0.007***(0.002)	-0.003*(0.002)	0.026***(0.002)
Log std. dev. *ROE*	0.016 (0.039)	-0.025***(0.00)	-0.019***(0.00)	-0.024***(0.004)	-0.012***(0.004)
Log leverage	-0.122** (0.049)	0.013***(0.004)	0.005 (0.005)	0.014***(0.004)	-0.007 (0.005)
Sales growth	-0.383* (0.219)	0.000 (0.006)	0.018**(0.007)	-0.024***(0.009)	-0.022**(0.009)
Constant	-2.729***(0.39)	0.144***(0.043)	0.109**(0.053)	1.081***(0.029)	0.397***(0.059)
Adjusted R^2	0.537***	0.157***	0.181***		
Sigma				0.115***(0.009)	0.118***(0.003)
Wald chi^2				111.68***	561.75***
Log likelihood				939.09	972.26

***|**|* = significant at 1%|5%|10% levels. Standard errors are in parentheses. Results of industry, country and year dummies are excluded. 30 *OLS*/truncated regressions of ownership concentration on ten dependent measures (of three specifications each) of firm value, profitability, dividend yield, cash flow, efficiency and growth.

Text box A13: Explanation of endogeneity and application to study

In order to test the instruments' exogeneity, endogeneity tests contrast the efficient, but potentially inconsistent estimates pre-instrumental variable procedure with the consistent, but possibly inefficient instrumental variable estimates. If the pre-instrumental variable estimates are found to be inconsistent, the variables in question are deemed endogenous and must be instrumented (Medvedev, 2006). The instrumental variable estimator (more generally: two-stage least squares – *2SLS*; three-stage least squares – *3SLS* [combination of *2SLS* and seemingly unrelated regression], and; generalised method of moments – *GMM*) uses at least one instrument and identifying assumptions to get the unbiased estimator.

The identifying assumption, as has been given, is that the instrument correlates highly with the predictors, but does not correlate with the error term. The second part of the assumption can not really be tested leading to conclusions from instrumental variable estimators based on assumptions which cannot be tested. Dahya et al. (2008) and Drobetz et al. (2004a) explain that a suitable instrument is one that is correlated with the endogenous variable but not with the error terms in the regression equation in which this variable is used as a regressor. Ideal instruments are generally difficult to come across in practice. Lags of endogenous variables are sometimes used as their own instruments. This approach is an appealing alternative as endogeneity tests do not actually test for endogeneity of the variables but rather for exogeneity of the instruments. In addition, the implementation of the available endogeneity tests in the presence of serial correlation is not clear (Medvedev, 2006).

Bøhren and Ødegaard (2004) and Seifert et al. (2005) argue in their study that endogeneity is insignificant in the governance and performance relationship; implying that firms with higher market values are likely to have better governance mechanisms than others. In Drobetz et al.'s (2004a) study, they select and operationalise a dummy to be exogenous. They use the *F*-statistic (of a Wald test) of the first stage to check for the information contained in the instrumental variable. The first stage *F*-statistic of the *2SLS* tests that the null hypotheses of the coefficients on the instruments are equal to zero. When there is a single endogenous regressor, the *F*-statistic must be 10 or more to indicate that the instrument is not weak, otherwise the two-stage estimators are biased and the *t*-statistics will be unreliable. The first stage should contain a constant, the instrument(s) and all exogenous variables.

Hausman and Taylor (1981) suggest a method for the estimation of time-invariant variables. They reason regressing the time invariant variables on the dummy variable coefficients to obtain consistent estimates of the time-invariant variable effects. If there is a minimum variance in the time dimension, the two-step approach estimator of Hausman and Taylor can be overlooked as *OLS* estimation will give an unbiased prediction. Additionally, the estimation may not be efficient because the variance of the estimated coefficients tend to approach infinity because most of the within variation is absorbed by the firm dummies. The Hausman-Taylor model is difficult to specify as the correlation is unobservable.

Plümper and Troeger (2007) agree that adapting the random effects model is more appropriate than pooled *OLS* in the presence of time-invariant variables. They further concur that the random effects perform better than pooled *OLS* even if a Hausman test suggests otherwise but the estimates are not consistent. They suggest a three-stage model using fixed effects and Prais-Winsten transformation in addition to the random effects to effectively take care of time-invariant variables. Since this model is not available in STATA and other econometric software, we mainly use the Prais-Winsten transformation to a random effects specification in our main analyses.

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Text box A13 continued: Explanation of endogeneity and application to study

Addressing endogeneity problems in the study

There is some empirical evidence against the exogeneity of ownership and firm value and has called into play the use of instrumental variable regression. Hermalin and Weisbach (1991) for example use lagged explanatory variables as instruments for ownership. They find this to increase the coefficient of ownership. Himmelberg et al. (1999) argue that using lagged variables as instruments may give biased results if the source of endogeneity is from omitted variable bias. Demsetz and Villalonga (2001) argue that firm performance does not affect ownership structure but the latter affects the former so it is prudent to consider ownership as endogenous and run simultaneous equation models to ascertain this. They do not employ lagged explanatory variables but some variables that we will also adapt for our analysis. We utilise the third specification from table A45 and employ both the *2SLS* and *GMM* approaches to model ownership concentration with firm value. Table A46 reports values and the instrumented variables.

We use the pooled regression (as our data does not allow for dynamic *GMM*) and follow the Demsetz-Villalonga procedure although we substitute investments and average 5-year sales growth for *R&D*, advertising and fixed investments. Our investment proxy is highly correlated with *R&D* but since a lot of firms do not report for *R&D* and we have no information for advertising, we use investments. We then substitute investments with our proxy for growth opportunities which is an average 5-year sales growth. We find that this better explains variability in ownership and firm value and report the results for this. We also use the standard deviation of 4-year *ROE* growth as volatility in place of beta (firm risk). This is because we only have one current value of beta (year 2006) as the OSIRIS database does not maintain past values of this.

For robustness, we replace the largest direct owner (cash flow rights) with the five largest direct owners and also with the total (direct or indirect – voting rights) shares of the largest shareholder. The ownership variable still remains significantly negative although with a reduced coefficient when the five largest shareholders is utilised. We do not report the industry and country dummies (17 categories each) although an *F*-test of joint significance of both categories remains validated. This analysis is only with the relationship between firm valuation and ownership concentration as endogeneity tests are mainly concerned with this relationship.

Comparing the coefficient ($p<0.01$, and robust standard error in parentheses) of our pooled *OLS* (-0.079 (0.01)) with the pooled *GMM* (-0.926 (0.144)) and pooled *2SLS* (-0.931 (0.144)) results indicates that ownership is still negatively related as the coefficients of the *2SLS* and *GMM* regressions are both negative like the *OLS* estimate but then the second stage utilises *GLS* z statistics rather than t-statistics so comparisons can only be made by a specification test. The coefficient of the *2SLS* regression is slightly higher than that of the *GMM* regression. The first stage results gives as a relationship between ownership concentration and growth opportunities (-, $p<0.1$), risk (-, $p<0.1$), size (-, $p<0.1$) and financial policy (+, $p<0.5$). Leverage is also negatively and significantly related to firm value in both econometric specifications in line with our predictions for firms with high investment opportunities. Sales growth, our proxy for growth opportunities, is positively associated with firm value but only at a level of significance of 10%.

Table A46: Instrumental variable regressions of ownership concentration and firm value

First-stage regression	***OLS***	***OLS***
Log largest direct owner	Coefficient (robust standard error)	Coefficient (robust standard error)
Average 5-year sales growth	-0.0236*** (0.0085)	-0.0236*** (0.0085)
Log leverage	0.0429** (0.0185)	0.0429** (0.0185)
Log sales	-0.0553*** (0.0079)	-0.0553*** (0.0079)
Log std. Dev. 4-yearr *ROE*	-0.0587*** (0.0170)	-0.0587*** (0.0170)
Constant	0.2680* (0.1388)	0.2680* (0.1388)
Adjusted R^2	0.4478***	0.4478***
Second stage regression	***GMM***	***2SLS***
Log Tobin's *Q*	Coefficient (robust standard error)	Coefficient (robust standard error)
Log largest direct owner	-0.9256*** (0.1437)	-0.9309*** (0.1445)
Average 5-year sales growth	0.0309* (0.0178)	0.0301* (0.0176)
Log leverage	-0.0426** (0.0173)	-0.0427** (0.0174)
Constant	-0.3575*** (0.1216)	-0.3591*** (0.1219)
Wald chi^2 (35)	290.62***	284.79***
N = 2196: pooled over three years, *n* = 732		

Instrumented: log largest direct owner. Instruments: average 5-year sales growth, log standard deviation of 4-year *ROE*, log leverage, log sales, industry dummies and country dummies. Industry and country dummies (17-1) for both categories are not reported (in both regression stages) but all dummies of these categories are jointly significant. ***|**|* = Significant at 1%|5%|10% levels. Heteroskedasticity-corrected robust standard errors are in parentheses.

Text box A14: Explanations of panel heteroskedasticity and autocorrelation

To correct for panel heteroskedasticity and serial correlation at the same time, a three-step *FGLS* estimator is recommended. This allows for estimation in the presence of first-order autoregressive –*AR*(1)- correlation within panels and cross-sectional correlation and/or heteroskedasticity across panels. This estimator works best when there is adequate degrees of freedom since this estimator generates additional estimates of the the autocorrelation, covariance and variance parametisations.

The standard version of the *FGLS* estimator in the presence of both heteroskedasticity and autocorrelation as we have just noted is a three-step process: in the first step, the model assumes homoskedastic errors and calculates consistent estimates of the *AR*(1) parameter(s); in the second step, a groupwise heteroskedastic model is applied to the transformed data (which is now free of autocorrelation); and in the third step, the new moment matrix is used to solve the full *FGLS* system and obtain the correct asymptotic variance-covariance matrix. The autoregressive parameters are either cross-section specific or assumed to be constant across all cross-sections. The assumption of constancy enhances efficiency of the estimator. Both the cross-sectional specificity or constancy assumptions give similar results. We select the more efficient method using a common autoregressive –*AR*(1)- model as suggested by Beck and Katz (1995) and Medvedev (2006).

Autocorrelation can also be controlled by including an independent variable that explains part of the regression residual. Beck and Katz (1996) also address the issue of autocorrelation by lagging the endogenous variable. A lagged regression model relates a current endogenous variable to past values of the exogenous and endogenous variables. Beck and Katz have shown that data does not lose any efficiency in its estimates when the dependent variable is lagged. They propose to calculate standard errors by using panel-corrected standard errors (*PCSE*s). The combination of *OLS* and *PCSE* allows for accurate estimation of variability in the presence of panel error structures curtailing issues caused by *GLS* and other *CSTS* models (Beck & Katz, 1996).

The analysis of firms of different sizes inherently introduces heteroskedasticity in any regression. Data standardisation only reduces heteroskedasticity but does not remove it when firm sizes are remarkably different. There are several acceptable methods available to detect heteroskedasticity, including the use of auxiliary regressions and the Breusch-Pagan (1979) test. In using the Lagrange multiplier, the residuals are regressed from an *OLS* estimation of the equation on the first lag of those residuals together with the independent variables used in the *OLS* estimation. The estimated coefficient on the lagged residual term yields an estimate of the remaining serial correlation of the errors. In our case, we regress the dependent variable against all our predictor variables. We obtain a significant estimated coefficient indicating serial correlation.

If serial correlation remains present in the model, *FGLS* models, instrumental variables or dummy variables must be utilised. The addition of dummy variables in the equation offers explanations of the unexplained variance controlling for autocorrelation although a Durbin-Watson test is first required for justification. An argument against using the Durbin-Watson test for autocorrelation is when one of the explanatory variables is a lagged dependent variable. An *h* test or *m* test should then be used.

Text box A15: Explanation of Feasible Generalised Least Squares method and application to study

Cross-sectional time-series FGLS regression

There are a number of methods available for dealing with serial correlation. One well-known approach to dealing with serial correlation in time series is *FGLS*. In this approach, we run the *OLS* regression of the dependent variable on all predictor variables and obtain the *OLS* residuals. Subsequently, we run the regression of the *OLS* residuals on the lagged dependent variable for the subsequent periods. In doing this, we obtain the coefficient on the lagged dependent variable, rho. We then subtract rho from 1 for all predictor variables and the dependent variable. Finally, we apply *OLS* to that equation. The coefficient estimates in some of the regressions of our various performance variables on the predictors with grouping variables have been derived from the *FGLS* estimation. The formula as given from previous literature (see for example, Beck & Katz, 1995 & 1996; kittel, 2001) for the *GLS* estimator is below.

$$\hat{\beta}_{GLS} = (X'\hat{\Omega}X)^{-1}X'\hat{\Omega}y \qquad \text{(A4.6.1)}$$

$$Var(\hat{\beta}_{GLS}) = (X'\hat{\Omega}X)^{-1}$$

Where X stands for regressors; Ω indicates the large variance matrix of all observed disturbance units written in terms of Kronecker product:

$$\Omega = \sum\nolimits_{N*N} \otimes I_{T_i*T_i} \qquad \text{(A4.6.2)}$$

where $I = 1,..., N$ is the number of units and $t = 1,...,T$ is the number of observations for unit i. An estimated variance matrix Ω is then obtained by substituting the estimator $\hat{\Sigma}$ for Σ in equation (A4.6.3) where;

$$\hat{\Sigma}_{i,j} = \frac{\hat{\varepsilon}_i{}'\hat{\varepsilon}_j}{T}. \qquad \text{(A4.6.3)}$$

We first obtain the residuals used in the estimation from an *OLS* regression. We then put in the estimated variance matrix $\hat{\Omega}$ in the *GLS* formula of equation (A4.6.2) and this gives the *FGLS* estimator.

There are several methods for *FGLS* estimation of the *AR(1)* model which result from the different methods of estimating rho. Cochrane-Orcutt estimation omits the first observation and uses estimated rho from the regression of the *OLS* residuals on the lagged dependent variable whereas Prais-Winsten estimation uses the first observation instead of dropping it. Another method to correct for autocorrelation, this one specifically geared toward dealing with multiple units over time, is a simple extension of the "basic" *FGLS* approach. This is the Park's method and we also apply this to our data analysis.

Beck and Katz (1996) have also argued that it is better to assume a common autoregressive process when using any of these methods. To check for first-order autocorrelation (*AR*1), we regress the pooled *OLS* regression residual on one lagged value of this residual and other predictor variables with no dummies for firm fixed effect. The result is significant at 1% indicating serial correlation obtains.

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Text box A15 continued: Explanation of Feasible Generalised Least Squares method and application to study

This is particularly so as some of our predictor variables of interest are time-invariant. We apply this Park's method to the relationship between corporate governance and firm value using various considerations of the distribution of heteroskedasticity and first order correlation and report regression estimates in table A47.

As a first test of non-linearities in ownership concentration and board size as suggested by some of the past studies and mentioned as extensions to our hypotheses in Chapter Three, we include the square of these variables. It is observed that in regression 1 where correction is not made for both heteroskedasticity and autocorrelation, the negative relationship between ownership concentration and firm value is not significant.

Financials, individual/family and industrial companies have significant positive effects when the largest direct shareholder is any of these. Financials have the most marked effect, followed by individuals/family and industrial companies respectively. The negative association when State is the largest owner is not significant. All board characteristics are not significant while leverage has a significant effect. Firm risk and growth opportunities lead to positive market valuation.

In regressions 2, there is correction for heteroskedasticity but not for autocorrelation. The coefficients and standard errors as compared to regression 1 are more improved. Ownership concentration has a significantly negative relationship with Tobin's *Q* and this relationship is linear. All ownership types are significant with expected signs. Leverage also has a negative relationship with valuation while risk, growth opportunities and firm size are all with the expected signs as in regression 1. Board size reveals an inverted U-shaped quadratic leading to the prediction that after a certain size, board size has a negative effect on valuation.

Regression 3 has correction for heteroskedasticity and a common *AR*(1) coefficienct for all panels. Regression 4 has corrections for heteroskedasticity and panel-specific *AR*(1). Beck and Katz (1995 & 1996) recommend the use of regression 3 over regression 4. We see that the coefficients in regression 4 are generally better than in regression 3 but all variables in both regressions are statistically significant. The relationship between valuation and ownership concentration is a U-shaped function and that for board size is an inverted U-shaped function. This implies that from low to medium levels of ownership, valuation decreases but as the concentration becomes higher, it positively impacts on valuation supporting Drobetz et al.'s (2004a) argument we used to extend hypothesis *H1*.

In regressions 2 to 4, separating the *CEO* from the board chairman leads to decreased value (not significant in regression 1) while increasing board outsiders leads to improved value (not significant in regression 1). Leverage has a negative effect on valuation in all regressions while the other control variables are all significant and with similar signs in all four regressions. The relationship between value and board outsiders is positive and squaring the value makes both the original and squared values insignificant.

Table A47: *FGLS* regressions of corporate governance and firm value

Variables	Regression 1	Regression 2	Regression 3[a]	Regression 4[b]
Tobin's *Q*	Coefficient (standard error)	Coefficient (heteroskedastic panels)	Coefficient (heteroskedastic panels)	Coefficient (heteroskedastic panels)
		Ownership variables		
Largest direct shareholder	-0.6916 (0.4673)	-0.5973*** (0.1544)	-0.9205*** (0.2650)	-0.9732*** (0.2671)
Squared largest shareholder	0.3592 (0.5862)	0.3072 (0.1927)	0.7640*** (0.2954)	0.6641** (0.2927)
Individuals/ family	0.3155*** (0.1148)	0.2341*** (0.0294)	0.1620*** (0.0503)	0.2211*** (0.0553)
Financials	0.3371*** (0.1120)	0.2764*** (0.0280)	0.1592*** (0.0465)	0.2086*** (0.0561)
Publicly-listed	0.2633 (0.1690)	0.2028*** (0.0437)	0.1121*** (0.0652)	0.1405* (0.0833)
Industrials	0.2938*** (0.1114)	0.2211*** (0.0266)	0.0449*** (0.0411)	0.1565** (0.0528)
State	-0.0482 (0.2048)	-0.1090*** (0.0381)	-0.1777*** (0.0587)	-0.2705*** (0.1080)
		Board variables		
CEO-chairman separation	-0.0597 (0.0464)	-0.0718*** (0.0147)	-0.0524*** (0.0274)	-0.0706*** (0.0286)
Board independence	0.1859 (0.1159)	0.2255*** (0.0291)	0.2718*** (0.0536)	0.2116*** (0.0606)
Board size	0.0467 (0.0338)	0.0448*** (0.0102)	0.0625*** (0.0164)	0.0589*** (0.0182)
Squared board size	-0.0019 (0.0016)	-0.0019*** (0.0004)	-0.0025*** (0.0007)	-0.0024*** (0.0008)
		Financial policy		
Log of leverage	-0.2534*** (0.0266)	-0.2113*** (0.0087)	-0.1045*** (0.0117)	-0.1480*** (0.0079)
		Controls for size, specific risk and opportunities for growth		
Log of sales	0.0940*** (0.0140)	0.0784*** (0.0040)	0.0439*** (0.0084)	0.0700*** (0.0078)
Std. dev. Of 4-year averaged *ROE* growth	0.0068*** (0.0019)	0.0056*** (0.0007)	0.0051*** (0.0009)	0.0062*** (0.0006)
5-year sales growth	0.0858*** (0.0250)	0.1057*** (0.0131)	0.0951*** (0.0133)	0.0795*** (0.0112)
Constant	-0.1902 (0.3649)	0.0388 (0.0992)	0.3372** (0.1683)	0.2333 (0.1905)
N	1870 (*n* = 705)		1786[@c] (*n* = 621)	
Wald chi^2 (49)	517.6***	15840.5***	2003.4***	2637.4***
Log likelihood	-2360.02			

[a] = Common *AR*(1) coefficient for all panels (0.7499). [b] = Panel-specific *AR*(1). [@c] = 84 observations dropped because of only 1 observation in group. *P (z)*: ***|**|* = significant at 1%|5%|10% levels. Standard errors of beta coefficients are in parentheses. Likelihood-ratio test *LR* chi^2 (1265) = 4865.88*** (assumption: homoskedasticity nested in heteroskedasticity). Industry and country dummies are not reported. Inclusion of the square of outside directors to the equation makes its identity insignificant while it does not contribute to an opposite sign or being significant. We therefore exclude the square of board outsiders from the model. Please refer to page 306 (left side page) for details of the table.

Table A48: Prais-Winsten regressions of piecewise linear relationship between firm performance and ownership concentration (knot at 20%) and board size (knots at 5 and 15)

	Log Tobin's *Q*	Log *MBV*	*ROA*	*ROE*	Cash flow	Log dividend yield
Variables	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error).	Coefficient (standard error)
Up to 20% shares	-0.110 (0.151)	-0.019 (0.228)	16.896***(3.855)	26.892***(8.591)	-0.131 (0.445)	1.945***(0.418)
Shares > 20%	-0.258***(0.081)	-0.376***(0.128)	4.711* (2.547)	8.802* (4.957)	0.576**(0.276)	0.949***(0.249)
1-5 board members	-0.252 (0.242)	-0.162 (0.351)	-6.679 (5.811)	-2.066 (13.492)	-0.931** (0.417)	0.372 (0.607)
5-15 board members	0.161***(0.059)	0.256***(0.089)	-9.133***(1.793)	-11.086***(2.88)	-0.209 (0.164)	0.253 (0.220)
Board more than 15	-0.912***(0.287)	-1.656***(0.560)	-39.009***(9.028)	-42.887** (19.02)	5.272** (2.635)	0.568 (0.823)
Board independence	0.122** (0.062)	0.271***(0.095)	-5.725***(2.120)	-6.397 (4.058)	-0.258 (0.211)	0.105 (0.216)
Individual/family	0.181***(0.068)	0.252** (0.105)	8.362***(1.906)	12.487***(3.146)	-0.034 (0.203)	0.648***(0.189)
Financials	0.198***(0.065)	0.256***(0.102)	4.743***(1.758)	5.578* (2.926)	-0.155 (0.195)	0.543***(0.165)
Public	0.154* (0.094)	0.328***(0.133)	5.066* (2.771)	7.965* (4.764)	-0.763** (0.367)	0.407* (0.222)
Industrial company	0.158***(0.064)	0.238** (0.099)	3.669**(1.798)	4.998* (3.047)	-0.210 (0.194)	0.354** (0.167)
State	-0.008 (0.143)	-0.015 (0.180)	-0.546 (3.975)	-0.273 (5.801)	-0.613 (0.472)	0.678** (0.311)
CEO is not Chairman	-0.023 (0.030)	-0.057 (0.040)	-1.234 (0.894)	-2.336* (1.422)	-0.055 (0.075)	0.003 (0.112)
Log sales	0.043***(0.009)	0.062***(0.012)	5.031***(0.323)	7.861***(0.480)	0.330***(0.023)	0.174***(0.033)
Sales growth	0.049***(0.013)	0.033* (0.020)	-1.202*** (0.465)	-1.556* (0.815)	-0.022 (0.026)	-0.377 (0.255)
Log std. dev. *ROE*	0.041***(0.012)	0.047***(0.017)	-2.116***(0.393)	-3.668***(0.713)	-0.246***(0.034)	-0.029 (0.034)
Log leverage	-0.090***(0.015)	-0.017 (0.023)	-3.579***(0.442)	-5.806***(0.876)	-0.127***(0.038)	-0.111** (0.055)
Rho	0.554	0.528	0.513	0.482	0.473	0.683
R^2	0.245***	0.183***	0.331***	0.313***	0.392***	0.550***
Wald chi^2	2107***	2143***	1059.37***	1117***	1642***	1574***
N (panel for 3 years)	1870	1859	1932	1935	1674	758

***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation.

Table A49: Prais-Winsten regressions of piecewise linear relationship between firm performance and ownership concentration (knot at 25%) and board size (knot at 15)

	Log Tobin's *Q*	Log *MBV*	*ROA*	*ROE*	Cash flow	Log dividend yield
	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error).	Coefficient (standard error)
Up to 25% shares	-0.059* (0.032)	-0.084* (0.046)	1.361 (1.030)	1.465 (1.738)	0.161** (0.073)	0.209** (0.103)
Shares > 25%	-0.083* (0.048)	-0.124* (0.078)	1.169 (1.431)	3.687 (2.857)	0.160 (0.169)	0.324** (0.144)
Board less than 16	0.111** (0.057)	0.207***(0.084)	-8.816***(1.686)	-9.971***(2.773)	-0.304** (0.138)	0.255 (0.198)
Board more than 15	-0.853***(0.288)	-1.593***(0.563)	-39.817***(8.984)	-43.714** (18.89)	5.346** (2.665)	0.522 (0.835)
Board independence	0.118* (0.062)	0.267***(0.095)	-5.730*** (2.090)	-6.266 (4.003)	-0.275 (0.210)	0.105 (0.217)
Individual/family	0.178***(0.068)	0.247** (0.105)	8.418***(1.899)	12.621***(3.140)	-0.024 (0.202)	0.667***(0.189)
Financials	0.186***(0.065)	0.240** (0.102)	4.984***(1.782)	5.896***(2.968)	-0.135 (0.194)	0.577***(0.168)
Public	0.148* (0.094)	0.320** (0.134)	5.189* (2.747)	8.072* (4.724)	-0.754** (0.366)	0.430** (0.223)
Industrial company	0.150** (0.064)	0.227** (0.099)	3.807** (1.795)	5.231* (3.055)	-0.203 (0.194)	0.372** (0.168)
State	-0.012 (0.142)	-0.018 (0.180)	-0.594 (3.959)	-0.043 (5.786)	-0.629 (0.470)	0.655** (0.309)
CEO is not Chairman	-0.022 (0.030)	-0.054 (0.040)	-1.279 (0.893)	-2.365* (1.409)	-0.061 (0.075)	-0.005 (0.111)
Log sales	0.043*** (0.009)	0.061*** (0.012)	5.038*** (0.324)	7.847*** (0.481)	0.333***(0.023)	0.178***(0.033)
Sales growth	0.050***(0.014)	0.033***(0.021)	-1.219***(0.466)	-1.567* (0.814)	-0.023 (0.026)	-0.379 (0.246)
Log std. dev. *ROE*	0.040***(0.012)	0.047***(0.017)	-2.136***(0.394)	-3.678***(0.711)	-0.25***(0.034)	-0.03 (0.034)
Log leverage	-0.087***(0.015)	-0.013 (0.023)	-3.600***(0.440)	-5.85***(0.878)	-0.124***(0.038)	-0.112** (0.055)
Constant	-0.797***(0.190)	-1.334***(0.330)	-36.165***(5.053)	-50.16***(9.83)	0.759 (0.899)	-3.599***(0.656)
Rho	0.554	0.537	0.508	0.478	0.467	0.691
R^2	0.244***	0.183***	0.332***	0.314***	0.394***	0.550***
Wald chi^2	621.7***	413.3***	556.67***	647.14***	1012***	806.5***
N (panel for 3 years)	1870	1859	1932	1935	1674	758

***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation.

Table A50: Prais-Winsten regressions of piecewise linear relationship between firm performance and ownership concentration (knot at 50%) and board size (knot at 15)

Variables	Log Tobin's *Q* Coefficient (standard error)	Log *MBV* Coefficient (standard error)	*ROA* Coefficient (standard error)	*ROE* Coefficient (standard error)	Cash flow Coefficient (standard error).	Log dividend yield Coefficient (standard error)
Shares ≤ 50%	-0.066***(0.024)	-0.101***(0.034)	1.425** (0.742)	2.215* (1.300)	0.199***(0.062)	0.265***(0.074)
Shares > 50%	-0.064 (0.140)	-0.018 (0.234)	-0.668 (4.644)	1.145 (9.654)	-0.611 (0.523)	0.039 (0.428)
Board size < 16	0.111** (0.057)	0.207***(0.084)	-8.811***(1.684)	-9.975***(2.776)	-0.319** (0.139)	0.254 (0.197)
Board size > 15	-0.838***(0.286)	-1.554***(0.555)	-39.988***(8.884)	-45.15** (18.72)	5.089* (2.717)	0.447 (0.832)
Board independence	0.119** (0.061)	0.270***(0.095)	-5.730***(2.095)	-6.411* (4.013)	-0.289 (0.207)	0.105 (0.216)
Individual/family	0.179***(0.068)	0.247**(0.105)	8.471***(1.913)	12.548***(3.117)	-0.019 (0.200)	0.669***(0.187)
Financials	0.186***(0.065)	0.238** (0.102)	5.068***(1.808)	5.894**(2.982)	-0.123 (0.194)	0.590***(0.168)
Public	0.147* (0.095)	0.312** (0.135)	5.298**(2.784)	8.257* (4.788)	-0.710** (0.365)	0.455** (0.222)
Industrial company	0.150** (0.064)	0.224** (0.100)	3.914**(1.825)	5.284* (3.093)	-0.179 (0.194)	0.382** (0.167)
State	-0.008 (0.140)	-0.011 (0.177)	-0.562 (3.924)	-0.402 (5.729)	-0.637 (0.469)	0.615** (0.302)
CEO is not Chairman	-0.022 (0.030)	-0.053 (0.040)	-1.294 (0.890)	-2.413* (1.408)	-0.065 (0.075)	-0.015 (0.110)
Log sales	0.043*** (0.009)	0.061***(0.012)	5.034***(0.322)	7.862***(0.479)	0.336***(0.023)	0.178***(0.033)
Sales growth	0.050***(0.014)	0.034* (0.020)	-1.225***(0.466)	-1.580** (0.812)	-0.024 (0.026)	-0.386 (0.241)
Log std. dev. *ROE*	0.040***(0.012)	0.048***(0.017)	-2.151***(0.394)	-3.708***(0.713)	-0.251***(0.034)	-0.032 (0.035)
Log leverage	-0.087***(0.015)	-0.013 (0.023)	-3.597***(0.440)	-5.858***(0.881)	-0.126***(0.038)	-0.112** (0.055)
Constant	-0.822***(0.179)	-1.397***(0.314)		-47.57***(9.56)	0.953 (0.881)	-3.426***(0.620)
Rho	0.551	0.533	0.504	0.475	0.465	0.677
R^2	0.244***	0.183***	0.333***	0.314***	0.395***	0.551***
Wald chi^2	626.1***	415.4***	557.67***	649.82***	1013***	816.8***
N (panel for 3 years)	1870	1859	1932	1935	1674	758

***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation.

Table A51: Prais-Winsten regressions of piecewise linear relationship between firm performance and ownership concentration (knot at 70%) and board size (knot at 15)

Variables	Log Tobin's *Q* Coefficient (standard error)	Log *MBV* Coefficient (standard error)	*ROA* Coefficient (standard error)	*ROE* Coefficient (standard error)	Cash flow Coefficient (standard error).	Log dividend yield Coefficient (standard error)
Up to 70% shares	-0.065***(0.022)	-0.098***(0.031)	1.180* (0.680)	1.954* (1.192)	0.191***(0.062)	0.263***(0.066)
Shares > 70%	-0.210 (0.446)	0.079 (0.726)	13.333 (16.039)	21.924 (34.055)	-3.201** (1.671)	-2.016 (2.372)
Board size < 16	0.110** (0.057)	0.207***(0.084)	-8.817***(1.682)	-9.973***(2.770)	-0.318** (0.139)	0.250 (0.196))
Board size > 15	-0.846***(0.282)	-1.558***(0.557)	-39.060***(8.800)	-43.946** (18.70)	4.950* (2.645)	0.480 (0.829)
Board independence	0.119** (0.061)	0.270***(0.095)	-5.706***(2.105)	-6.385* (4.023)	-0.284 (0.206)	0.106 (0.216)
Individual/family	0.180***(0.068)	0.249** (0.105)	8.397***(1.908)	12.474***(3.119)	-0.015 (0.201)	0.658***(0.187)
Financials	0.187***(0.064)	0.240** (0.102)	4.903***(1.786)	5.719** (2.955)	-0.119 (0.195)	0.589***(0.166)
Public	0.148* (0.094))	0.316** (0.134)	5.069* (2.765)	8.014* (4.743)	-0.685* (0.364)	0.465** (0.224)
Industrial company	0.152** (0.064))	0.226** (0.099)	3.683** (1.797)	5.024* (3.050)	-0.176 (0.194)	0.375** (0.166)
State	-0.007 (0.140)	-0.012 (0.178)	-0.610 (3.959)	-0.480 (5.756)	-0.616 (0.472)	0.615** (0.298)
CEO is not Chairman	-0.022 (0.030)	-0.053 (0.040)	-1.275 (0.893)	-2.401* (1.415)	-0.060 (0.075)	-0.016 (0.110)
Log sales	0.043***(0.009)	0.061***(0.012)	5.037***(0.323)	7.863***(0.479)	0.337***(0.023)	0.176***(0.033)
Sales growth	0.050***(0.014)	0.033* (0.020)	-1.209***(0.465)	-1.567** (0.814)	-0.024 (0.026)	-0.389 (0.241)
Log std. dev. *ROE*	0.040***(0.012)	0.047***(0.017)	-2.122***(0.393)	-3.682***(0.712)	-0.249***(0.034)	-0.031(0.035)
Log leverage	-0.088***(0.015)	-0.013 (0.023)	-3.600***(0.440)	-5.861***(0.881)	-0.127***(0.038)	-0.111**(0.055)
Constant	-0.817***(0.176)	-1.383***(0.313)	-36.928***(4.820)	-48.801***(9.39)	0.865 (0.861)	-3.378***(0.613)
Rho	0.546	0.534	0.511	0.479	0.471	0.675
R^2	0.244***	0.183***	0.332***	0.313***	0.394***	0.551***
Wald chi^2	628.3***	413.7***	554.88***	647.57***	1013***	840***
N (panel for 3 years)	1870	1859	1932	1935	1674	758

***|**|* = significant at 1%|5%|10% levels. Heteroskedastic panels-corrected standard errors are in parentheses. Coefficients of industry and country dummies are not reported. Correction has been made for first-order serial correlation.

Declaration

This thesis has been entirely my own work and has not been previously submitted for a degree or diploma in any university. The thesis, to the best of my knowledge and belief, contains no previously published material by any other person except where references have appropriately been acknowledged. This is the final draft of the thesis which was submitted for the evaluation process on 12th November 2008 and scheduled for public defence on 9th October 2009.

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Published and presented works

- 2007: "Interstanding the Industrial District: Contrasting Conceptual Images as a Road to Insight". Entrepreneurship and Regional Development: An International Journal, 19 (6), 527-554. Co-authored with: Johannisson, B; Centeno C.L; Discua C.A.F; Epure, M; Hormiga, E.P; Kapelko, M; Murdock, K; Olejárová, M; Sanchez A.L; Sekki, A; Stoian, M-C; Tötterman, H; & Bisignano, A.
- 2006: "Corporate Ownership and Technical Efficiency Analysis in the Spanish Real Estate Sector." Corporate Ownership & Control 4 (2), 100-114.
- October 2007: Presentation at the 3rd edition of 2007 *Jornades Doctorials* (doctorate workshops) held at *EADA* in Collbatò – Spain.
- July 2006: Presentation at the 21st European conference in Operational Research (*EURO* 2006) held at the University of Iceland in Reykjavik – Iceland.
- April 2006: Presentation at the 3rd *EDP* Workshop held at *UAB* in Barcelona – Spain.
- November 2005: Presentation at the 2nd Conference of Preliminary Papers to Congresses held at *UAB* in Barcelona - Spain.