The success of Spanish new firms: A study on the impacts of firm-specific and industry-specific factors

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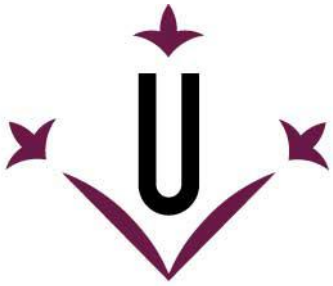

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The success of Spanish new firms: A study on the impacts of firm-specific and industry-specific factors

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The success of Spanish new firms: A study on the impacts of firm-specific and industry-specific factors

Abstract

This thesis studies the impacting factors on the success of new firms in Spain mainly from the perspectives of accounting, financing, and industry. In particular, two important facets of success are focused on: survival (or survival-based success) and profitability. Survival-based success is studied in three situations in both manufacturing and trading distributive industries. The first situation is about researching on the impacts and predictability of firm-specific factors on the survival-based success or failure of new firms before and during the recent crisis period. Logistic model is used for analysis and comparison of the changes of the predictability in three dimensions: year after year versus just the first year, manufacturing versus distributive industry, and before versus during the recent crisis period.

In the second situation, particular interests are put on the impacts and predictability of financial, accounting-based, and industrial factors (as well as corporate venturing). Logistic regression again is used for comparing the differences of factors in the prediction of future survival-based success after different time periods since the studying years (the years of age 1, age 2, and age 3 respectively). The third situation is for exploring the impacts and predictability of some firm-specific factors (mainly financial factors) and industry-specific factors in more detailed forms. Thus, decision trees are built not only for comparing the impacts between different factors but also for observing the change of factor's impact with firm´s ageing and after industry adjustment.

In addition to the survival-based success, with using linear regression, the influence of some financial and accounting-based factors on new firm profitability is also researched in this thesis, with the focus on two manufacturing sectors (food products sector and

computer, electronic and optical products sector) separately for adding new evidence to high-technology and low-technology sectors. Generally speaking, the principal impacting factor on profitability is different to those on survival-based success: indebtedness performs best in profitability study while firm size and profitability (together with group membership in distributive industry) outperform than others in survival-based success study. Besides, when using different research methods in survival-based success study, the results tend to be different.

Resumen

Esta tesis estudia los factores que influyen en el éxito de las nuevas empresas en España, principalmente desde las perspectivas de contabilidad, financiación e industria. En particular, dos facetas importantes del éxito se centran en la supervivencia (o el éxito basado en la supervivencia) y la rentabilidad. El éxito basado en la supervivencia se estudia en tres situaciones, tanto en la industria de distribución como en la de manufactura. La primera situación se trata de investigar los impactos y la previsibilidad de los factores específicos de las empresas sobre el éxito o el fracaso de las nuevas empresas basados en la supervivencia antes y durante el período de crisis reciente. El modelo logístico se usa para el análisis y la comparación de los cambios de la previsibilidad en tres dimensiones: año tras año versus solo el primer año, industria manufacturera versus industria distributiva, y antes versus durante el período reciente de crisis.

En la segunda situación, se ponen intereses particulares en los impactos y la previsibilidad de los factores financieros, contables e industriales (así como aventuras corporativas). La regresión logística nuevamente se usa para comparar las diferencias de factores en la predicción del éxito futuro basado en la supervivencia después de diferentes períodos de tiempo desde los años de estudio (los años de edad de 1, 2 y 3 años, respectivamente). La tercera situación es para explorar los impactos y la previsibilidad de algunos factores específicos de la empresa (principalmente factores financieros) y factores específicos de la industria en formas más detalladas. Por lo tanto, los árboles de decisión se construyen no solo para comparar los impactos entre diferentes factores, sino también para observar el cambio del impacto del factor con el envejecimiento de la empresa y después del ajuste de la industria.

Además del éxito basado en la supervivencia, con el uso de regresión lineal, la influencia de algunos factores financieros y contables sobre la rentabilidad de la nueva empresa también se investiga en esta tesis, centrándose en dos sectores manufactureros (sector de productos alimenticios y el sector de productos informáticos, electrónicos y

ópticos) por separado para agregar nueva evidencia a los sectores de alta tecnología y baja tecnología. En general, el principal factor de impacto en la rentabilidad es diferente al éxito basado en la supervivencia: el endeudamiento tiene mejor rendimiento en el estudio de rentabilidad mientras que el tamaño de la empresa y la rentabilidad (junto con la membresía grupal en la industria distributiva) superan a otros en el estudio de éxito basado en la supervivencia. Además, cuando se utilizan diferentes métodos de investigación en el estudio de éxito basado en la supervivencia, los resultados tienden a ser diferentes.

Resum

Aquesta tesi estudia els factors que influeixen en l'èxit de les noves empreses a Espanya, principalment des de les perspectives de comptabilitat, finançament i indústria. En particular, dues facetes importants de l'èxit es centren en la supervivència (o l'èxit basat en la supervivència) i la rendibilitat. L'èxit basat en la supervivència s'estudia en tres situacions, tant en la indústria de distribució com en la de manufactura. La primera situació es tracta d'investigar els impactes i la previsibilitat dels factors específics de les empreses sobre l'èxit o el fracàs de les noves empreses basats en la supervivència abans i durant el període de crisi recent. El model logístic s'usa per a l'anàlisi i la comparació dels canvis de la previsibilitat en tres dimensions: any rere any versus només el primer any, indústria manufacturera versus indústria distributiva, i abans versus durant el període recent de crisi.

En la segona situació, es posen interessos particulars en els impactes i la previsibilitat dels factors financers, comptables i industrials (així com l'aventura empresarial). La regressió logística novament s'usa per comparar les diferències de factors en la predicció de l'èxit futur basat en la supervivència després de diferents períodes de temps des dels anys d'estudi (els anys d'edat d'1, 2 i 3 anys, respectivament). La tercera situació és per explorar els impactes i la previsibilitat d'alguns factors específics de l'empresa (principalment factors financers) i factors específics de la indústria en formes més detallades. Per tant, els arbres de decisió es construeixen no només per comparar els impactes entre diferents factors, sinó també per observar el canvi de l'impacte del factor amb l'envelliment de l'empresa i després de l'ajust de la indústria.

A més de l'èxit basat en la supervivència, amb l'ús de regressió lineal, la influència d'alguns factors financers i comptables sobre la rendibilitat de la nova empresa també s'investiga en aquesta tesi, centrant-se en dos sectors manufacturers (sector de productes alimentaris i el sector de productes informàtics, electrònics i òptics) per separat per afegir nova evidència als sectors d'alta tecnologia i baixa tecnologia. En general, el principal factor d'impacte en la rendibilitat és diferent a l'èxit basat en la supervivència:

l'endeutament té millor rendiment en l'estudi de rendibilitat mentre que la mida de l'empresa i la rendibilitat (i la membresía grupal en la indústria distributiva) superen a altres en l'estudi d'èxit basat en la supervivència. A més, quan s'utilitzen diferents mètodes d'investigació en l'estudi d'èxit basat en la supervivència, els resultats tendeixen a ser diferents.

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Chapter 1

Introduction

1.1 The foundation of this thesis

1.1.1 Entrepreneurship

Entrepreneurship is a hot research topic attracting scholars by virtue of its significant influence on economy. Positive effects of entrepreneurship on employment growth in Pan-European regions are advocated by Doran et al. (2016); Vázquez-Rozas et al. (2010) believe that GDP (gross domestic product) growth would be positively impacted by entrepreneurship in Spanish and Portuguese regions. In fact, as pointed out by Morris et al. (1994), the history of the term "entrepreneurship" is over two hundred years, but no consensus has been reached on its meaning; they further point out seven principal perspectives of entrepreneurship: creation of wealth, creation of enterprise, creation of innovation, creation of change, creation of employment, creation of value, and creation of growth. This thesis chooses creation of enterprise, just as business administration subject does — relating entrepreneurship to the creation of new business organizations (Hoppe, 2016). And the core of entrepreneurship is to explore and explain the issue of new venture success and failure (Amason et al., 2006).

1.1.2 Success and failure

Business failure means a waste of assets (Bottazzi et al., 2011) and it has been studied by many researchers in different countries (Dimitras et al., 1996) for several decades: Balcaen and Ooghe (2006) list some important prediction models of business failure and the related comments since 1960s last century; what is more, Bellovary et al. (2007) record the literature regarding bankruptcy prediction dating back to 1930s. Though the history of using success or failure as the measure of performance has been long-lasting

(as drawn by Dess and Robinson, 1984), arguments still exist on the definition and measurement.

Some scholars believe that the definition of success should be a quite wide concept. For example, Fisher et al. (2014) deem that defining the concept of success would include both subjective and objective elements, and to explain success is dependent on its indicators which may exist in a wide range of areas (for instance from business to psychology) for explaining, predicting and identifying success. Just as Murphy et al. (1996) point out, business success or failure can be subjectively defined by scholars themselves.

There is also no unique definition of failure (Mellahi and Wilkinson, 2004). It can be interpreted as exit from the market (Mellahi and Wilkinson, 2004) or ceasing operation (Åstebro and Bernhardt, 2003). Here noteworthy is that failure may not be the same concept with exit. Dunne and Hughes (1994) state that exit is mainly caused by corporate failure (like liquidation and receivership); so the scope of exit is larger than that of failure. Research purpose can be one important factor making scholars choose their required definitions. For example, Headd (2001) does research on the factors for successful close of business, a concept being subjectively judged by owners, which is different to the traditional dichotomy of business success or failure.

1.1.3 Survival, profitability, and success

It is also advised to classify success into different levels and take multiple factors into account. Gordon and Davidsson (2013) point out the difficulty for measuring success in a single standard when, for example, considering industrial differences; furthermore they believe that the standard for measuring success should take the stage of development and the type of firms into account and, particularly, they propose that the firms surviving but with poor performance in profitability should be classified as being less successful than those surviving with gaining plenty of profits. Brüderl and

Preisendörfer (1998) too believe success can be measured from different dimensions and they further point out that survival should be the minimum standard in measuring success.

As proposed by Van Praag (2003), there are two important issues regarding start-ups: promoting business starting up on the one hand; reducing business dissolutions of start-ups on the other hand. However, compared to the issue of start-up promotion, the problem of start-up dissolution seems to deserve more attention. Based on the finding that the variance of survival rates is much larger than that of entry rates in the subsectors of manufacturing industry, Audretsch (1995a) believes that barriers of survival should be a more complex issue compared to barriers of entry.

Geroski (1995) too points out some facts that to some extent underlie the research of new firm success: the easiness of entry but the hardness of survival, as well as the high of entrant failure rate and the long of time for survivors to be competitive with incumbents. In fact, of great importance is the issue of survival or failure to entrants or new firms: for example, after doing research on 10 OECD (The Organisation for Economic Co-operation and Development) countries, Bartelsman et al. (2005) find that 20 to 40 percent of entrants suffer failure in the first two years and the survival rate is between 40 and 50 percent after seven years.

Based on previous research, Mcdougall et al. (1992) state two important features of new businesses: a period of time before gaining first profits and low survival rates. Further, Suárez and Utterback (1995) state that survival is the basis for firm success in (for example) market share or profitability. Though profit maximization is the core purpose of firm´s stockholders (Lieberman and Montgomery, 1988), in practice it is difficult for new firms to seek for profits: as pointed out by Reynolds (2016), even after six years, only one third of new businesses can gain profits. So exploring survival-based success and firm profitability are the basic targets of this thesis.

1.2 The contributions of this thesis

With using different research methods, this thesis contributes to the study on the impacting factors on the survival-based success of new firms in different industries (manufacturing and trading distributive industries), in different macro-economic environments (before and during the recent crisis), and in different variable formats (before and after industry adjustment). In addition, the contributions also include a study on the impacting factors in two particular manufacturing sectors for identifying the influence on profitability in high-technology and low-technology sectors.

1.2.1 Survival-based success study

This thesis firstly focuses on the survival-based success of new firms in manufacturing and trading distributive industries — Section C (manufacturing) and Section G (wholesale and retail trade; repair of motor vehicles and motorcycles) of NACE Rev.2 in the publication of Eurostat (European Commission, 2008). Both two industries deserve to be deeply studied. By virtue of its important role, manufacturing industry has been studied by plenty of scholars in literature; the importance of wholesale and retail sector for Spanish economy (contributing to 22 percent of value added in 2008) is pointed out by Cruces et al. (2015) with citing the data from National Accounts. Furthermore, based on the differences in the characteristics of the two industries, it is also necessary to compare the two industries for finding the similarities and differences.

In concrete, survival-based success is studied in three different situations. The first situation (studied in Chapter 4) is for observing the similarities and differences of the impacts of firm-specific factors (mainly financial factors) on the survival-based success of Spanish new firms before and during the recent crisis period. In particular, logistic regression is operated for identifying the relationships between the impacting factors and survival-based success. The second situation (studied in Chapter 5) is for identifying the impacts of both firm-specific (mainly financial and accounting-based)

and industry-specific factors during the crisis period, again using logistic regression. The reason for choosing the crisis period is that the database used here (SABI) can only supply industry-specific information in the last 12 years (which completely covers the recent crisis period but does not cover many years in the economic booming period). The third situation (studied in Chapter 6) is for further studying the impacts of firm-specific and industry-specific factors during the crisis period — that is, decision tree method is employed to draw the predictability in detailed situations together with trying to observe some general trends; here industry adjustment is also used on some firm-specific variables to compare the impacts between the original format and adjusted format.

With regard to the results of the survival-based success studies, generally speaking the results would change with the change of research method and industry. Notwithstanding that, there do exist some common results: both methods give sufficient weight to firm size and profitability, which indicates the importance of these two factors to the survival-based success of new firms; besides, group membership (whether belonging to a group) tends to impact more in distributive industry. Another noteworthy point is that the two methods used here (logistic regression and decision tree) to some extent compensate for the potential drawbacks of each other. In particular, logistic regression works on drawing the general relationship between factors and the likelihood of success but it can not depict the relationship in detailed situation; on the other hand, decision tree tends to build a more detailed and more complex relationship for different situations, thus being relatively hard to grab the general relationship.

1.2.2 Profitability study

Though profitability study should be related to survival study (because of the benefits of gaining profits in theory), here with using linear regression the study on two particular sectors (food products sector and computer, electronic and optical products sector separately as the case sectors of high-technology and low-technology manufacturing sectors; according to high-tech classification of manufacturing industries of Eurostat)

tells a different story: that is, indebtedness is the most powerful impacting factor on profitability among the selected factors. On the basis of this result with a little surprising, this thesis tends to support the view that as for new firms the similarities override the diversities at least from the perspective of financial study on profitability.

Chapter 2

Theoretical foundations and literature review

2.1 Theoretical foundations

As is stated by Fackler et al. (2013), survival and exit are crucial research topics in different academic areas — for example, resource-based theory, organizational ecology, and industrial economics including the well-cited passive learning model (Jovanovic, 1982) saying that firms can learn their efficiency only after operation. Like other researchers, Lotti and Santarelli (2004) discriminate the theory of Jovanovic (1982) and the theory of Ericson and Pakes (1995) separately as passive learning and active learning in their research where the theory of Ericson and Pakes (1995) is summarized as firms´ decisions for maximizing the expected value with knowing the characteristics of themselves and competitors and the future distribution of industry structure.

There are several theories of liability: liability of smallness (Aldrich and Auster 1986) stresses the high likelihood of exit on small firms; liability of newness (Stinchcombe, 1965) highlights the disadvantages of young firms; liability of adolescence (Brüderl and Schüssler 1990) draws the picture of exit as initially low (because of initial stock of resources) and then increasing but finally decreasing; liability of ageing (Barron et al., 1994) portrays increasing in exit risk along with the increase of firm´s age; liability of obsolescence (Barron et al., 1994) believes that inertia causes constraints for old firms to accommodate themselves to environmental changes; liability of senescence (Barron et al., 1994) attributes the higher exit risk of older firms to accumulated rules and routines.

Firm profitability is also studied by scholars from different academic domains. Goddard et al. (2005) identify three research areas studying firm-level profitability: industry economics (with the Structure–Conduct–Performance paradigm), strategic management

(focusing on internal resources), and accounting and finance (giving weight to the usefulness of the random walk model). Hirsch and Gschwandtner (2013) further state that: on the one hand, the traditional structure-conduct-performance paradigm proposed by Bain (1956, 1968) and then industry structure characteristics should be taken into consideration when researching on the persistence of abnormal profitability; on the other hand, new learning theory (including resource-based view highlighting both the tangible internal resources and intangible internal resources) gives weight to firm-level characteristics and then differences in profitability variation study.

2.2 Literature review for the impacting factors

2.2.1 Firm-specific factors

Profit

As for new firms, Swinney et al. (2011) point out that one important difference of the targets between start-ups and established firms is to maximizing the probability of survival and maximizing expected profits. If wealth maximization and survival can coexist, chasing optimality would be the choice of firms; however, if it is hard to harmonize wealth maximization and survival, firms tend to prefer survival (Oprea, 2014).

Fritsch et al. (2006) believe that one of the reasons for the failure of new firms is the existence of a certain time period of surviving to gain profits. So new firms may not get profits at beginning. Furthermore, Audretsch (1995b) states that, even if in the situation of suffering economic losses, firms may stay operating and keep positive output if with the expectation of gaining profits in the future.

Although the positive effect of profitability has been supported by some studies — for example Fotopoulos and Louri (2000) finding that profitability is negatively related to hazard and Delmar et al. (2013) observing positive effect of profitability on survival, the fact may be not as clear as it should be. Golombek and Raknerud (2012) observe a seemingly unintelligible characteristic of Norwegian manufacturing firms — that is, the firms with consistently positive profits may also exit whereas frequently incurring negative profits may not necessarily drive firms out; furthermore, their research shows that profitability is negatively related to the probability of exit and that high probability of exit persists among the exiting firms (which does not support the impact of negative profitability shock prior to exit).

Liquidity

As pointed out by Bolek and Wiliński (2012), keeping high level liquidity can help to reduce the risk of insolvency in general and to pay liabilities in time in particular. On the other hand, they also state that too many current assets may harm profitability, because excess cash and inventory are kept for unexpected events (not for current turnover to generate profits) and too many receivables may increase the risk of reception. Finally, they point out that negative relationship exists between financial liquidity and profitability, conditional on keeping liquidity above the minimum required level, or else positive relationship exists (when below the minimum liquidity level). Nevertheless, diversity — for example, positive relationship (Enqvist et al., 2014) or insignificance (Pervan and Višić, 2012) — again is shown in empirical studies.

Asset liquidity

The proportion of current assets to total assets as an indicator of asset structure is often employed when researching on business failure especially in the miscellaneous Z-Score and bankruptcy prediction models, for example in the research of Briggs and MacLennan (1983) and Pervan et al. (2011). In fact, the proportion of current assets to

total assets also serves for indicating liquidity, just like the role played in the research of Grünberg and Lukason (2014); so in this thesis the proportion of current assets to total assets represents the liquidity of assets. Because Asimakopoulos et al. (2009) find negative effects of current assets on profitability, here asset liquidity is assumed to be a negative factor.

Liability liquidity

The impacts of debt maturity on firm performance are too the main theme of some research: for example, the work of Schiantarelli and Sembenelli (1997) denies positive effects of short-term debt on some parts of firm performance, and they believe there is positive relationship between debt maturity and performance in some situations. Different to the above results, as a transnational study, Baum et al. (2007) find the existence of positive relationship between short-term liabilities and profitability in Germany, rather than in the United States. Therefore, liability maturity structure should be taken into consideration. Here the proportion of current liabilities to total liabilities is chosen as the proxy of liability liquidity (measuring liability maturity structure from the opposite angle), because it also works as one indicator of liquidity for predicting failure, like in the research of Charitou et al. (2004).

Efficiency

Asset rotation, usually as a proxy of efficiency or activity, is commonly chosen as a predicting factor especially in the research of bankruptcy prediction, like the widely cited Altman's Z-Score (Altman, 1968). Santosuosso (2014) states that the relationship between efficiency and profitability is an important topic of efficiency research and positive relationship is supported by the studies with different techniques — including the famous "DuPont system" which decomposes ROE into profit margin, asset turnover and financial leverage (Soliman, 2008); besides, the importance of reducing costs and increasing efficiency in the crisis period is also stressed by Santosuosso (2014).

Pervan and Višić (2012) use asset turnover to represent asset productivity and then business efficiency. Denčić-Mihajlov (2014) further points out that asset turnover ratio not only can reflect productivity but can also mirror pricing strategy because of low profit margins usually leading to high asset turnover. Empirically, the study of Santosuosso (2014) shows that total asset turnover is positively related to profitability; on the other hand, the predictability of asset rotation on failure is challenged by Charitou et al. (2004) due to their findings of statistical insignificance.

Leverage

The frequency of appearance of indebtedness is quite high especially in the models and literature for predicting bankruptcy, like in the research of Ohlson (1980 cited Parnes, 2011) and Platt and Platt (1991); Altman and Lavallee (1981) too include indebtedness as one variable for analyzing business failure in manufacturing and retailing industries, which reflects the importance of solvency factor in prediction.

Zingales (1998) does survival analysis in trucking industry with the condition of deregulation, and finally negative relationship between high leverage and survival is found; similarly, negative relationship between leverage and survival is also supported by Baggs (2005). On the other hand, Nunes and Serrasqueiro (2012) find that debt is positively related to survival for both young and old SMEs (small and medium-sized enterprises), particularly the young. After analyzing the impacts of initial financial conditions on firm hazard in Canadian manufacturing entrants, Huynh et al. (2012) reach a more complex conclusion: there exist positive relationship between leverage and hazard in high leverage cases but negative relationship in other cases.

As for new firms, the change of leverage with ageing can be observed. Huynh et al. (2015) point out that, when tracking particular cohort (1985 and 1989 cohorts in their

study), there is a decreasing trend of average leverage as firms age; and they also state the selection effects (initially lower average leverage for the survivors) and survival effects (leverage lowering down with ageing because of the increase in profits and then retained earnings and equity). Laitinen (1992) attributes the failure of newly founded firms to the factor of revenue financing to debt and describes the process as follows: in the initial stages, highly indebted firms require large revenues to fulfill financial obligations because of limitation in share capital; however, in some situations (for example, too poor profitability) where firms cannot reach the planned revenues, taking more debt is the way for keeping on survival, which would result in more planned revenues to reach for the increased financial obligation and finally cause failure due to insolvency. Theodossiou et al. (1996) further point out that high leverage is more likely to cause firm´s failure in low income and downturn periods.

Regarding the relationship between leverage and profitability, Yazdanfar and Öhman (2015b) list two different viewpoints: signaling theory supporting positive relationship based on the increase in market´s perception of value along with the increase in leverage (Ross, 1977); agency cost theory arguing either negative or positive relationship (Titman and Wessels, 1988) which is because, for example as pointed out by Weill (2008), whereas debt financing can help to abate agency costs of free cash flows (Jensen, 1986), higher leverage may cause the conflicts between shareholders and debt-holders and then higher agency costs (Jensen and Meckling, 1976).

Further explanation could be found in the study of Amato and Amato (2004), who point out that there exists ambiguity regarding the relationship between capital structure and profitability: on the one hand, net worth to total assets would be positively related to profitability when the cost of internally generated funds is lower (compared to the cost of borrowed funds); on the other hand, when borrowing funds, firm´s managers should be experts in financial management and business because of the requirements of the lending financial institutions, which may result in negative relationship between net worth to total assets and profitability.

Empirical studies tend to be in favour of negative relationship between leverage and profitability (Denčić-Mihajlov, 2014). With regard to the explanation of the negative relationship, some viewpoints are gleaned here: Yazdanfar and Öhman (2015a) believe that negative impact of debt ratio on profitability is in accord with agency theory; Asimakopoulos et al (2009) state that negative relationship is due to the repayment of debt being consumption of resource and thus negatively impacting on investment; and, with the support of previous studies, Baños-Caballero et al. (2012) attribute the negative relationship between leverage and profitability of SMEs to higher borrowing costs (which are resulted from greater information asymmetries and opacity as well as higher likelihood of bankruptcy) and the constraints on valuable investments (due to financing constraints caused by higher leverage).

Size

Smallness in size is an important characteristic of new entrants (Audretsch, 1995a). The smallness of entrants compared to incumbents would be kept for a period after entry, and even after one decade the sizes of those entrants are still smaller than the sizes of incumbents (Bellone et al., 2006). Mata and Portugal (2002) summarize three reasons on the ground of past literature to explain the phenomenon that new firms generally show smallness in firm size: being small can help new firms shun the aggression of existing firms; being small can help new firms reduce losses if happening; and insufficiency in funds is an objective reason that causes smallness of new firms. As for new firms, it is hard for them to survive to the day that they are able to threat dominant firms, and their competitors are other small and new firms (Mata et al., 1995).

Generally speaking, larger firms have advantages in scale economies, diversification, market power and then in earnings and stability (Mills and Schumann, 1985; Theodossiou et al., 1996), and one important reason for larger firms showing longer lifespan is that shrinking in size (rather than exit) is the choice of larger firms in inefficient situations (Mata and Portugal, 1994). In fact, showing smaller size than industry average or efficient scale is a feature of exiting firms (Cincera and Galgau,

2005). Audretsch (1991) proposes inherent size disadvantage which is explained by Audretsch and Mahmood (1995) as cost disadvantage and exposure to risk impacting much on new business survival.

However, it does not mean that there is no advantage to small size. Brüderl et al. (1992) list the advantages of both large and small new firms: large firms have more financial resources to support start-up period and for against environmental shocks as well as advantages in the facets of capital, tax and labor, while less overhead costs and less resources for sustenance are the advantages of small ones. Pervan and Višić (2012) also summarize some viewpoints about the impacts of firm size on profitability: positive relationship from the perspective of economics of scale for financial, organizational, and technical reasons; negative relationship based on the managerial utility maximization function because of managers pursuing self-interested goals in large firms. Small firms could still be successful in competition with large ones by virtue of their more flexible production technologies to occupy a disproportionate share of industrywide output fluctuations (Mills and Schumann, 1985).

With regard to empirical studies, positive effect of size on survival is found in plenty of past empirical research (Görg and Strobl, 2003; Colombo et al., 2004); notwithstanding that, no consensus has been reached. The research results of Santarelli and Vivarelli (2007) show that start-up size is not positively related to survival in any industrial sector and the significance is also a problem; Audretsch et al. (1999) find that start-up size is not related to survival. Furthermore, Agarwal and Audretsch (1999) point out that the impacts of size on start-up survival are different in different life-cycle stages: in the formative stages the survival rates of larger start-ups are higher than those of smaller ones, whereas in the mature stages small firms do not incur size disadvantage in survival because of occupying strategic niche.

Jónsson (2007) summarizes the viewpoints of industrial economics on the relationship between size and profitability as follows: from the long-run perspective, there should be no firm gaining above-average profit (which may exist temporarily) because of the

correction of market by virtue of entry and exit or other competitive forces; on the other hand, based on the strength and duration of persistent above-average profit, empirical study indicates the differences for firms in long-run equilibrium which are impacted by industry-level and firm-level factors (for example, size, market share, gearing, and liquidity).

In fact, although plenty of researchers — such as, Roper (1999), Serrasqueiro (2009), and Yazdanfar (2013) — empirically find positive relationship between size and profitability, different voices still exist: for example, negative relationship is shown in the study of Enqvist et al. (2014). In fact, the relationship between firm size and profitability may vary in different situations. For example, Serrasqueiro and Nunes (2008) find that there exists positive relationship between size and profitability for SMEs but no statistically significant relationship for large companies. Besides, Yazdanfar and Öhman (2015a) point out that the impacts of size on profitability could be different in different industry sectors, and in particular they show the existence of negative relationship between size and profitability in the retail trade and wholesale sectors.

Group membership (corporate venturing)

Theoretically speaking, corporate ventures should have some advantages that do not exist in independent ventures — for instance, the experience of the established firms being helpful to subsidiaries (Audretsch and Mahmood, 1995) and membership in a group (especially larger conglomerate) being helpful to market access (Musso and Schiavo, 2008). However, whether these can help corporate ventures much still deserves to be further studied. In fact, for independent ventures, advantages can come from decision-making process where there is direct and active involvement of owners (Zahra and George, 1999).

Shrader and Simon (1997) state that corporate ventures are relatively easier to gain more resources by virtue of sponsoring from parent companies (whereas independent ventures are hindered by liability of newness to gain resources), and internal and external capital resources are separately highlighted by corporate ventures and independent ventures; they further find that, notwithstanding the differences of resources and strategies of the two types of ventures, difference in performance is not supported.

Estrin et al. (2009) also point out some benefits of being in a business group: internalizing market transactions and creating internal networks (which could not only minimize transaction costs but also help to gain valuable group resources and capabilities) as well as transferring financial resources internally to decrease risk and boost survival; on the other hand, they state another situation that the values of affiliates are extracted by business groups for promoting group stability (by virtue of redistributing profits through internal markets).

As for empirical studies, Bridges and Guariglia (2008) use group dummy variable to identify whether a firm belongs to a group, and they find positive relationship between being part of a group and survival; Karabag and Berggren (2014) proffer the empirical evidence that group membership is positively related to profitability. Disney et al. (2003) document that single establishments show lower survival rate than group establishments do as time goes by; and, after researching in depth, they find that the characteristics related to whether belonging to a group (rather than belonging to a group per se) are crucial to relative hazard.

On the other hand, Jensen et al. (2008) do not support the view that compared to de alio firms de novo firms tend to underperform in survival. In addition, the research of Mata et al. (1995) shows that the survival rate of de novo single plant entrants generally is higher than that of the entrants with parent firm, which further causes the puzzle that the de novo single plant entrants with the characteristic of smallness in size (compared to other types of entrants) are quite strong in survival.

Bank credit and trade credit

The relationship between bank credit and trade credit has been studied by a number of researchers; however, no consensus has been reached. Some researchers support either complementary (Andrieu et al., 2017) or substitution (Biais and Gollier, 1997) relationship, while others believe the relationship should be more complex. For example, Burkart and Ellingsen (2004) point out that, whereas the relationship between bank credit and trade credit is complementary for the firms being insufficient in aggregate debt capacity, trade credit serves as a substitute for bank credit in the situation of being sufficienct in aggregate debt capacity. Besides, the study of Norden and van Kampen (2015) shows that substitution relationship between bank credit and trade credit tends to decrease in the crisis period.

Ang (1991) points out that: at the formative stage, firms are mainly financed by owners, friends, and relatives, which may cause relatively low cost of funds as well as less asymmetric information problems; after that, introducing outside funds (like bank loans) would bring monitoring mechanisms in at the same time, and agency and asymmetric information problems may become more important which may further increase the cost of capital. Petersen and Rajan (1994) also state that, whereas loans from the owner and owner´ family are main sources of financing for the youngest firms, bank loans occupy the largest share of loans (when excluding loans from the owner and owner´ family) and increase fast, which causes decrease in relying on personal funds.

Theoretically, the influence of bank on firm performance could be double-sided, as pointed out by Agarwal and Elston (2001): thanks to the decrease of agency costs (as a result of banks gaining private information) as well as better access to finance (because of close bank relationships), bank-influenced firms should outperform in profitability and growth than those without bank influence; on the other hand, bank-influenced firms may underperform in the case of banks putting their interests on the top of shareholders´

interests, making the influenced firm invest in the projects with less risk, or extracting income away from the firm.

Positive effects of bank finance or bank loans on survival are found in the research of, for example, Saridakis et al. (2008), as well as Åstebro and Bernhardt (2003) who further highlight "ceteris paribus" for getting the positive effects but showing negative relationship if unconditional. Bastié et al. (2011) propose a relatively complex conclusion that bank debt would insignificantly or negatively impact new firm survival within two years but positively influence survival beyond two years in the medium term.

The use of trade credit is composed of two parts: receiving it as accounts payable and supplying it as accounts receivable (Ferrando and Mulier, 2013). In some European countries like Spain and France, accounts receivable or accounts payable occupies a considerable proportion of assets (García-Teruel and Martínez-Solano, 2010). Norden and van Kampen (2015) summarize the importance of trade credit from both the supply side and demand side based on previous literature: from the supply side, trade credit can help to obtain information from customers, strengthen bargaining power, reduce the costs for store, and build long-term business relationship; from the demand side, the most important reason for relaying on trade credit is financial constraints.

Compared to bank credit, the size of trade credit is much larger especially in smaller firms (Wilson and Summers, 2002). The research of Huyghebaert (2006) as well as Huyghebaert and Van de Gucht (2007) shows that: high failure rates, as one of the features of start-ups, would cause limitations for start-ups to get bank loans, thus relying on supplier financing (although this relationship may change as time goes by); financial constraints, no history, and no established relationships with banks and suppliers also promote the use of trade credit; and private benefits of control (featured as highly concentrated ownership in start-ups) could be a reason for entrepreneurs to decrease the reliance on bank debt when starting up. Burkart and Ellingsen (2004) state the reason for the phenomenon of firms receiving and supplying trade credit simultaneously is that receivables can work as collateral; and they further point out that the firms being

sufficient in funds or being constrained and relatively unprofitable tend to supply trade credit.

From the empirical perspective, negative impact of accounts payable on profitability is found by Yazdanfar and Öhman (2015a), while the study of Muscettola (2014) shows that profitability is negatively related to the ratio of trade receivables to total assets. Besides, the effects of trade credit on firm performance should be gauged with considering different situations in empirical study. For example, Martínez-Sola et al. (2014) find that investing in trade credit is positively related to profitability but not for the firms with less market share and those without reputation. Researching on accounts receivable and payable is also contained in the literature of bootstrapping: for instance, Rutherford et al. (2012) find that accounts receivable is negatively related to survival.

Market share

As pointed out by Goddard et al. (2005), the relationship between market share (as an indicator of market power) and profitability is explored by scholars in industrial economics area under the Structure–Conduct–Performance paradigm because of the linkage between market power and anti-competitive strategies for the sake of gaining abnormal profit; besides, they also state another relation — that is, good productive efficiency would drive profitability and then growth for reaching larger market share.

Similarly, Feeny and Rogers (2000), on the one hand, state the view of structure-conduct-performance (SCP) supporting positive relationship between firm´s price-cost margin and both its market share and market concentration (with an extreme case of monopoly where super profit would be gained by virtue of increasing price); on the other hand, they also discuss the views of Brozen (1971) and Demsetz (1973) regarding dynamic performance which attributes the increase in market share and profits to investments in innovation or technology and enhancement of efficiency.

In fact, positive relationship between market share and profitability is supported by plenty of literature (Spanos et al., 2004). Buzzell et al. (1975) point out the theoretical basis supporting positive relationship between market share and profitability: economics of scale, market power (for example advantages in bargaining and prices), and quality of management (because of good managers driving both market share and profitability). Furthermore, the study of Buzzell et al. (1975) also shows that, compared to turnover on investment, profit margin increases obviously with the increase in market share, and they attribute this phenomenon to the decrease of the ratio of purchases to sales as a result of the traits of high-share businesses — for example, vertical integration causing high-share businesses to make (not to buy), scale economics reducing marketing costs, and the competitiveness of market leaders in producing higher-quality products and services for charging higher prices.

Notwithstanding the above analysis of positive relationship, there are still different empirical findings. For example, McDonald (1999) finds the general insignificance of market share in determining profitability; Fraering and Minor (1994) highlight the heterogeneity between industries. The study of Feeny and Rogers (2000) shows a relatively complex relationship: as market share increases, profit margin decreases firstly and then increases when beyond a point as U-shape; they explain the first negative relationship by the advantages entwined with small market shares on costs, strategic niches, innovation, flexibility or management control, and the latter positive relationship by the traditional theory of market power or efficiency in the firms with large market shares.

Growth

Steffens et al. (2009) summarize some previous studies theoretically supporting positive relationship between growth and profitability: L-shaped cost curves and minimum efficient scale (Mansfield, 1979; Gupta, 1981) showing the benefits of growth at least

until a certain point, experience curve effects saying the negative relationship between cumulative output and total unit costs (Buzzell et al., 1975), first-mover advantages in earning profits (Lieberman and Montgomery, 1988), and network externalities stressing the effects of the number of users (Katz and Shapiro, 1985). On the other hand, Steffens et al. (2009) also list some probabilities for negative relationship between growth and profitability: growth beyond the efficient scale, growth conditional on low-growth markets or low initial market share, or expansion driving firms (if not price-takers) from the most profitable market segments to less profitable segments.

Steffens et al. (2009) also separately point out the advantages of younger and older firms — larger resource stocks and exploitation ability of older firms and flexibility and discovery ability of younger firms; they further state that discovery ability (as one forte of younger firms) can help to realize short-term growth as well as possible profitability, and it should work together with exploitation for achieving sustention. What is more, Steffens et al. (2009) point out that the well-cited liabilities of newness (Stinchcombe, 1965) and smallness (Aldrich and Auster, 1986) could cause hurddles for young firms to realize profitable growth, and in particular they believe that resource deficiencies — for example, lack of financial capital as well as managerial knowledge and financial management abilities (Thornhill and Amit, 2003) — make young firms disadvantageous in exploitation ability.

Davidsson et al. (2009) state that it is difficult to conclude the generally driving effects of growth on profitability (because of the diversified results of empirical study), though theoretically speaking growth can improve profitability by virtue of reducing costs and strengthening market position. Their study also shows that, as for small and medium-sized firms, high growth of the firms with low profitability may probably lead to the status of both low growth and low profitability (rather than reaching high profitability), whereas the firms with high profitability and low growth would easily turn to the more successful type (those with both high profitability and high growth).

Intangible assets

Based on the finding of positive relationship between profit and intangible assets, Guzić (2014) highlights the importance of intangible assets on business results. The study of Tiron-Tudor et al. (2014) further shows that the relationship between intangibles and profitability changes in different industries (for example, being positive in administrative and support service activities sector, being negative in wholesale and retail trade sector, and being not statistically significant in manufacturing sector), and they attribute this phenomenon to the difference in sectors´ average profitability as well as the uncertainty of intangibles´ valuation and the variance of intangibles´s structure.

Previous profitability

Yazdanfar (2013) states the theoretical positive relationship between past-year profitability and current profitability based on the fact that good past-year profitability can bring more resources in and then benefit for liquidity, customer relationships, and market share. At the formative stage, as pointed out by Ang (1991), outside funds are not the main sources of financing; thus highlighting the importance of internal sources (for example retained earnings from previous profits). The empirical studies of Serrasqueiro (2009) and Salman and Yazdanfar (2012) also support positive relationship between previous and current profitability.

2.2.2 Industrial factors

Industry entry

Fritsch et al. (2006) deem that high entry rate signifies more intensity of competition which would lead to new firm failure. Mata and Portugal (1994) further point out that high industry entry would bring competition and challenges to both the new firms per se

and incumbents (including the new firms in different generations). In fact, correlation between entry rate and exit rate is observed in the literature (for example, in the research of Disney et al., 2003). The explanation of the relationship between high entry rate and high exit rate can be found in the paper of Geroski et al. (2010) where the viewpoints of organization ecology are summarized as follows: high exit rates are the results of the increased density in the market that is caused by high entry rate; as for the entrants in the industries with high entry rates, competition faced by them would be firstly with other entrants, rather than incumbents.

Industry concentration

Mata and Portugal (2002) also state the theoretical impacts of industry concentration on entrants from both the perspectives of organizational ecology and industrial organization: in organizational ecology literature, competition is a crucial factor that determines surviving or not and, in the industries with less number of firms, increasing density would be beneficial to survival at first but would be disadvantageous to survival if beyond a certain level (because of raising competition); on the other hand, industrial organization academicians believe that collusion would be resulted from market concentration and, in the industries with high concentration, it is more probable that entrants are attacked by existing firms.

From the angle of empirical study, the impacts of concentration on new venture performance are uncertain because three different results (positive, negative and no statistically significant relationships) are all found in past empirical research (Robinson, 1999). Baggs (2005) finds that industry concentration is a negative factor to survival whereas Audretsch (1991) believes the impact of market concentration on survival would change as time goes by, being positive on short-run survival but null on long-run survival. Mata and Portugal (1994) find that concentration is insignificant in manufacturing industry, and this kind of result is explained by Mata (1991) and Mata and Portugal (1994) as the weakness of the impacts of fear of aggression on entry.

Industry growth

The study of Baggs (2005) shows that industry growth works as a positive factor to survival. The research of Holmes et al. (2010) on manufacturing industry also shows positive impacts of sectoral growth on the survival of both micro-enterprises and small and medium establishments (SMEs). Burke and Hanley (2009) further quantify the positive effects on survival particularly that 10 percent of industry growth would promote the survival of new venture at about 1 percent. On the other hand, Audretsch et al. (2000) use average growth rates of industry sales as the proxy of the effects of industry life cycle (differentiating in product standardization and uncertainty) and believe that high growth industries contain high uncertainty, thus showing relatively low survival of new firms there. Besides, McCloughan and Stone (1998) find that industry growth is insignificant to survival.

2.3 Summary of this chapter

Two types of factors relating to firm survival and profitability are reviewed in this chapter — namely firm-specific factors and industry-specific factors. In fact, these two types of factors are separately highlighted by the scholars in resource-based theory area and industrial organization area. Particularly, among the firm-specific factors, except for group membership (corporate venturing), all are obtained from financial statements or calculated on the basis of the data in financial statements. There are two main reasons for focusing on financial data: (1) it is easy to obtain financial data for large number of firms (compared to non-financial data); (2) based on the easiness in availability, it is necessary to explore the predictability and impacts of financial data on survival and profitability (which are too shown in financial statements — the continuity in generating operating revenues and the return on total assets). The next chapter will discuss the above mentioned factors in detailed variable format.

Chapter 3

Data and variables descriptions

3.1 Data composition

It is common that past research chose a series of cohorts established in a certain time period as researching sample. And this time span can be as long as more than one decade — fox example, from 1984 to 1998 including 15 cohorts in the research of Fritsch et al. (2006); or, on the contrary, Audretsch and Mahmood (1995) just chose one cohort (founded in 1976) but it was tracked for ten years.

Here four cohorts are selected from the Iberian Balance sheet Analysis System (SABI; developed by Bureau Van Dijk) database, namely the firms incorporated in 2000, 2001, 2008, and 2009 in Spanish manufacturing and distributive industries (shown in Table 3-1; excluding manufacture of tobacco products sector due to no new firms founded); furthermore, 2000 and 2001 cohorts as well as 2008 and 2009 cohorts are separately bound together as the upturn group and downturn group respectively as the representatives of the pre-crisis period and the crisis period, because Spain was in economically booming period from 2000 to 2007 (Petrovic el al., 2016) and was hit by the crisis since 2008 according to the data comparison of Xifré (2014). By virtue of combining two cohorts into one group, the sample size of each group can be enlarged. The following three chapters (4, 5 and 6) respectively choose the new firms incorporated in both the upturn and downturn periods, in downturn period, and in downturn period as the studying targets for survival-based success.

In this thesis, the first year (or age 1) of a firm is defined as the year after the incorporation year. For instance, if one firm is incorporated in October 2008, 2009 is its first year. There are two reasons for this year (or age) setting. Firstly, selecting age 1 as the beginning year of study can avoid difficulties in comparing the financial status of

newly incorporated firms. Because the incorporating dates of new firms are dispersed among their incorporation year, their financial statements usually cannot completely cover the incorporation year but just cover several months from the incorporating date to the end of that year. Secondly, a number of firms do not report their operating revenues in their incorporation year; by contrast, the proportion of firms reporting operating revenues in their age 1 year (the year after incorporation year) is much higher than that of those reporting in the incorporation year.

Table 3-1 Statistics of total sample

	Upturn		Downturn	
Manufacturing industry	Frequency	Percent	Frequency	Percent
10. Manufacture of food products	804	9,4	442	9,7
11. Manufacture of beverages	184	2,2	115	2,5
13. Manufacture of textiles	349	4,1	146	3,2
14. Manufacture of wearing apparel	357	4,2	130	2,9
15. Manufacture of leather and related products	439	5,1	181	4,0
16. Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	467	5,5	232	5,1
17. Manufacture of paper and paper products	107	1,3	41	0,9
18. Printing and reproduction of recorded media	623	7,3	367	8,1
19. Manufacture of coke and refined petroleum products	3	0,0	4	0,1
20. Manufacture of chemicals and chemical products	197	2,3	117	2,6
21. Manufacture of basic pharmaceutical products and pharmaceutical preparations	16	0,2	16	0,4
22. Manufacture of rubber and plastic products	310	3,6	132	2,9
23. Manufacture of other non-metallic mineral products	519	6,1	195	4,3
24. Manufacture of basic metals	154	1,8	83	1,8
25. Manufacture of fabricated metal products, except machinery and equipment	1832	21,5	940	20,7
26. Manufacture of computer, electronic and optical products	136	1,6	88	1,9
27. Manufacture of electrical equipment	159	1,9	88	1,9
28. Manufacture of machinery and equipment n.e.c.	444	5,2	257	5,7
29. Manufacture of motor vehicles, trailers and semi-trailers	107	1,3	44	1,0
30. Manufacture of other transport equipment	48	0,6	42	0,9
31. Manufacture of furniture	618	7,2	256	5,6
32. Other manufacturing	225	2,6	155	3,4
33. Repair and installation of machinery and equipment	441	5,2	473	10,4
Total	8539	100,0	4544	100,0
Distributive industry	Frequency	Percent	Frequency	Percent

45. Wholesale and retail trade and repair of motor vehicles and motorcycles	1998	10,7	1404	10,2
46. Wholesale trade, except of motor vehicles and motorcycles	8416	45,2	6658	48,2
47. Retail trade, except of motor vehicles and motorcycles	8195	44,0	5742	41,6
Total	18609	100,0	13804	100,0

Given the problem pointed out by Wagner (1994) that the life span at the beginning may be less than a year (for example just several months) when using year as the unit to measure the life span of firm, this thesis sets a requirement that all the sample firms should report operating revenues at age 1 (the year after the incorporation year). All the firms in the sample are tracked for five years after the incorporation (for example, the 2000 cohort is tracked from 2001 to 2005), which is similar to the selecting methods in the studies of Fritsch et al. (2006) and Helmers and Rogers (2010).

The reason for choosing five-year period is on the basis of the definition of youngness. Cefis and Marsili (2006) believe that the firms under age 5 can be seen as young. In addition, the research of Brixy et al. (2006) shows that, observing from the perspectives of labor fluctuation and wage setting, the period for new firms to become incumbents is just a few years (three to five years). The characteristics of young firms are also widely explored by scholars: Mata and Portugal (1994) find that only half of the new firms would survive for four years; the research of Konings et al. (1996) shows increasing trend of exit rate in the first three years and stable trend after; and Calvino et al. (2015) find that age two is a significant time node with regard to hazard.

3.2 Variables descriptions

In this thesis, the adopted cutting point between firm's success (survival-based) and failure is whether without reporting operating revenues to SABI database in two consecutive years. One firm would be judged as failure when the event of two consecutive years without reporting operating revenues occurs; or else, it would be judged as success. This criterion for separating success and failure here can be seen as

being built on the survival status of a firm (or based on the record of generating operating revenues), which is backed up by the viewpoint of survival as the minimum standard for success (Brüderl and Preisendörfer, 1998), the emphasis of market nexus in performance evaluation (Reid and Smith, 2000), and the statement of Stearns et al. (1995) that new firms are more likely to discontinue operations. So this thesis uses "survival-based success and failure" rather than the term "survival and exit".

This type of identifying method (two consecutive years without reporting information) is also employed by some researchers, such as Fotopoulos and Louri (2000) and Geroski et al. (2009). Mata and Portugal (1994) point out the benefit of this identifying method as reducing the misclassifying risk, after considering that it is possible for firms to be absent in the database due to the reasons like operation suspending or failing to report the data (rather than ceasing operation permanently).

The reason for choosing operating revenues in two consecutive years can be gleaned from past research. Scott and Bruce (1987) believe that product and market are key in the inception stage, and continuously generating operating revenues is the very vinculum linking product and market. In fact, the importance of production in identifying the survival span of firms is also underlined by Harhoff et al. (1998) who believe that the production period of a firm after the declaration of bankruptcy should still be recorded in its survival span.

However, this identification has its drawback: it cannot show the time point of one firm perpetually exiting from market and then the real lifetime from its entry to exit, as it neglects the future information after the defined two consecutive years. Nevertheless, it still has practical meanings, that is, it can measure the life-span before stopping to report operating revenues in a relatively not too short term (two consecutive years); and this may indicate a significant stoppage of operation, which could be viewed as the symbol of failure, because for instance Dimitras et al. (1996) point out that discontinuity of operation can be one mutual trait of miscellaneous definitions of failure in general.

In terms of selecting independent variables, an important guidance here is that the value of the variable selected should be available in most of the firms in each cohort. The purpose of this is to reduce the number of dropped cases, for the sake of overcoming the small sample problem (Brüderl et al., 1992). Because of that, some variables are not chosen here. For example, number of employees is not suitable for working as the proxy of firm size — albeit prevalently used in the literature, such as the studies of Wagner (1999) and Tveterås and Eide (2000) — because part of firms does not report this information in SABI database.

Another noteworthy point in independent variables is that the following chapters would choose different variables firstly because of difference in studying purposes (for example, survival-based success and profitability). There are also some other reasons: the constraints of industrial data (already mentioned before), the lack of information about bank loan and accounts payable in the pre-crisis period, the overlaps between current assets and accounts receivable and between current liabilities and accounts payable (which would cause collinearity problem), and the limitation in the availability of variables for calculating industry medium and then adjusting original variables. In spite of those limitations, some variables still would be commonly shared by the following four chapters.

3.3 Statistical descriptions

Here some commonly used independent variables (shown in Table 3-2) are described; in particular, the mean, standard deviation, Pearson Chi-Square value, and asymptotic significance (of Pearson Chi-Square value) of the firms′ first year after incorporation are shown in Table 3-3. The data are extracted from the firms belonging to the upturn (2000 and 2001 cohorts) and the downturn (2008 and 2009 cohorts) groups separately in manufacturing and distributive industries. The reason for describing the first year data is that all the firms in the sample should report their operating revenues in the database.

Pearson Chi-Square is operated for the failure firms and the success firms when comparing to the mean of the total, where the failure firms are those that do not report operating revenues in two consecutive years in the first five-year period after incorporation.

It is clear that: in both the manufacturing and distributive industries from the upturn to the downturn group, decreasing trend is observed on average total assets and average economic profitability, while increasing trend is observed on average general liquidity, average indebtedness and average proportion of firms belonging to a group (shown as the mean of group membership). As for the Pearson Chi-Square, except for general liquidity in upturn groups and asset rotation in distributive groups, all the Pearson Chi-Square values are statistically stgnificant at the significant level of 0.05. This means that, for most variables, differences exist between the failure firms and the success firms.

Table 3-2 Independent variables

Independent variables	Definitions
Total assets	Total assets in thousands of Euros
Economic profitability	Profits before tax/Total assets
Profitability (dichotomous)	Profitability, equals 1 if the economic profitability of one firm is positive figure; equals 0 if the economic profitability of one firm is zero or negative figure.
Indebtedness	(Total shareholders funds and liabilities — Shareholders equity)/Total shareholders funds and liabilities
General liquidity	Current assets/Current liabilities
Asset rotation	Sales/Total assets
Group membership (dichotomous)	Group membership, equals 1 if the number of companies in corporate group is more than zero; equals 0 if the number of companies in corporate group is zero.

Table 3-3 Descriptive Statistics

Independenrt variables in year 1	Mean	Std. Deviation	Pearson Chi-Square Value	Asymptotic Significance (2-sided)
	Upturn manufacturing (Number of cases: 8539)			
Total assets (thousands of Euros)	1258.72	16294.02	48.82	0.00
Economic profitability	-0.12	4.39	259.29	0.00
Profitability	0.60	0.49	172.80	0.00
General liquidity	2.53	64.59	0.18	0.67
Indebtedness	0.98	3.13	156.18	0.00
Assets rotation	2.46	16.17	20.67	0.00
Group membership	0.19	0.39	194.12	0.00
	Downturn manufacturing (Number of cases: 4544)			
Total assets (thousands of Euros)	935.81	5249.78	12.37	0.00
Economic profitability	-0.15	2.28	96.42	0.00
Profitability	0.60	0.49	66.19	0.00
General liquidity	4.64	93.98	13.78	0.00
Indebtedness	1.01	2.84	72.92	0.00
Assets rotation	2.44	8.48	4.24	0.04
Group membership	0.32	0.47	11.71	0.00
	Upturn distributive (Number of cases: 18609)			
Total assets (thousands of Euros)	532.31	7504.94	149.44	0.00
Economic profitability	-0.15	3.17	617.57	0.00
Profitability	0.57	0.50	495.37	0.00
General liquidity	1.78	10.64	1.80	0.18
Indebtedness	1.06	3.20	506.65	0.00
Assets rotation	3.44	19.82	0.41	0.52
Group membership	0.21	0.41	438.80	0.00
	Downturn distributive (Number of cases: 13804)			
Total assets (thousands of Euros)	484.47	5254.11	97.72	0.00
Economic profitability	-0.17	2.18	439.74	0.00
Profitability	0.58	0.49	399.59	0.00
General liquidity	7.26	272.58	6.11	0.01
Indebtedness	1.09	3.34	460.53	0.00
Assets rotation	3.82	61.36	0.15	0.70
Group membership	0.31	0.46	59.18	0.00

Chapter 4

The study of the impacts and predictability of firm-specific factors (mainly financial factors) on the survival-based success of new firms before and during the recent crisis

4.1 Background

The purpose of the study of this chapter is to record and compare the changes and differences of the predictability of eight factors (seven financial and one non-financial) on the success or failure of new firms, by way of separately testing the first three-year data year by year and just the first year data for the whole observed period, before and during the recent crisis since 2008 between two different types of industry (manufacturing and distributive industries).

Financial factors are the indicators of economic goals (Venkatraman and Ramanujam, 1986). Several decades have witnessed the development of using financial ratios to predict financial distress and failure since the research pioneers in 1960s — Beaver (1966) and Altman (1968) — as pointed out by Gepp and Kumar (2015). It is also not fresh to use financial information to explore the success or failure of new firms: for example, Laitinen (1992) specially stresses three indicators of financial statements (indebtedness, revenue-generating capacity and start-up size) in the prediction of new firm failure. There are also plenty of research literature about the impacts of the recent crisis, among which however not too many focus on the impacts on the prediction of business success or failure.

The impacts of macro-economic environment on firms have been studied by many scholars. For instance, Fotopoulos and Louri (2000) believe that economic downturn tends to cause more failure; on the contrary, as a non-traditional result, the research of Boeri and Bellmann (1995) manifests that exit does not wave with economic cycle.

Notwithstanding that, there is not too much research targeting on the impacts of the crisis on the predictability of factors on success. A similar case in point is the research of Abildgren et al. (2013) that points out the manifest effect of the soundness of bank on firm default during the crisis.

Some scholars point out that new incorporations and establishments tend to increase in unfavourable macroeconomic climate (Highfield and Smiley, 1987) and job-losing environment (Audretsch and Vivarelli, 1995). The poor performance of Spanish economy during the recent crisis is documented in the literature: for example, Xifré (2014) compares the average annual GDP (gross domestic product) growth rate between two periods (from 1999 to 2007 and from 2008 to 2011) in one table with the data sourced from Eurostat; and the result shows that the average growth is positive in pre-crisis period but negative during the crisis. Therefore, it is necessary to observe and analyze the impacts of crisis on new firms.

Here, it is worth to briefly introduce corporate entrepreneurship or, more precisely, corporate venturing as an important non-financial factor starting to work from this chapter. Cuervo et al. (2007) in their book identify two types of entrepreneurship: individual entrepreneurship and corporate entrepreneurship. As is distinguished from independent entrepreneurship, corporate entrepreneurship has two crucial forms (illustrated in the study of Sharma and Chrisman, 1999) — strategic renewal and corporate venturing, in which innovation may be included. Leten and Van Dyck (2012) state corporate venturing (that has been emerging since 1960s) as creating independent organization unit to invest new technological and business opportunities, which includes internal venturing and external venturing. This thesis only takes external venturing (corporate venture capital units as independent start-ups for external opportunities — Birkinshaw and Hill, 2005) into study.

Bierwerth et al. (2015) believe that corporate venturing can help firms diversify business structures and products market area when venturing in new industrial segments; the purpose of venturing is to enhance profitability and competitiveness (Zahra, 1993).

Sykes (1990) further points out that: different to private venture capitalist with the only goal on financial return, most corporate venture capital programs view strategic goals (such as identifying new opportunities, developing business relationships, changing corporate culture, and finding potential acquisitions) for developing new business as the core and financial gains as minor.

It must be highlighted that financial goals may not oppose strategic goals, and in fact strategic goals should generate financial benefits from the long run perspective; on the other hand, short-term financial goals may not correspond with strategic goals (Ernst et al., 2005). Nevertheless, scholars still have different viewpoints regarding this issue: Dushnitsky and Lenox (2006) believe that strategically (rather than financially) oriented corporate venture capital creates firm value, while the research of Birkinshaw and Hill (2005) shows that the survival rate of financially focused units is higher than that of strategically focused units.

4.2 Methodology

Table 4.1 and 4.2 show the details of the definitions and measurements of variables. Here in order to reduce the collinearity between some variables in the regressions, transformations are made to some variables — just as Taffler (1983 cited Balcaen and Ooghe, 2006) does — such as reciprocal and logarithm; besides, the method of categorizing profitability into two types does appear in the literature, for example the research of Ohlson (1980 cited Parnes, 2011). In particular, natural logarithm is calculated for total assets; the reciprocals of indebtedness and general liquidity are used as the proxies of leverage and liquidity; profitability (profit factor) is subdivided into two levels: one with positive economic profitability, and, the other with null or negative economic profitability; group membership for identifying whether a firm belongs to a group is too categorized into two levels: one with the number of companies in the corporate group being more than zero, and, the other with zero in this number.

Table 4.1 Definition of dependent variable

Dependent variable	Definition	Measurement
Success or failure	Whether or not showing the failure event: two consecutive years without reporting operating revenues during the first five-year period	It equals 1 if not showing the defined failure event during the observed period, meaning success; equals 0 if showing the defined failure event during the observed period, meaning failure.

Table 4.2 Definitions of independent variables

Factors	Independent variables	Definitions	Measurements in regression
Firm size	Total assets	Total assets in thousands of Euros	Natural logarithm of one plus total assets: Ln (1+total assets in thousands of Euros)
Profitability (or profit)	Economic profitability	Profits before tax/Total assets	Profitability, equals 1 if the economic profitability of one firm is positive figure; equals 0 if the economic profitability of one firm is zero or negative figure.
Leverage	Indebtedness	(Total shareholders funds and liabilities— Shareholders equity)/Total shareholders funds and liabilities	Reciprocal of indebtedness: 1/indebtedness
Liquidity	General liquidity	Current assets/Current liabilities	Reciprocal of general liquidity: 1/general liquidity
Efficiency	Asset rotation	Sales/Total assets	Sales/Total assets
Asset liquidity	Proportion of current assets to total assets	Current assets/Total assets	Current assets/Total assets
Liability liquidity	Proportion of current liabilities to total liabilities	Current liabilities/Total liabilities	Current liabilities/Total liabilities
Group membership	Group membership	Number of companies in corporate group	Group membership, equals 1 if the number of companies in corporate group is more than zero; equals 0 if the number of companies in corporate group is zero.

Logistic regression is operated several times separately on the sample that is sorted twice: the first (shown in Figure 4-1) is to decompose the sample according to the life-span (or years of survival), just as Persson (2004) does in her research; the second (shown in Figure 4-2) is to generally classify the sample within the whole five-year

period. In particular, these two classifications would be explained as follows. In the first detailed classification, regressions would be operated respectively on the firms with the life-span of 1 year and those with more than 1 year, the firms with the life-span of 2 years and those with more than 2 years, and the firms with the life-span of 3 years and those with more than 3 years. In the second general classification, the firms showing the failure event during the whole five-year period would be regressed with those not showing. Here considering the imbalance of the number of cases in the dichotomous groups of dependent variable, cases are weighted by their relative frequency in order to roughly equal the number of cases in the paired success and failure groups.

As for the first classification method, it is designed to observe the changes of impacts with time for year after year analysis — just like the method used by Yazdanfar and Nilsson (2008) in which factors are observed one, two and three years separately before bankruptcy. Particularly, the data of the first, second and third year are regressed respectively, as long as these can be covered by the life-span. (Because the observed period is five years and the time span of failure event is two consecutive years, here the maximum life-span of the failure is three years, thus the third year data being the utmost.) The advantage of this method is that it can find, say, which factor showing significant impacts in all the first three years and which factor not.

The target of the second classification here is to explore the impacts of the first year data on post-entry success or failure (for just the first year analysis). That is, doing logistic regressions with the first year data on all the firms reporting revenues in their first year which are identified as success or failure by observing if showing the failure event in the whole five-year period after incorporation. This type of method (confining a fixed time after the start of firms for tracing their status with self-made standards for identifying survival or failure) can be found in the past research of some scholars, like Åstebro and Bernhardt (2003). The importance of the first year of trading is also highlighted by Saridakis et al. (2013).

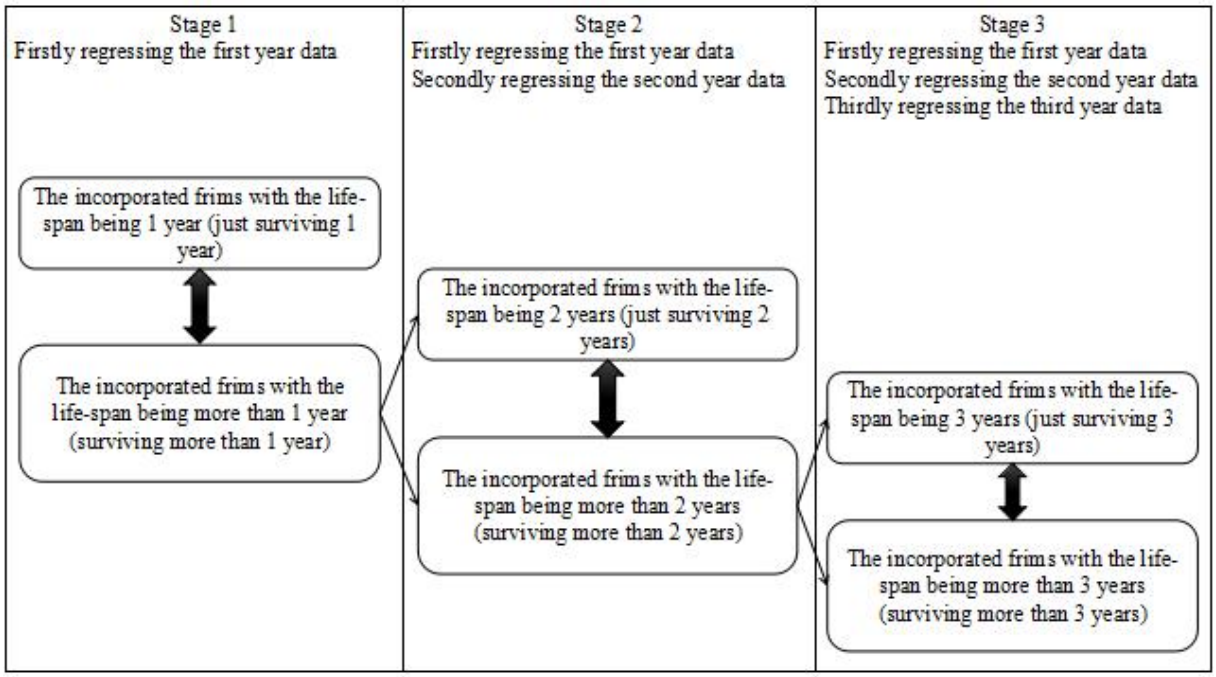


Figure 4-1. The first detailed classification for year after year analysis

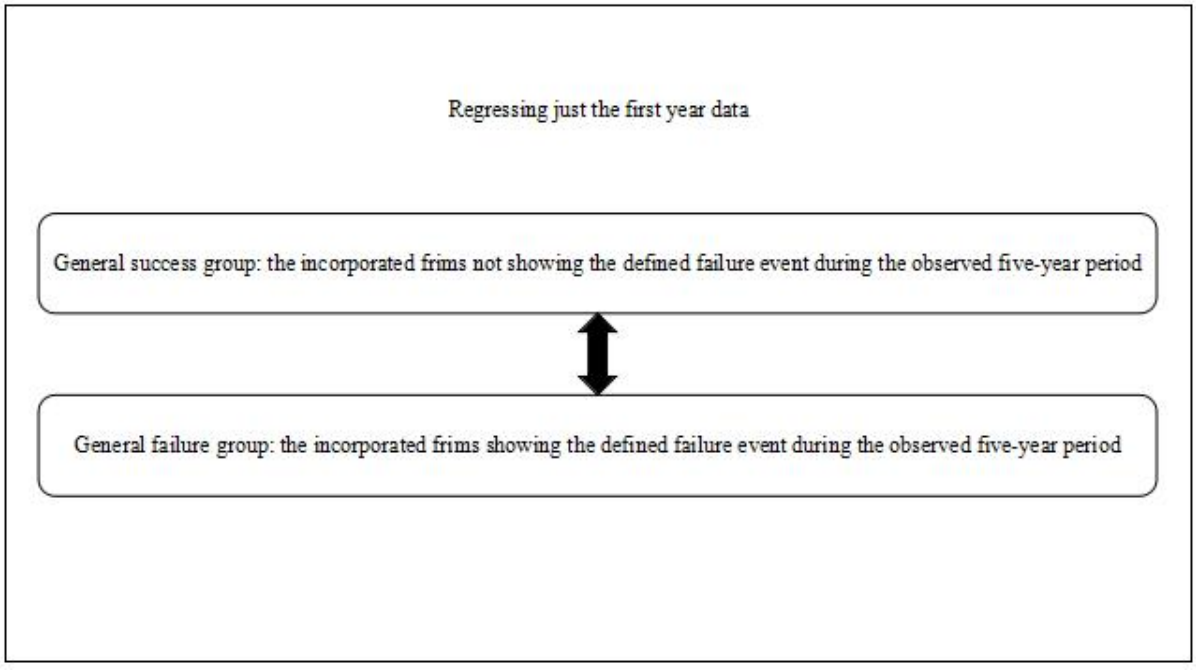


Figure 4-2. The second general classification for just the first year analysis

In fact, the impacts of initial resources and conditions on the performance of new entrants are the core or significant part of some research. Sharma and Kesner (1996) shed some light on the impact of scale of entry and find its impacts being different in different market conditions (highly concentrated or not). Huyghebaert and Gucht (2004)

give weight to the impacts of initial firm size and initial leverage as well as industry conditions. Geroski et al. (2009) find initial conditions to a large extent impact the survival of new firms, but these impacts tend to decrease when firms age; they further develop the research from just the initial conditions to both the initial and current conditions.

4.3 Regression results

4.3.1 Regression results of the first detailed classification with the transformed variables (Table A4-1 — A4-5)

This section describes the results of logistic regressions. For each group, three stages of regression are operated: stage 1 deals with the subgroups surviving just one year and those more than one year; stage 2 copes with the subgroups surviving just two years and those more than two years; stage 3 deals with the subgroups surviving just three years and those more than three years. In stage 1 only the first year data are regressed; in stage 2, the data in both the first year and second year are regressed separately; in stage 3, the data in the first year, second year and third year are regressed in order. And further two-step regression is operated in each stage with the data in one particular year: step 1 regressing all the eight variables one by one; step 2 regressing only the variables that are significant at the confidence level of 95 percent in step 1. Finally recorded in the tables are the variables being significant at the confidence level of 95 percent in step 2. Note that, thanks to the reciprocal transformations, the effects of general liquidity and indebtedness in the regressions are opposite to their originals: for example, when saying that general liquidity or indebtedness shows positive effect on success, it means that the coefficient sign of its reciprocal in the regression is negative.

In the upturn group of manufacturing industry, total assets, profitability, and group membership are strong and positive indicators for success in the regressions of all the three stages. On the other hand, indebtedness, the proportion of current liabilities, and

asset rotation (albeit some of them show significance frequently) are weak indicators, for the reason that they show opposite signs of coefficient in different stages. The proportion of current assets (as a negative indicator) tends to appear more in the regressions of the first year whereas general liquidity may perform as a positive indicator in the regressions of the second or third year.

In the downturn group of manufacturing industry, strong and positive predictive effects on success are kept in total assets and profitability in all the regressions. The proportion of current assets (negative effects) as well as group membership (positive effects) can be classified as secondary strong predictors. Others should be classified as weak indicators showing relatively lower frequency of significance, especially the proportion of current liabilities also due to its change of coefficient sign.

In the upturn group of distributive industry, total assets, profitability, and group membership are still the top three strongly positive indicators for success. General liquidity and the proportion of current liabilities are ranked as the second class indicator, displaying positive and negative effects respectively. Indebtedness and asset rotation are unstable in the sign of coefficient; besides, the proportion of current assets only shows significance (negative effect) once.

In the downturn group of distributive industry, total assets, profitability, and group membership keep on working as the top class positive indicators. General liquidity (positive effects) and the proportion of current liabilities (negative effects) show significance not as commonly as that of the above three. Indebtedness and the proportion of current assets are weak indicators from the angle of the frequency of significance, separately with positive and negative relationships to success. Here asset rotation is the weakest because of never showing significance.

4.3.2 Regression results of the second general classification with the transformed variables (Table A4-6)

Total assets, profitability and group membership are positively related to success with significance in all the regressions. Negative and significant effects of the proportion of current assets are too found in manufacturing industry; similarly, the proportion of current liabilities exerts negative and significant effects on both the manufacturing and distributive industries only in the pre-crisis period. General liquidity and indebtedness occasionally perform positive and significant effects. No significant effect is observed as for asset rotation.

It also seems that, compared to in manufacturing industry, the predictability of factors in distributive industry tends to be impacted more by the crisis. This is because, with the advent of the crisis, the number of significant predictable factors in distributive industry halves (from six to three) whereas that number in manufacturing industry keeps stable at five (though with general liquidity replacing the proportion of current liabilities).

Table 4-3. Summary of the findings

Firm size is a strong and positive indicator to success.
Profitability is a strong and positive indicator to success.
General liquidity is a positive indicator to success.
Indebtedness is a cloudy indicator to success: both positive and negative effects are observed.
Asset liquidity is a strong and negative indicator to success in manufacturing industry.
Liability liquidity is a negative indicator to success mainly in distributive industry.
Asset rotation is a cloudy indicator to success: both positive and negative effects are observed.
Group membership is a strong and positive indicator to success.

4.4 Summary of this chapter

By comparing the regressing results of the first detailed (for year after year analysis) and the second general (for just the first year analysis) classifications, it is easy to find that the results of the second do not challenge those of the first much. In fact, the majority is maintained: positive effects of firm size, profitability, and group

membership as well as negative effects of the proportion of current assets in manufacturing industries; and the weakness of asset rotation as predictor maintaining in both the first and second classifications. However, compared to the results of the first, more steady results are generated in the second, like positive effect of indebtedness as well as negative effects of the proportion of current liabilities though not always showing significance. Ergo, as the main body, the followings are concluded for the first detailed classifications. And the summary of the results is shown in Table 4-3.

No matter in manufacturing or distributive industry, firm size and profitability are the most powerful two factors in the prediction of post-entry success or failure, and both are positively related to success. The positive effects of firm size and profitability also correspond to most past literature; and the appearance of significance in all the regressions means that the impacts of these two factors penetrate all the first three years.

Group membership performs its positive effects in all the regressions in distributive industry rather than in manufacturing industry; even if so, it should still be seen as a reliable predictive factor with long-lasting influence (at least for the first three years). This supports the theoretical expectation of corporate entrepreneurship: the assistance of the experience of existing firms to their subsidiaries (Audretsch and Mahmood 1995).

As for asset liquidity (showing negative relationship to success), its significance is more prevalently observed in manufacturing industry, rather than in distributive industry. This phenomenon may not be quite surprising, because asset liquidity from the opposite side represents the impact of fixed assets which is negatively related to firm hazard (Fotopoulos and Louri 2000), and firms in manufacturing industry tend to hold higher proportion of tangible fixed assets than those in distributive industry. In the contrary, liability liquidity may be more predictable in distributive industry, because negative relationship of the proportion of current liabilities to success is held in distributive industry while in manufacturing industry both positive and negative effects are obtained in different regressions. In addition, the frequency of significance of the proportion of current liabilities obviously lowers down in manufacturing industry since driving into

the crisis. This may indicate that the crisis imposes more impacts on the predictability of liability liquidity in manufacturing industry than in distributive industry.

Similar to the status of liability liquidity, indebtedness and asset rotation too have double-sided effects (positive and negative effects respectively shown in different regressions) to success in both manufacturing and distributive industries. In fact, the complexity of the impacts of liability liquidity and indebtedness are also supported by the scholars who find the impact of one factor could be different in different countries (Baum et al. 2007) or situations (Huynh et al. 2012). The double-sided effects of asset rotation may mean that asset rotation is not suitable for predicting new firm success, which is relatively close to the literature showing the problem of the significance of asset rotation — for example, Altman (1968) and Charitou et al. (2004) — or supporting the existence of living space for inefficient firms in some situations (Zingales, 1998).

In both the two types of industry, the frequency of the significance of indebtedness decreases during the crisis. Thus there seems to be a tendency that the crisis, to some extent, would weaken the predictability of liability-related factors (liability liquidity and indebtedness). In fact, the crisis does cause negative repercussions on financing Spanish business (Maudos 2015), so it should be reasonable to relate the reduction of the predictability of liability-related factors and the crisis. And manufacturing industry is more impacted by the crisis than distributive industry is — according to the research of Fariñas and Martín-Marcos (2015) which points out that construction and manufacturing industries are influenced by the crisis most strongly in Spain; thus one of the results would be the decrease of the predictability of liability liquidity in manufacturing industry.

Different to those factors that do not keep uniqueness in their signs of coefficient, liquidity (general liquidity) shows stable and positive relationship to success. It is in accord with the theoretically expectation of Huyghebaert et al. (2000) (who point out

that generally liquidity is an indicator for buffering current liabilities, notwithstanding that they do not find significance on this factor at 95 percent confidence level).

All in all, three strong positive factors are found in the study of this chapter, namely firm size, profitability, and group membership; and the percent correct of the prediction would increase, when using the data that are closer to the time of failure event. The above three factors (together with three others — liquidity, solvency, and efficiency) will be further tested in the next chapter with more factors (which are related to financing and industrial characteristics) joining in to get a wider picture of success-impacting factors.

Appendix of chapter 4

Note that only the variables being statistically significant at 95 percent confidence level in twice regressions are shown in the tables of regression results.

Table A4-1 Regression results of the first detailed classification: upturn manufacturing industry

Stage 1		β coefficient
The first year: 6 variables	Ln total assets	0.185
Percentage correct: 63.0 %	Profitability	0.905
-2 Log likelihood: 20257.835	Proportion of current assets to total assets	-0.832
Cox & Snell R Square: 0.110	Proportion of current liabilities to total liabilities	0.369
Nagelkerke R Square: 0.146	Asset rotation	-0.035
	Group membership	0.968
Stage 2		
The first year: 5 variables	Ln total assets	0.318
Percentage correct: 63.5 %	Profitability	0.570
-2 Log likelihood: 17759.027	Proportion of current liabilities to total liabilities	-0.618
Cox & Snell R Square: 0.101	Asset rotation	0.009
Nagelkerke R Square: 0.135	Group membership	0.916
The second year: 7 variables	Ln total assets	0.409
Percentage correct: 66.1 %	Profitability	0.793
-2 Log likelihood: 17045.545	Reciprocal of general liquidity	-0.009
Cox & Snell R Square: 0.146	Reciprocal of indebtedness	-0.011
Nagelkerke R Square: 0.195	Proportion of current liabilities to total liabilities	-0.453
	Asset rotation	0.011
	Group membership	0.810
Stage 3		
The first year: 5 variables	Ln total assets	0.159
Percentage correct: 59.3 %	Profitability	0.410
-2 Log likelihood: 16187.427	Reciprocal of indebtedness	-0.003
Cox & Snell R Square: 0.065	Proportion of current assets to total assets	-0.444
Nagelkerke R Square: 0.086	Group membership	1.110
The second year: 6 variables	Ln total assets	0.187
Percentage correct: 62.9 %	Profitability	0.641
-2 Log likelihood: 15877.802	Reciprocal of indebtedness	0.017
Cox & Snell R Square: 0.088	Proportion of current liabilities to total liabilities	-0.574
Nagelkerke R Square: 0.118	Asset rotation	-0.034
	Group membership	1.056
The third year: 7 variables	Ln total assets	0.283
Percentage correct: 65.6 %	Profitability	0.907
-2 Log likelihood: 15234.430	Reciprocal of general liquidity	-0.015
Cox & Snell R Square: 0.135	Proportion of current assets to total assets	-0.365
Nagelkerke R Square: 0.180	Proportion of current liabilities to total liabilities	-0.259
	Asset rotation	-0.022
	Group membership	0.990

Table A4-2 Regression results of the first detailed classification: downturn manufacturing industry

Stage 1		β coefficient
The first year: 3 variables	Ln total assets	0.156
Percentage correct: 59.7 %	Profitability	0.685
-2 Log likelihood: 10828.193	Proportion of current liabilities to total liabilities	-0.321
Cox & Snell R Square: 0.050		
Nagelkerke R Square: 0.067		
Stage 2		
The first year: 4 variables	Ln total assets	0.079
Percentage correct: 55.5 %	Profitability	0.380
-2 Log likelihood: 9460.713	Proportion of current assets to total assets	-0.520
Cox & Snell R Square: 0.020	Group membership	0.248
Nagelkerke R Square: 0.026		
The second year: 6 variables	Ln total assets	0.138
Percentage correct: 61.8 %	Profitability	0.782
-2 Log likelihood: 9151.934	Reciprocal of general liquidity	-0.018
Cox & Snell R Square: 0.062	Reciprocal of indebtedness	-0.007
Nagelkerke R Square: 0.083	Proportion of current assets to total assets	-0.551
	Group membership	0.181
Stage 3		
The first year: 6 variables	Ln total assets	0.084
Percentage correct: 55.8 %	Profitability	0.359
-2 Log likelihood: 8018.943	Reciprocal of general liquidity	-0.030
Cox & Snell R Square: 0.024	Proportion of current assets to total assets	-0.428
Nagelkerke R Square: 0.032	Asset rotation	-0.010
	Group membership	0.155
The second year: 5 variables	Ln total assets	0.117
Percentage correct: 57.5 %	Profitability	0.537
-2 Log likelihood: 7983.432	Proportion of current assets to total assets	-0.459
Cox & Snell R Square: 0.030	Asset rotation	-0.011
Nagelkerke R Square: 0.039	Group membership	0.130
The third year: 6 variables	Ln total assets	0.197
Percentage correct: 63.1 %	Profitability	0.993
-2 Log likelihood: 7625.767	Reciprocal of general liquidity	-0.009
Cox & Snell R Square: 0.087	Proportion of current assets to total assets	-0.702
Nagelkerke R Square: 0.116	Proportion of current liabilities to total liabilities	0.244
	Asset rotation	-0.016

Table A4-3 Regression results of the first detailed classification: upturn distributive industry

Stage 1		β coefficient
The first year: 8 variables	Ln total assets	0.254
Percentage correct: 61.4 %	Profitability	0.619
-2 Log likelihood: 44570.406	Reciprocal of general liquidity	-0.006
Cox & Snell R Square: 0.085	Reciprocal of indebtedness	-0.005
Nagelkerke R Square: 0.114	Proportion of current assets to total assets	-0.344
	Proportion of current liabilities to total liabilities	-0.137
	Asset rotation	-0.003
	Group membership	0.679
Stage 2		
The first year: 5 variables	Ln total assets	0.347
Percentage correct: 62.9 %	Profitability	0.530
-2 Log likelihood: 37347.153	Reciprocal of general liquidity	-0.004
Cox & Snell R Square: 0.096	Asset rotation	0.005
Nagelkerke R Square: 0.129	Group membership	0.822
The second year: 5 variables	Ln total assets	0.465
Percentage correct: 67.1 %	Profitability	0.811
-2 Log likelihood: 35511.574	Reciprocal of indebtedness	-0.003
Cox & Snell R Square: 0.152	Asset rotation	0.001
Nagelkerke R Square: 0.202	Group membership	0.751
Stage 3		
The first year: 5 variables	Ln total assets	0.195
Percentage correct: 61.3 %	Profitability	0.483
-2 Log likelihood: 33398.232	Reciprocal of general liquidity	-0.008
Cox & Snell R Square: 0.072	Proportion of current liabilities to total liabilities	-0.313
Nagelkerke R Square: 0.095	Group membership	0.985
The second year: 5 variables	Ln total assets	0.241
Percentage correct: 63.5 %	Profitability	0.701
-2 Log likelihood: 32843.198	Reciprocal of indebtedness	0.008
Cox & Snell R Square: 0.092	Proportion of current liabilities to total liabilities	-0.374
Nagelkerke R Square: 0.122	Group membership	0.941
The third year: 6 variables	Ln total assets	0.304
Percentage correct: 66.2 %	Profitability	0.883
-2 Log likelihood: 31618.648	Reciprocal of general liquidity	-0.013
Cox & Snell R Square: 0.134	Reciprocal of indebtedness	-0.004
Nagelkerke R Square: 0.179	Proportion of current liabilities to total liabilities	-0.108
	Group membership	0.828

Table A4-4 Regression results of the first detailed classification: downturn distributive industry

Stage 1		β coefficient
The first year: 4 variables	Ln total assets	0.243
Percentage correct: 60.2 %	Profitability	0.630
-2 Log likelihood: 32152.283	Reciprocal of general liquidity	-0.006
Cox & Snell R Square: 0.063	Group membership	0.105
Nagelkerke R Square: 0.083		
Stage 2		
The first year: 3 variables	Ln total assets	0.167
Percentage correct: 58.9 %	Profitability	0.531
-2 Log likelihood: 27902.183	Group membership	0.231
Cox & Snell R Square: 0.037		
Nagelkerke R Square: 0.049		
The second year: 5 variables	Ln total assets	0.245
Percentage correct: 64.0 %	Profitability	0.858
-2 Log likelihood: 26611.352	Reciprocal of general liquidity	-0.021
Cox & Snell R Square: 0.095	Proportion of current assets to total assets	-0.203
Nagelkerke R Square: 0.126	Group membership	0.174
Stage 3		
The first year: 4 variables	Ln total assets	0.166
Percentage correct: 58.0 %	Profitability	0.485
-2 Log likelihood: 23548.827	Proportion of current liabilities to total liabilities	-0.261
Cox & Snell R Square: 0.035	Group membership	0.270
Nagelkerke R Square: 0.047		
The second year: 4 variables	Ln total assets	0.184
Percentage correct: 60.7 %	Profitability	0.748
-2 Log likelihood: 23149.128	Proportion of current liabilities to total liabilities	-0.285
Cox & Snell R Square: 0.057	Group membership	0.248
Nagelkerke R Square: 0.076		
The third year: 6 variables	Ln total assets	0.266
Percentage correct: 65.4 %	Profitability	1.097
-2 Log likelihood: 21979.424	Reciprocal of general liquidity	-0.006
Cox & Snell R Square: 0.118	Reciprocal of indebtedness	-0.002
Nagelkerke R Square: 0.157	Proportion of current liabilities to total liabilities	-0.250
	Group membership	0.162

Table A4-5 Sum of variable´s frequency at 95 % confidence level in the first detailed classification

Variables	Groups	The first year (maximum 3)	The second year (maximum 2)	The third year (maximum 1)
Ln total assets	Upturn manufacturing	3	2	1
	Downturn manufacturing	3	2	1
	Upturn distributive	3	2	1
	Downturn distributive	3	2	1
Profitability	Upturn manufacturing	3	2	1
	Downturn manufacturing	3	2	1
	Upturn distributive	3	2	1
	Downturn distributive	3	2	1
Reciprocal of general liquidity	Upturn manufacturing	0	1	1
	Downturn manufacturing	1	1	1
	Upturn distributive	3	0	1
	Downturn distributive	1	1	1
Reciprocal of indebtedness	Upturn manufacturing	1	2	0
	Downturn manufacturing	0	1	0
	Upturn distributive	1	2	1
	Downturn distributive	0	0	1
Proportion of current assets to total assets	Upturn manufacturing	2	0	1
	Downturn manufacturing	2	2	1
	Upturn distributive	1	0	0
	Downturn distributive	0	1	0

Proportion of current liabilities to total liabilities	Upturn manufacturing	2	2	1
	Downturn manufacturing	1	0	1
	Upturn distributive	2	1	1
	Downturn distributive	1	1	1
Asset rotation	Upturn manufacturing	2	2	1
	Downturn manufacturing	1	1	1
	Upturn distributive	2	1	0
	Downturn distributive	0	0	0
Group membership	Upturn manufacturing	3	2	1
	Downturn manufacturing	2	2	0
	Upturn distributive	3	2	1
	Downturn distributive	3	2	1

Table A4-6 Regression results of the second general classification

The upturn group of manufacturing industry (5 significant variables; percentage correct 62.8 %)	
-2 Log likelihood: 16756.250	
Cox & Snell R Square: 0.099	
Nagelkerke R Square: 0.132	β coefficient
Ln total assets	0.255
Profitability	0.656
Proportion of current assets to total assets	-0.341
Proportion of current liabilities to total liabilities	-0.270
Group membership	1.072
The downturn group of manufacturing industry (5 significant variables; percentage correct 58.2 %)	
-2 Log likelihood: 8283.202	
Cox & Snell R Square: 0.036	
Nagelkerke R Square: 0.048	β coefficient
Ln total assets	0.110
Profitability	0.495
Reciprocal of general liquidity	-0.052
Proportion of current assets to total assets	-0.561
Group membership	0.188
The upturn group of distributive industry (6 significant variables; percentage correct 63.3 %)	
-2 Log likelihood: 34846.300	
Cox & Snell R Square: 0.099	
Nagelkerke R Square: 0.132	β coefficient
Ln total assets	0.303
Profitability	0.590
Reciprocal of general liquidity	-0.003
Reciprocal of indebtedness	-0.003
Proportion of current liabilities to total liabilities	-0.213
Group membership	0.905
The downturn group of distributive industry (3 significant variables; percentage correct 60.5 %)	
-2 Log likelihood: 24057.559	
Cox & Snell R Square: 0.056	
Nagelkerke R Square: 0.075	β coefficient
Ln total assets	0.227
Profitability	0.625
Group membership	0.249

Chapter 5

The study of the predictability and impacts of firm-specific (mainly financial and accounting-based) and industry-specific factors on the survival-based success of new firms during the crisis period with logistic regression

5.1 Background

With using logistic regression, this chapter studies the predictability and impacts of some firm-specific (mainly financial and accounting-based) and industry-specific factors on the survival-based success of new firms at different ages in manufacturing and distributive industries. Murphy et al. (1996) point out eight facets in measuring the performance of entrepreneurship: efficiency, growth, profit, size, liquidity, success or failure, market share, and leverage. Except for success or failure, all the factors are financial (efficiency, profit, liquidity, and leverage) and accounting-based factors (growth, size, and market share).

Compared to the previous chapter, here industry-specific factors are introduced. The study of this chapter is built on the crisis period (choosing the new firms incorporated in downturn period); this is because of the limitation that the industry data can only be obtained for the last 12 years in SABI database. So it is difficult to use industry data in the pre-crisis period (due to lacking sufficient years for observation).

Chrisman et al. (1998) divide the influence of industry structure into two types: absolute and relative affects. In particular, on the ground of previous literature, they list three dimensions of impacts from the angle of absolute or average profit potential and expected returns to explain the attractiveness of industry: the impacts of structural barriers and gateways on the difficulty to enter, the impacts on remaining business during its vulnerable period in competition, and the impacts on the availability of resources for survival in industry; as for relative affect, they illustrate it as the

opportunities generated by industry structure and the ability of ventures to catch these opportunities with using their resources to create value.

In fact, as is stated by Bellone et al. (2008), industry characteristics impact more on young firms compared to old firms and the impacts of industry dynamic features (turbulence) are more important than those of static features (market structure). This chapter employs three industry-specfic factors — namely industry entry, industry growth, and industry concentration. According to the classification of Bellone et al. (2008), industry sales growth as well as entry signify industry turbulence, while concentration is a factor representing market structure.

Segarra and Callejón (2002) believe that industry entry rate can represent both barriers to entry and competition: in particular, high entry rate means low level of entry barrier and high degree of competition; on the other hand, their findings also show that even in the industries with high competition or with significant barriers high entry rate still appears. Regarding entry barrier, though the linkage between entry barrier and exit barrier is supported by for example Fotopoulos and Louri (2000) with the case of sunk cost, according to the study of McAfee et al. (2004) whether sunk cost per se (as well as economies of scale and capital requirements) can be classified as entry barrier is an arguing point because of different definitions of entry barrier.

Bogliacino and Pianta (2013) use the growth of industry sales to reflect industry demand; Sharma and Kesner (1996) also state that high industry growth means expanding demand and then new entrants would cause less threat to incumbents and suffer less retaliations from incumbents. Except for less retaliations from incumbents, Strotmann (2007) points out that another important beneficial factor is the increase of price-cost-margins driven by the increase of demand in growing industries.

As for industry concentration, traditional viewpoint is that industry concentration means market imperfection, so firms with lower market power (especially young firms) would

have higher probability to exit (Bellone et al., 2008). Robinson (1999) believes that low concentration industries absorb most of new ventures, which means that low concentration works as a necessary but not sufficient condition on successful entry. Notwithstanding that, López-García and Puente (2006) state two different views about highly concentrated industries (the existence of survival space for sub-optimal scale new firms; and the collusion of incumbents for against new entrants).

In addition to industry-specific factors, two special financial factors (as the representatives of financing effects) and one accounting-based factor join in the study of this chapter — namely bank credit, trade credit and market share — which are also difficult to be completely catched before 2007. As pointed out by Robb and Robinson (2014), there are three most important financing sources of start-ups: bank debt, personal equity and trade credit. In the case of Spain, the significant positions of bank credit and trade credit are highlighted by bank-centered financial system and less developed financial markets (Ruiz-Mallorquí and Aguiar-Díaz, 2017) and fewer alternative external financing sources (García-Teruel and Martínez-Solano, 2007). For start-ups, as pointed out by Fraser et al. (2015), trade credit ranks before bank debt in that gaining track record is the prerequisite for granting bank credit. Thus, it is necessary to study the impacts of these two important external financing sources.

In terms of market share, there should exist some linkages between it and firm size, because it is possible that the firms being larger in size would have stronger productivity and more output which would help them occupy higher market share. Compared to relatively higher entry rate, the proportion of the total sales of entrants to that of the whole industry should be lower and this could be explained by relatively smaller size of entrants to incumbents (Geroski, 1995).

5.2 Methodology

The firms incorporated in 2008 and 2009 in manufacturing and distributive industries are the studying targets of this chapter (as shown in Table 5-1). Logistic regression works here for analyzing the impacts and predictability of different factors. In particular, the variables are processed twice: in the first time, variables are put into the regression one after another and only the variables being statistically significant at the confidence level of 95 percent are allowed to go into the second time regression; in the second time, all the statistically significant variables in the last step are put into the regression together to finally identify statistical significance again at the confidence level of 95 percent, and only the finally statistically significant variables are documented. Here, for addressing the issue that the numbers of firms in success groups are larger than those in failure groups, weighting is used in the regressions.

The method classifying samples for regressing could be seen as the accumulation of traditional survival time dividing method based on time change. Traditional survival time division is to set a certain time period after the start of new firm and then to analyze the impacts of factors on survival of the firms that survive beyond that period and those that do not. For example, Audretsch (1994) observes the impacts of factors at different time points after the established year. Here the observation method used by Hunter and Isachenkova (2006) is also referred to (that is, one year and two years before failure work as the studying time points).

The purpose of the method used here is to identify the predictability of factors in different studying years (particularly, age 1, age 2, and age 3) for different periods of time. Specifically speaking, with using the data of age 1 (as the studying year), predictability can be observed three times (immediately after the studying year, after one year, and after two years); with using the data of age 2, predictability can be observed twice (immediately after the studying year and after one year); with using the data of age 3, predictability can be observed only once (immediately after the studying year). The specific explanation of the above described six times classification and prediction would be illustrated in next section. The reason for studying till age 3 is that the whole observation period is five years after incorporation and the data in the years of age 4 and 5 can only be used to identify whether showing operating revenues in two

consecutive years. Here noteworthy is that, when exploring the predictability of age 2 or age 3, it means that the firms survive at least till that age.

Table 5-1. Distribution of firm´s number and percentage in two-digit code division (according to NACE Rev. 2 from Eurostat; European Commission, 2008)

Manufacturing industry	Number	Percent
10. Manufacture of food products	425	9,70
11. Manufacture of beverages	111	2,53
13. Manufacture of textiles	136	3,10
14. Manufacture of wearing apparel	120	2,74
15. Manufacture of leather and related products	169	3,86
16. Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	227	5,18
17. Manufacture of paper and paper products	41	0,94
18. Printing and reproduction of recorded media	355	8,10
19. Manufacture of coke and refined petroleum products	4	0,09
20. Manufacture of chemicals and chemical products	114	2,60
21. Manufacture of basic pharmaceutical products and pharmaceutical preparations	16	0,37
22. Manufacture of rubber and plastic products	127	2,90
23. Manufacture of other non-metallic mineral products	189	4,31
24. Manufacture of basic metals	81	1,85
25. Manufacture of fabricated metal products, except machinery and equipment	913	20,84
26. Manufacture of computer, electronic and optical products	82	1,87
27. Manufacture of electrical equipment	85	1,94
28. Manufacture of machinery and equipment n.e.c.	252	5,75
29. Manufacture of motor vehicles, trailers and semi-trailers	41	0,94
30. Manufacture of other transport equipment	36	0,82
31. Manufacture of furniture	246	5,61
32. Other manufacturing	152	3,47
33. Repair and installation of machinery and equipment	460	10,50
Total	4382	100,00
Distributive industry	Number	Percent
45. Wholesale and retail trade and repair of motor vehicles and motorcycles	1330	10,34
46. Wholesale trade, except of motor vehicles and motorcycles	6362	49,45
47. Retail trade, except of motor vehicles and motorcycles	5173	40,21
Total	12865	100,00

Table 5-2 and 5-3 describe the detailed information about the factors and variables chosen from a variety of literature: seven from the research of Murphy et al. (1996) — success or failure, size, market share, profit, leverage, liquidity, and efficiency; bank debt from the research of Saridakis et al. (2008); trade credit from the studies of Martínez-Sola et al. (2014) and Kestens et al. (2012); industrial variables from the research of Geroski et al. (2010), López-García and Puente (2006), and Baggs (2005).

Here size and market share are treated as accounting-based factors in that they are calculated on the ground of the data in financial statements; and, except for group membership (representing whether an incorporated firm belongs to a group; used in the study of Bridges and Guariglia, 2008), all the factors and variables could change with time.

For addressing the problem of collinearity, changes are done on some variables. Mathematical reciprocals are calculated on indebtedness and general liquidity. Similar to the classifying method used by Westhead and Storey (1997), profitability is subdivided into two types (gaining profits or not), based on the fact that a proportion of firms suffer losses in the samples. This type of classifying is also suitable for bank debt (bank loans), like in the study of Reid and Smith (2000). As for the three industrial variables, the measures here of entry rate and industry growth are generally in accordance with past literature; while the measuring method of López-García and Puente (2006) for concentration (the proportion of operating revenues of the top 10 percent firms to that of the whole industry) is adopted here, considering the large number of firms in distributive industry and the difficulty for calculating Herfindahl concentration index being used in the research of, for instance, Delmar et al. (2013).

Table 5-2. Definition of dependent variable

Dependent variable	Definition	Measure
Success or failure	Whether or not showing the failure event: two consecutive years without reporting operating revenues	It equals 1 if not showing the defined failure event during the observed period, meaning success; equals 0 if showing the defined failure event during the observed period, meaning failure.

Table 5-3. Definitions of independent variables

Factors	Independent variables	Definitions	Measures in regression
Firm size	Total assets	Total assets in thousands of Euros	Natural logarithm of one plus total assets: Ln (1+total assets in thousands of Euros)
Market share	Proportion of firm´s operating revenues to the total amount of operating revenues in the industry where that firm is	Firm´s operating revenues/The total amount of operating revenues in the industry where that firm is	Firm´s operating revenues/The total amount of operating revenues in the industry where that firm is
Profitability (or profit)	Economic profitability	Profits before tax/Total assets	Profitability, equals 1 if firm´s economic profitability is positive figure; equals 0 if firm´s economic profitability is zero or negative figure.
Solvency (or leverage)	Indebtedness	(Total shareholders funds and liabilities—Shareholders equity)/Total shareholders funds and liabilities	Reciprocal of indebtedness: 1/indebtedness
Liquidity	General liquidity	Current assets/Current liabilities	Reciprocal of general liquidity: 1/general liquidity
Efficiency	Asset rotation	Sales/Total assets	Sales/Total assets
Bank credit	Bank loans	Whether showing positive bank loans in balance sheet (liabilities)	Bank loans, equal 1 if positive bank loans are shown in firm´s balance sheet (liabilities); equal 0 if positive bank loans are not shown in firm´s balance sheet (liabilities)
Trade credit	Proportion of accounts receivable to total assets	Accounts receivable/Total assets	Accounts receivable/Total assets
	Proportion of accounts payable to total liabilities	Accounts payable/Total liabilities	Accounts payable/Total liabilities
Group membership	Group membership	Number of companies in corporate group	Group membership, equals 1 if the number of companies in corporate group is more than zero; equals 0 if the number of companies in corporate group is zero.

Industrial factors (identified in two-digit code division in Table 5-1)	Entry rate	Proportion of the number of incorporated firms within a year in a selected industry to the number of the firms reporting total assets in that industry in the same year	The number of incorporated firms within a year in a selected industry/The number of the firms reporting total assets in that industry in the same year
	Concentration rate	Proportion of the total amount of operating revenues of the top 10 percent firms in a selected industry in a year to the total amount of operating revenues in that industry in the same year	The total amount of operating revenues of the top 10 percent firms in a selected industry in a year/The total amount of operating revenues in that industry in the same year
	Industry growth rate	Rate of the difference between operating revenues in a selected industry in a year and the operating revenues in that industry one year before to the operating revenues in that industry one year before	(Operating revenues in a selected industry in a year — the operating revenues in that industry one year before)/ The operating revenues in that industry one year before

5.3 Regression results

The detailed results of the regressions in manufacturing and distributive industries are shown separately in Table A5-1 and Table A5-2 (where only the variables that are statistically significant at the confidence level of 95 percent are recorded) as well as Table A5-3 as a summary. Particularly in each industry, there are six classifications representing different studying years and different observation periods, which would be explained in the following paragraph and Figure 5-1.

In the regressions with using the data of age 1, the firms in the year of age 1 are initially subdivided into four categories: those failing after age 1, those failing after age 2, those

failing after age 3, and those being successful after age 3. Then, the first classification (C1) identifies only the firms failing after age 1 as failure group and the residual three categories together as success group; the second classification (C12-345) identifies the firms failing after age 1 and those failing after age 2 as failure group and the other residual two categories together as success group; the third classification (C123-45) identifies the firms failing after age 1, failing after age 2, and failing after age 3 as failure group and the other residual one category as success group. In the regressions with using the data of age 2 and age 3, the classifications are similar to those of age 1.

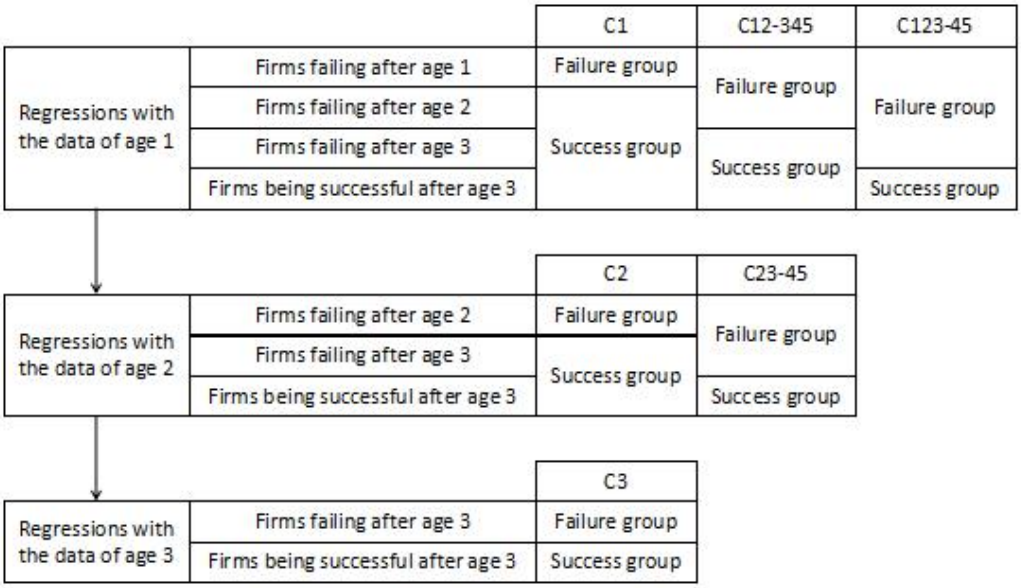


Figure 5-1. Classifications for respectively regressing

Generally speaking, there are more variables showing statistical significance in distributive industry than in manufacturing industry. In particular, entry rate and concentration are never statistically significant in manufacturing industry but frequently show significance in distributive industry (separately with negative and positive relationships to success). Trade credit variables also only show statistical significance in distributive industry (with negative relationships of accounts receivable and positive relationship of accounts payable to success). Besides, though positive effects of general liquidity and indebtedness are observed, in distributive industry the appearing frequency of statistical significance of general liquidity is much higher than that of indebtedness.

Despite the previously listed differences, similarities in the two industries can still be summarized as follows. The first undoubted common result is that total assets and profitability show statistically significant and positive effects on success in every regression in both manufacturing and distributive industries while market share never shows significance even once. Secondly, positive effects of group membership as well as negative effects of the growth rate of industrial operating revenues are commonly (or in majority) observed in both two industries. Thirdly, so limited are the impacts of asset rotation and bank loans that statistically significant result is recorded only once each (asset rotation showing negative relationship to success in manufacturing industry; bank loans showing positive relationship to success in distributive industry).

Analyzing the value of coefficient (B) is helpful to identify not only the impacts of factors per se but also the changes of the impacts, as increase (or decrease) in the absolute value of coefficient means increase (or decrease) in its impacts. In both manufacturing and distributive industries, the values of coefficients of the natural logarithm of total assets and group membership are positive and generally keep stable, so this signifies relatively steady effects of these two factors; by contrast, increasing trends are observed from C1 to C3 in the value of profitability´s coefficient, meaning increment of the impacts of profitability from age 1 to age 3. Increasing trend also appears in the absolute value of the coefficient of the growth rate of industrial operating revenues, although along with the change of its sign from being negative to being positive. On the other hand, in distributive industry, instability is shown in the absolute values of the coefficients of the reciprocal of general liquidity, entry rate and concentration, stable signs notwithstanding.

5.4 Summary of this chapter

Before summarizing the predictability and impacts, a special point of conclusion for the variables frequently showing statistical significance can be extracted from the previous

analysis of the values of coefficients. That is, when studying the predictability from age1 to age 3, the impacts of firm size and group membership change only to a little extent; even for the factors and variables that show different impacts across ages (such as, profitability, entry rate, concentration, and the growth rate of industrial operating revenues), their impacts in the same age tend to be relatively stable.

Generally speaking, it is easy to conclude the existence of difference in factors′ predictability on success when comparing manufacturing and distributive industries. Nevertheless, some factors still have overwhelming effects on the success of new firms. Firm size and profitability are the most strongly predictable factors, as the proxy variables of these two show statistically significant and positive effects on success in all the regressions. This corresponds to the views of Audretsch (1991) and Audretsch and Mahmood (1995) about inherent size disadvantage and the study of Delmar et al. (2013) on profitability.

Group membership follows the above two as the second strong positive factor, which is similar to the findings of Bridges and Guariglia (2008). So this result illustrates the usefulness of obtaining experience from the established parent companies, as is expected by Audretsch and Mahmood (1995). Here the predictability of group membership seems to be stronger in distributive industry, because of showing statistical significance in all the regressions in distributive industry (rather than manufacturing industry).

Completely different to those strong factors, market share does not show statistically significance at all when controlling other variables. This does not correspond to the expectation that market share should have similar effects to size by virtue of the expected correlation between market share and firm size. A possible explanation may be that the market shares of entrants are too small to cause effects, which is to some extent linked to the view of Audretsch et al. (1999) saying that the gross market share of entrants usually is not as high as the rate of new firm formation.

Albeit not always showing statistical significance, the effects of liquidity and solvency factors are stable and positive, since all the reciprocals of general liquidity and indebtedness show negative signs in the regressions in which they are statistically significant. Furthermore, the frequency of statistical significance of the reciprocal of general liquidity is quite high in distributive industry, so it is reasonable to ascertain that the predictability of liquidity in distributive industry is strong. Positive effect of liquidity is also supported by Bunn and Redwood (2003). In terms of the positive effect of indebtedness, it is close to the empirical findings of Nunes and Serrasqueiro (2012).

The low frequency of statistical significance in bank loans, accounts receivable, and accounts payable means that credit factors (including both bank credit and trade credit) are weak indicators on the success of new firms; however, the empirical results in distributive industry (positive effects of bank loans and accounts payable as well as negative effect of accounts receivable) seem to be theoretically reasonable. Here positive effect of accounts payable and negative effect of accounts receivable indicate generally positive effect of trade credit, for the reason that holding more accounts payable and less accounts receivable represents increment in trade credit. Therefore, it is possible to explain the above results that: the strength of the predictability of credit factors may change from industry to industry; and in the industries where showing statistical significance (like distributive industry here), some weight should be given to both bank credit and trade credit, because they are the two major sources of debt-financing for start-ups (Huyghebaert et al., 2007). The impact of asset rotation as the proxy of efficiency is questioned too due to its low frequency of statistical significance, which is similar to the research results of Charitou et al. (2004) challenging its significance as well.

With regard to the three industrial variables, the growth of industrial operating revenues shows statistical significance most but its impact on success is not constant (mostly being negative but occasionally being positive). Though the result of the negative impact is contrary to some theoretical expectations or empirical results, like of Baggs

(2005), similar results can still be found from past research, for example the research of Audretsch et al. (2000) where the negative effect of industry growth is kept till age 8. So the statement of Audretsch et al. (2000) that uncertainty is entwined with industry's high growth could be employed to explain the negative effect; however, this effect seems to be maintained at early ages, because positive effect emerges later.

Entry rate shows statistical significance only in distributive industry; its effect on success is consistently negative and this negative effect is within the setting of competition theory of Fritsch et al. (2006). The effect of concentration on success keeps on being positive and statistically significant too only in distributive industry. This is different to many empirical studies; however, from another angle it may implicitly support the views of Baldwin and Rafiquzzaman (1995) pointing out that entrants could not threaten the existing firms immediately due to smallness and Cincera and Galgau (2005) showing that the time for a new firm to be competitive with incumbents should be five to ten years.

In a nutshell, the positive effects of firm size, profitability, and group membership are again verified in this chapter, so these three are strong and positive factors in logistic models. Besides, positive effect of liquidity is too kept in this chapter, although its statistical significance is not as frequently shown as that of the above three factors is in manufacturing industry. The percent correct would be higher if the data is closer to the failure event in manufacturing industry (not in distributive industry where keeping stable); and the percent correct would also increase with the increase in firm's age. This chapter together with last chapter studied the general effects of factors on success with using logistic model, and next chapter will use decision tree method to explore these effects in details.

Appendix of chapter 5

Table A5-1. Regression results in manufacturing industry (B=coefficient; Sig.=statistical significance)

Manufacturing industry classifying	C1		C12-345		C123-45		C2		C23-45		C3	
Percentage correct	60.7 %		58.7%		57.4%		61.2 %		60.1%		62.6%	
-2 Log likelihood	10393.112		9253.885		8076.464		8688.606		7838.651		7236.148	
Cox & Snell R Square	0.059		0.035		0.032		0.066		0.047		0.079	
Nagelkerke R Square	0.079		0.047		0.043		0.089		0.063		0.106	
Results of variable	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.
Ln Total assets	0.158	0.000	0.144	0.000	0.130	0.000	0.141	0.000	0.131	0.000	0.172	0.000
Market share												
Profitability	0.653	0.000	0.545	0.000	0.504	0.000	0.730	0.000	0.627	0.000	0.947	0.000
Reciprocal of indebtedness							-0.008	0.003	-0.007	0.025		
Bank loans												
Accounts receivables to total assets												
Accounts payable to total liabilities												
Reciprocal of general liquidity	-0.060	0.000					-0.055	0.000	-0.031	0.001		
Asset rotation											-0.022	0.010
Group membership			0.176	0.001	0.168	0.003	0.146	0.008	0.152	0.009		
Entry rate												
Concentration												
Industry growth	-0.686	0.000	-0.645	0.001	-0.675	0.001	-1.377	0.000			1.774	0.000

Table A5-2. Regression results in distributive industry (B=coefficient; Sig.=statistical significance)

Distributive industry classifying	C1		C12-345		C123-45		C2		C23-45		C3	
Percentage correct	60.5%		59.9%		60.2%		63.3%		63.1%		65.0%	
-2 Log likelihood	30083.116		26326.809		22631.926		24075.358		21801.353		19314.320	
Cox & Snell R Square	0.063		0.056		0.058		0.088		0.078		0.115	
Nagelkerke R Square	0.084		0.075		0.078		0.118		0.104		0.153	
Results of variable	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.
Ln Total assets	0.238	0.000	0.208	0.000	0.215	0.000	0.213	0.000	0.219	0.000	0.261	0.000
Market share												
Profitability	0.642	0.000	0.622	0.000	0.606	0.000	0.849	0.000	0.853	0.000	1.088	0.000
Reciprocal of indebtedness											-0.002	0.005
Bank loans							0.073	0.021				
Accounts receivables to total assets	-0.385	0.000							-0.166	0.007		
Accounts payable to total liabilities					0.101	0.037						
Reciprocal of general liquidity	-0.013	0.000	-0.016	0.000	-0.014	0.003	-0.025	0.000	-0.010	0.001	-0.007	0.001
Asset rotation												
Group membership	0.107	0.000	0.204	0.000	0.268	0.000	0.214	0.000	0.268	0.000	0.198	0.000
Entry rate	-12.245	0.000	-11.429	0.000	-11.845	0.000	-28.265	0.000			-13.563	0.000
Concentration			1.939	0.000	1.751	0.002	5.087	0.000			2.775	0.000
Industry growth			-0.499	0.014	-0.729	0.001	4.194	0.000				

Table A5-3. Summary of the findings

Firm size is a strong and positive indicator.
Market share is not a statistically significant indicator.
Profitability is a strong and positive indicator.
Indebtedness is a weak and positive indicator.
Bank debt is a weak and positive indicator.
Accounts receivable is a weak and negative indicator.
Accounts payable is a weak and positive indicator.
General liquidity is a positive indicator especially in distributive industry.
Asset rotation is a weak and negative indicator.
Group membership is a strong and positive indicator.
Industry entry rate is a strong and negative indicator in distributive industry.
Industry concentration is a strong and positive indicator in distributive industry.
Industry growth is a cloudy indicator: being mostly negative but occasionally positive.

Chapter 6

The study of the predictability and impacts of firm-specific (mainly financial) and industry-specific factors on the survival-based success of new firms during the crisis period with decision tree method

6.1 Background

There are different views about the determinants of firm performance: the resource-based view focuses on the internal sources of a firm's sustained competitive advantage whereas the industrial organization view highlights the impacts of outside industry structure (Kraaijenbrink et al., 2010). With using decision tree approach, this chapter explores the predictability and impacts of some firm-specific factors (mainly financial factors) and industry-specific factors on the survival-based success of Spanish new firms in manufacturing and distributive industries in the crisis period. Because of using industry-specific factors, this chapter chooses the crisis period for observation, considering the constraints in obtaining industry data in the pre-crisis period in SABI database.

Different to the previous chapter, decision trees are built for analyzing the predictability and impacts. According to the statement of Gepp and Kumar (2015), the history of using decision tree to explore the prediction of business failure could be traced back to the research of Frydman et al. (1985). As for the introduction of decision tree method, the statement of Bastos and Ramalho (2016, p.349) is cited for illustrating: "Decision trees are one of the simplest techniques of pattern recognition, deriving their predictive power by recursively partitioning the original data set, in accordance with some criteria, into smaller mutually exclusive subsets, until all observations are allocated to a terminal node."

The advantages of decision tree model (as a non-parametric method) include: showing the results and relationships visually and clearly, being easy to understand and interpret, needing little data preparation, being able to process numerical and categorical data, working fast, no requirement for variable transformation, and being less impacted by the effects of outliers (Delen et al., 2013; D'Haen et al., 2013). One important feature of decision tree is that: compared to the relatively simple results of logistic regression, it can generate quite detailed and relatively complex results.

Another trait of this chapter is that, in order to research more deeply, here the financial variables are adjusted according to the median value of industry to compare the results between the original variables and the adjusted variables. When considering financial factors together with industrial factors, the issue of industry adjustment should be discussed. Ooghe et al. (2003) point out the difference of model´s predictability in different industries, so they propose to develop industry-specific models and variables. Platt and Platt (1991) also suggest to use industry-relative ratios (dividing company ratios by industry average ratios) in bankruptcy prediction models, which can eliminate industry-specific bias; and their research results show that industry-adjusted ratios perform better than unadjusted ratios do in accuracy and stability. Hence, with using the adjusting method of dividing the original financial ratios to the industry medians (Izan, 1984), this chapter compares the predictability of some original financial variables to that of their paired industry-adjusted variables.

In fact, early studies already establish the structure and system of financial ratios. Horrigan (1965) classifies financial ratios only into two categories: liquidity and profitability (where liquidity is further subdivided into short term liquidity and long term solvency, and profitability is too subdivided into turnover ratios, profit margin ratios and return ratios); similarly, Gupta (1969) identifies four types of financial ratios indicating profitability, turnover, leverage and liquidity. In particular, four financial variables are chosen in this chapter — profitability (ROA), liquidity, leverage (indebtedness) and total assets.

There is no much doubt that profit is a key factor attracting entrepreneurs to start up business. According to the traditional view of economics literature related to industrial organization, the excess of profitability drives firm entry (Audretsch, 1997); on the other hand, not earning sufficient money is a crucial reason for the discontinuance of business (Watson et al., 1998). Ilmakunnas and Topi (1999) also point out that profits and losses are separately the important reasons for entry and exit. In fact, financial ratios related to profitability are employed by academicians — such as Sharma and Mahajan (1980) and Pompe and Bilderbeek (2005) — for predicting business failure and bankruptcy.

Bruinshoofd and Kool (2004) summarize three main reasons for holding liquidity: the first is transaction and opportunity costs (together with precautionary demand for money, including future investment opportunity, volatility of cash flow, and refinancing uncertainty); the second is about asymmetric information problems (for example, moral hazard in high leverage, the relationship with financial intermediaries, agency problems between managers and owners because of the preference of managers on liquidity but the preference of shareholders on profit, and asymmetries in information when investing in research and development, investing in high-tech sectors, and investing in economic recession period); the third is passive adjustment of capital structure according to the pecking order theory of Myers and Majluf (1984) and Myers (1984) and buffer stock liquidity for absorbing shocks. As for small firms, liquidity problems should be stressed because of relatively lacking sources for financing, so it is necessary to prepare more assets in liquid form for daily transactions and in emergent situation (Bolek, 2013).

The door of the research on modern theory of capital structure and financing was opened by Modigliani and Miller (1958) when publishing their irrelevancy theory of capital structure (Harris and Raviv, 1991; Ardalan, 2017). As pointed out by Flannery and Rangan (2006), financing theory has been greatly developed since the publication of irrelevance proposition by Modigliani and Miller (1958); on the other hand, in spite of the Modigliani and Miller (1958) theory, other theoretical studies propose different and opposite arguments (Weill, 2008).

In fact, Myers (2001) in his paper negates the expectation of universality in the theory of debt-equity choice and lists some well-known ones. The following theories developed are reviewed in the study of Frank and Goyal (2009): trade-off theory highlights the trade-off between the benefits and costs of debt, including tax benefits against bankruptcy costs; agency theory proposes agency costs and the existence of conflicts among manager, shareholder, and debt-holder (Jensen and Meckling, 1976; Jensen, 1986); pecking order theory points out that the financing order would be retained earnings, debt, and then equity because of adverse selection problem (Myers and Majluf, 1984; Myers, 1984); market timing theory believes that capital structure is impacted much by the fluctuations of market valuations (Baker and Wurgler, 2002).

The impact of firm size on survival has been widely discussed especially by Industrial Organization scholars. Audretsch (1995a) points out two characteristics of new entrants: the smallness in firm size and the low variance in start-up size. In fact, firm size works as a considerable factor in survival analysis not just for new firms. Pérez et al. (2004) analyze the impacting factors of firm survival in manufacturing industries with no special limitations on firm age, and their findings show that small firms are riskier than large ones.

6.2 Methodology

The firms incorporated in the downturn period (2008 and 2009) are candidates for sample (shown in Table 6-1). For building the dependent variable, firms are categorized into two groups separately representing success and failure (shown in Table 6-2). Because there are much more firms in success groups than in failure groups, weighting is used to address the issue of imbalance. Regarding the independent variables, it is worth to explain the industry adjustment process in details. In particular, liquidity ratio, indebtedness, and total assets (as the proxy of firm size) are divided by the industry medians; the adjustment of total assets could to some extent reflect the impacts of

minimum efficient scale, because industry minimum efficient scale is measured as median logarithm of total assets in an industry in the research of Huyghebaert and Van de Gucht (2007). Here, considering that the sign of ROA (return on total assets) could be positive or negative, the adjusting method on ROA is to calculate the difference between firm´s ROA and the industry median ROA (firm´s ROA minus that of industry median).

Classification tree is used for analyzing the predictability and impacts of firm-specific (together with their industry-adjusted formats) and industry-specific factors on the survival-based success at different ages (age 1, 2 and 3). Here Chi-squared Automatic Interaction Detector (CHAID) is chosen as the algorithm. On the basis of adjusted significance testing, CHAID generates more than two categories at a level (rather than binary), and its output is characterized of high visualization and easiness to interpret (Delen et al., 2013). So it can not only build the relationship to dependent variable but can also help to summarize the changing trend between factor and the likelihood of the target (because of generating multiple categories at a level).

As stated by Ritschard (2013), the splitting criterion of CHAID is Chi-square using the p-value, which is introduced by Kass (1980). Milanović and Stamenković (2016, p. 572) describe the working process of CHAID as follows: the first independent variable is the one with the lowest p-value, which is most strongly associated with the dependent variables; if the p-value is equal to or lower than the predefined level of significance, the node would be splitted; this process keeps on going till the p-values of all the observed independent variables are higher than the split threshold; in the merging process, categories are megered for forming the statistically significant difference between them.

Table 6-1. Distribution of sample size according to ages as well as failure and success percentages in two-digit code industry division (according to NACE Rev. 2 from Eurostat; European Commission, 2008)

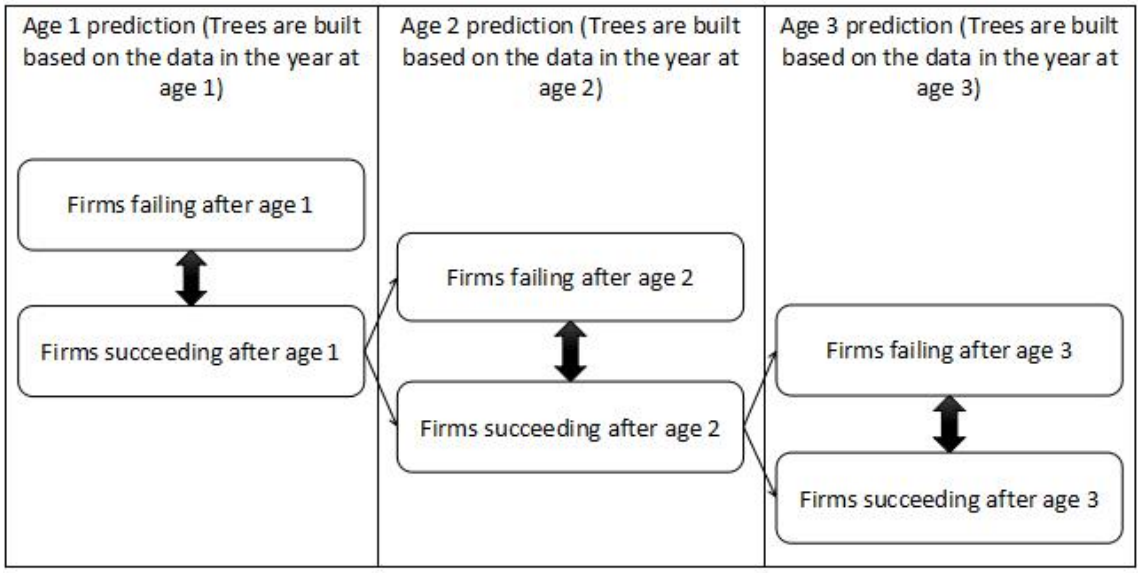
Manufacturing industry	Sample size at age 1	Sample size at age 2	Sample size at age 3
10. Manufacture of food products	442	395	353
11. Manufacture of beverages	115	99	89
13. Manufacture of textiles	146	125	110
14. Manufacture of wearing apparel	130	110	89
15. Manufacture of leather and related products	181	157	129
16. Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	232	210	189
17. Manufacture of paper and paper products	41	38	31
18. Printing and reproduction of recorded media	367	321	273
19. Manufacture of coke and refined petroleum products	4	2	2
20. Manufacture of chemicals and chemical products	117	102	83
21. Manufacture of basic pharmaceutical products and pharmaceutical preparations	16	15	15
22. Manufacture of rubber and plastic products	132	119	100
23. Manufacture of other non-metallic mineral products	195	177	156
24. Manufacture of basic metals	83	72	57
25. Manufacture of fabricated metal products, except machinery and equipment	940	808	677
26. Manufacture of computer, electronic and optical products	88	78	68
27. Manufacture of electrical equipment	88	76	64
28. Manufacture of machinery and equipment n.e.c.	257	239	207
29. Manufacture of motor vehicles, trailers and semi-trailers	44	39	33
30. Manufacture of other transport equipment	42	36	31
31. Manufacture of furniture	256	211	172
32. Other manufacturing	155	135	124
33. Repair and installation of machinery and equipment	473	421	370
Failure	488	506	462
Success	4056	3479	2960
Success percentage	89%	87%	86%
Total	4544	3985	3422
Distributive industry			
45. Wholesale and retail trade and repair of motor vehicles and motorcycles	1404	1240	1083
46. Wholesale trade, except of motor vehicles and motorcycles	6658	5734	4894
47. Retail trade, except of motor vehicles and motorcycles	5742	4980	4211
Failure	1639	1579	1427
Success	12165	10375	8761
Success percentage	88%	87%	86%
Total	13804	11954	10188

Table 6-2. Definitions of variables

Factors	Variables	Definitions
Dependent variable		
Success or failure	Two consecutive years without reporting operating revenues as the signal of failure	It equals 1 representing success if not showing the signal of failure; equals 0 if showing the signal of failure.
Independent variables		
Financial factor	Profitability	Return on total assets (ROA): Profits before tax / Total assets
		Adjusted format: Firm´s ROA — Industry median ROA
	Solvency	Indebtedness: (Total shareholders funds and liabilities — Shareholders equity)/ Total shareholders funds and liabilities
		Adjusted format: Firm's indebtedness / Industry median indebtedness
	Liquidity	Current ratio: Current assets/Current liabilities
		Adjusted format: Firm's current ratio / Industry median current ratio
Firm size	Total assets	Total assets in thousands of Euros
		Adjusted format: Firm's total assets / Industry median total assets
Group membership	Whether being in a group	Membership in a group, equals 1 if the number of companies in corporate group is more than zero; equals 0 if the number of companies in corporate group is zero.
Industrial factors (identified in two-digit code industry division)	Entry rate	The number of incorporated firms within a year in a selected industry / The number of the firms reporting total assets in that industry in the same year
	Concentration rate	The total amount of operating revenues of the top 10 percent firms in a selected industry in a year / The total amount of operating revenues in that industry in the same year
	Industry growth rate	(Operating revenues in a selected industry in a year — the operating revenues in that industry one year before) / The operating revenues in that industry one year before

Referring to the research method of Persson (2004), this chapter sets three time nodes after the founding of firms — age 1, age 2 and age 3 (respectively representing one, two and three years after the founding year); decision trees are built for each age. The reason for just studying the impacts at the first three ages is that the last two years in the

observed five-year period are used for identifying success or failure (due to two consecutive years without reporting operating revenues as the judging standard for failure). Particularly, as shown in Picture 6-1, the total samples are subdivided into success and failure groups according to survival year after year: firstly dividing the total into two groups — the firms keeping on survival after age 1 and the firms not; secondly, dividing the firms keeping on survival after age 1 into two groups — those keeping on survival after age 2 and those not; finally, again dividing the firms keeping on survival after age 2 into two groups — those keeping on survival after age 3 and those not. Decision trees are operated twice (separately with the original financial and size variables and their adjusted formats) for each age division on the paired success group and failure group. Noteworthy here is that as age grows firms would have more years of financial records: for example, the firms surviving after age 3 have financial records at age 1, 2 and 3. In this chapter, only the data in the latest age years are processed in that the research design here is to analyze the impacts of factors on survival immediately after the recorded year.



Picture 6-1

6.3 Results

6.3.1 Decision tree results of manufacturing industry (from Table A6-1 to A6-6)

For the age 1 prediction (unadjusted), indebtedness is the variable at the first level, and the likelihood of success decreases with the increase in indebtedness except for the case of low indebtedness; the second level is occupied by liquidity ratio, total assets, industry concentration, and industry entry; except for total assets and group membership, all the variables appear at the third level, and in most cases ROA tends to be positively related to success whereas the relationship between success and industry growth tends to be negative. For the adjusted age 1 prediction, at the first level adjusted ROA shows positive relationship with the likelihood of success. At the second level, the other three adjusted variables (liquidity, indebtedness and total assets) together with industry concentration appear; again, the relationship between adjusted indebtedness and success is negative except for the case of low adjusted indebtedness. Except for adjusted ROA and group membership, all the variables appear at the third level; adjusted liquidity as well as industry growth tend to be negatively related to success. Obviously, here the adjustment protrudes the impact of ROA.

For the age 2 prediction, the results of the unadjusted and adjusted models are to some extent similar: the first level is occupied by ROA or adjusted ROA, and both are generally positively related to success (with a slightly negative relationship in high ROA); at the second level, group membership (being positively related to success), industry concentration, total assets (or adjusted total assets) appear in both models, whereas industry entry and adjusted indebtedness separately appear in the unadjusted model and adjusted model; at the third level, indebtedness or its adjusted format (being negatively related to success), industry concentration, liquidity or adjusted liquidity, and industry entry (mostly being positively related to success) appear in the unadjusted and adjusted models, together with group membership (being negatively related to success) in the unadjusted model as well as adjusted ROA and industry growth in the adjusted model.

For the age 3 prediction, the first level is occupied by ROA or adjusted ROA, and both are generally positively related to success except in high ROA. At the second level, industry growth, total assets, and indebtedness appear in the unadjusted model; on the other hand, industry growth, adjusted total assets (being positively related to success), industry entry rate, and industry concentration are shown in the adjusted model. At the third level, the unadjusted tree includes indebtedness, liquidity, industry concentration, and industry growth. The third level of the adjusted tree is composed of adjusted ROA, industry entry, adjusted indebtedness, and industry growth, where positive relationship to success is shown in industry growth and negative relationship to success is observed in industry entry and adjusted indebtedness.

6.3.2 Decision tree results of distributive industry (from A6-7 to A6-12)

In all the models ROA or adjusted ROA ranks at the first level, and a generally increasing trend of success likelihood can be observed with the increase in ROA or adjusted ROA (except for the age 2 models at high profitability).

At age 1, in the unadjusted model, the second level is occupied by concentration, indebtedness, total assets (generally being positively related to success likelihood), and liquidity; in the adjusted model, the second level contains adjusted liquidity and adjusted indebtedness (following the low adjusted ROA branches of the first level) and adjusted total assets (following middle and high adjusted ROA branches of the first level). The third level of both the unadjusted and adjusted models are composed of all the variables, where group membership and ROA (as well as adjusted ROA) are positively related to success. Liquidity is an interesting variable at the third level: when being classified into two categories, in the unadjusted model it tends to be positively related to success, while in the adjusted model the relationship tends to be negative.

At age 2, in the unadjusted model, the second level consists of liquidity, indebtedness, group membership (being positively related to success), total assets (following the high ROA branches of the first level); in the adjusted model, the second level includes adjusted indebtedness (following the low adjusted ROA branches of the first level), adjusted total assets, adjusted liquidity, industry growth. The third level of both the unadjusted and adjusted models are composed of all the variables except for ROA or adjusted ROA, where the impact of group membership is not consistent in both the unadjusted and adjusted models. Some other interesting trends can also be observed at the third level: for both the unadjusted and adjusted models, although trends are difficult to be summarized when classifying into multiple categories, total assets and indebtedness are separately positively and negatively related to success when they are only classified into two categories.

At age 3, in the unadjusted model, industry growth, group membership (being positively related to success), indebtedness, total assets (generally being positively related to success) occupy the second level; in the adjusted model, industry growth, group membership (being positively related to success), adjusted total assets, adjusted indebtedness appear at the second level. The third level of the unadjusted model is occupied by all the variables except for industry growth; the third level of the adjusted model covers all the variables. At the third level of both the unadjusted and adjusted models, group membership, ROA, and total assets (when classified into two categories) are positively related to success.

6.4 Summary of this chapter

Among the findings obtained, the foremost one is that nearly all the trees highlight the importance of profitability and firm size, for the reason that five out of six models in manufacturing industry and all the six models in distributive industry rank ROA (or its adjusted format) at the first level while total assets (as well as its adjusted format) frequently appear at the second level in all the predictions in both manufacturing and

distributive industries. Besides, in distributive industry indebtedness also appears at the second level of all the models.

Because the first levels of the generated trees are occupied by profitability (and indebtedness in one model in manufacturing industry), the changes happening at the second level can illustrate the changes of the impacts of variables. Liquidity (or its adjusted format) plays a more important role in early ages: appearing at the second level of age 1 in manufacturing industry as well as the second level of age 1 and 2 models in distributive industry; this may represent a decreasing trend of the impact of liquidity with ageing, which may be caused by the bettering performance in profitability and then cash inflow with ageing. By contrast, group membership (as a dichotomous variable) shows instability in its relationship to success and its impact is a little different in different industries: in manufacturing industry it just appears in the age 2 models whereas in distributive industry it emerges in all the three age models.

As for industry-specific factors, differences between the two industries can be observed in industry entry and concentration: in manufacturing industry industry entry and concentration tend to be more important than industry growth does because of more frequently appearing at the second level, while in distributive industry concentration only enters into the second level in the unadjusted model of age 1. On the other hand, in both the two industries, industry growth comes into the second level at late ages (age 2 or 3 models). Therefore, the impact of industry growth tends to increase with ageing, and in manufacturing industry it ranks behind industry entry and industry concentration at early ages (here age 1 and age 2).

The research results here fail to conclude the effect of industry adjustment on the whole model, because the correct percent of prediction does not change much in either manufacturing or distributive industries. Notwithstanding that, industry adjustment does influence some variables. For instance, in manufacturing industry industry adjustment upgrades the impact of profitability in the age 1 prediction (replacing indebtedness at

the first level), whereas adjustment does not waver the status of profitability ranking at the first level in the age 2 and age 3 predictions.

With regard to the relationships of variables to firm success, fluctuating relationship prevalently exists not only for the continuous variables but also for the dichotomous variable (group membership changing its relationship to success in different models). This matches with the complexity of the results generated; thank to the complexity, decision tree approach can draw a more detailed picture of the results, which is an important advantage. In spite of the complexity, profitability is generally positively related to success (especially at the low and medium profitability) in both manufacturing and distributive industries, which corresponds with the commonsense about the positive impact of profitability.

To sum up, the percent correct of prediction of decision tree method is a little better than that of logistic model, which is an advantage of decision tree method. On the other hand, decision tree method tends to generate more detailed results, so it is difficult to draw a general relation between a factor and success. Notwithstanding that, similar to the previous two chapters, the importance of firm size and profitability to success is stressed in this chapter.

Appendix of chapter 6

Note: decision trees are generated from left to right; "N" and "S" in the parentheses separately represent the number of firms and the likelihood of success; due to weighting, the total number of firms in each model is larger than the sample size; and the minimum number of cases in the child nods is set to 100.

Table A6-1. Success prediction of manufacturing industry at age 1 with original variables (Correct percent: 66.8%; N: 7960)

Indebtedness <=0.435 (N: 796; S: 52%)	Liquidity <= 2.622 (N:294; S: 73%)	ROA <= 0.003 (N:133; S: 58%) ROA > 0.003 (N:161; S: 85%)
	Liquidity > 2.622 (N:502; S: 39%)	Industry entry <= 0.028 (N:121; S: 21%) Industry entry (0.028, 0.030] (N:110; S: 42%) Industry entry (0.030, 0.039] (N:151; S: 58%) Industry entry > 0.039 (N:120; S: 33%)
Indebtedness (0.435, 0.673] (N: 798; S: 72%)	Total assets <= 61.541 (N:223; S: 53%)	Industry growth <= -0.037 (N:102; S: 69%) Industry growth > -0.037 (N:121; S: 40%)
	Total assets (61.541, 122.243] (N:173; S: 68%)	
	Total assets (122.243, 236.134] (N:129; S: 100%)	
	Total assets (236.134, 777.067] (N:160; S: 80%)	
	Total assets > 777.067 (N:113; S: 72%)	
Indebtedness (0.673, 0.797] (N: 794; S: 62%)	Total assets <= 87.529 (N:330; S: 44%)	ROA <= 0.003 (N:140; S: 26%) ROA > 0.003 (N:190; S: 58%)
	Total assets (87.529, 236.134] (N:229; S: 69%)	
	Total assets (236.134, 777.067] (N:131; S: 94%)	
	Total assets > 777.067 (N:104; S: 62%)	
Indebtedness (0.797, 0.967] (N: 2392; S: 57%)	Liquidity <= 0.571 (N:265; S: 43%)	Indebtedness <= 0.927 (N:146; S: 51%) Indebtedness > 0.927 (N:119; S: 33%)
	Liquidity (0.571, 1.111] (N:1217; S: 62%)	ROA <= -0.108 (N:114; S: 37%) ROA (-0.108, 0.072] (N:929; S: 61%) ROA > 0.072 (N:174; S: 82%)
	Liquidity (1.111, 1.271] (N:496; S: 44%)	Indebtedness <= 0.871 (N:337; S: 38%) Indebtedness > 0.871(N:159; S: 55%)
	Liquidity (1.271, 1.625] (N:164; S: 76%)	
	Liquidity > 1.625 (N:250; S: 58%)	
Indebtedness (0.967, 1.153] (N: 1588; S: 47%)	Industry concentration <= 0.662 (N:486; S: 47%)	Liquidity <= 0.762 (N:126; S: 43%) Liquidity (0.762, 1.017](N:196; S: 59%) Liquidity > 1.017 (N:164; S: 37%)
	Industry concentration (0.662, 0.723] (N:551; S: 35%)	Industry growth <= -0.065 (N:256; S: 44%) Industry growth > -0.065 (N:295; S: 27%)
	Industry concentration (0.723, 0.843] (N:392; S: 65%)	ROA <= -0.023 (N:143; S: 78%) ROA (-0.023, 0.003] (N:114; S: 51%) ROA > 0.003(N:135; S: 64%)
	Industry concentration > 0.843 (N:159; S: 40%)	
Indebtedness (1.153, 1.590] (N: 797; S: 38%)	Industry entry <=0.034 (N:524; S: 42%)	Industry concentration <= 0.723 (N:354; S: 37%) Industry concentration > 0.723 (N:170; S: 53%)
	Industry entry > 0.034 (N:273; S: 30%)	
Indebtedness > 1,590 (N: 795; S: 24%)		

Table A6-2. Success prediction of manufacturing industry at age 1 with adjusted variables (Correct percent: 64.3%; N: 7960)

Adjusted ROA <= -0.658 (N: 796; S: 25%)	Adjusted liquidity <= 0.253 (N: 424; S: 19%)	Adjusted Total assets <= 0.095 (N: 225; S: 25%) Adjusted Total assets > 0.095 (N: 199; S: 12%)
	Adjusted liquidity > 0.253 (N: 372; S: 31%)	Industry growth <= -0.013 (N: 213; S: 40%) Industry growth > -0.013 (N: 159; S: 19%)
Adjusted ROA (-0.658, -0.280] (N: 798; S: 38%)	Adjusted Total assets <= 0.047 (N: 126; S: 24%)	
	Adjusted Total assets (0.047, 0.211] (N: 345; S: 35%)	Adjusted liquidity <= 0.579 (N: 192; S: 42%) Adjusted liquidity > 0.579 (N: 153; S: 27%)
	Adjusted Total assets > 0.211 (N: 327; S: 46%)	
Adjusted ROA (-0.280, -0.113] (N: 794; S: 44%)	Adjusted liquidity ratio <= 0.579 (N: 303; S: 45%)	
	Adjusted liquidity ratio (0.579, 0.852] (N: 289; S: 34%)	
	Adjusted liquidity ratio > 0.852 (N: 202; S: 56%)	
Adjusted ROA (-0.113, 0.009] (N: 2387; S: 52%)	Adjusted Indebtedness <= 0.611 (N: 240; S: 50%)	Adjusted liquidity <= 1.990 (N: 105; S: 62%) Adjusted liquidity > 1.990 (N: 135; S: 41%)
	Adjusted Indebtedness (0.611, 0.952] (N: 164; S: 76%)	
	Adjusted Indebtedness (0.952, 1.216] (N: 365; S: 67%)	Industry entry <= 0.034 (N: 229; S: 79%) Industry entry > 0.034 (N: 136; S: 47%)
	Adjusted Indebtedness > 1.216 (N: 1618; S: 47%)	Industry concentration <= 0.714 (N: 699; S: 48%) Industry concentration (0.714, 0.723] (N: 185; S: 35%) Industry concentration (0.723, 0.809] (N: 286; S: 64%) Industry concentration (0.809, 0.843] (N: 213; S: 47%) Industry concentration > 0.843 (N: 235; S: 32%)
Adjusted ROA (0.009, 0.066] (N: 1593; S: 58%)	Industry concentration <= 0.602 (N: 116; S: 79%)	
	Industry concentration (0.602, 0.662] (N: 414; S: 46%)	Industry growth <= -0.138 (N: 216; S: 59%) Industry growth > -0.138 (N: 198; S: 31%)
	Industry concentration (0.662, 0.683] (N: 100; S: 84%)	
	Industry concentration > 0.683 (N: 963; S: 58%)	Adjusted Total assets <= 0.095 (N: 121; S: 67%) Adjusted Total assets (0.095, 0.147] (N: 116; S: 45%) Adjusted Total assets (0.147, 0.400] (N: 299; S: 60%) Adjusted Total assets (0.400, 0.575] (N: 147; S: 46%) Adjusted Total assets > 0.575 (N: 280; S: 66%)
Adjusted ROA > 0.066 (N: 1592; S: 65%)	Adjusted Total assets <= 0.047 (N: 178; S: 42%)	
	Adjusted Total assets (0.047, 0.095](N: 184; S: 52%)	
	Adjusted Total assets (0.095, 0.147] (N: 137; S: 71%)	
	Adjusted Total assets (0.147, 0.211] (N: 197; S: 51%)	
	Adjusted Total assets (0.211, 0.300] (N: 133; S: 76%)	
	Adjusted Total assets (0.300, 0.400] (N: 170; S: 58%)	
	Adjusted Total assets (0.400, 0.575] (N: 164; S: 71%)	
	Adjusted Total assets (0.575, 0.896] (N: 157; S: 90%)	
	Adjusted Total assets > 0.896 (N: 272; S: 76%)	Adjusted Indebtedness <= 1.111 (N: 148; S: 84%) Adjusted Indebtedness > 1.111 (N: 124; S: 68%)

Table A6-3. Success prediction of manufacturing industry at age 2 with original variables (Correct percent: 64.2%; N: 7021)

ROA <= -0.486 (N: 702; S: 28%)	Group membership 0 (N: 545; S: 24%)	Indebtedness <= 1.597 (N: 170; S: 34%)
		Indebtedness > 1.597 (N: 375; S: 20%)
	Group membership 1 (N: 157; S: 42%)	
ROA (-0.486, -0.189] (N: 699; S: 39%)	Industry concentration <= 0.650 (N: 145; S: 23%)	
	Industry concentration (0.650, 0.713] (N: 131; S: 47%)	
	Industry concentration (0.713, 0.724] (N: 148; S: 29%)	
	Industry concentration > 0.724 (N: 275; S: 49%)	
ROA (-0.189, -0.009] (N: 1407; S: 44%)	Total assets <= 29.348 (N: 133; S: 16%)	
	Total assets (29.348, 49.171] (N: 104; S: 46%)	
	Total assets (49.171, 75.816] (N: 157; S: 33%)	
	Total assets (75.816, 151.819] (N: 266; S: 45%)	
	Total assets (151.819, 210.098] (N: 109; S: 61%)	
	Total assets > 210.098 (N: 638; S: 50%)	Industry concentration <= 0.713 (N: 126; S: 67%)
		Industry concentration (0.713, 0.724] (N: 151; S: 26%)
		Industry concentration > 0.724 (N: 361; S: 53%)
ROA (-0.009, 0.004] (N: 703; S: 39%)	Industry entry <= 0.030 (N: 265; S: 47%)	Indebtedness <= 0.913 (N: 108; S: 61%)
		Indebtedness > 0.913 (N: 157; S: 38%)
	Industry entry (0.030, 0.031] (N: 173; S: 27%)	
	Industry entry (0.031, 0.049] (N: 159; S: 52%)	
	Industry entry > 0.049 (N: 106; S: 21%)	
ROA (0.004, 0.015] (N: 699; S: 56%)	Total assets <= 109.028 (N: 165; S: 45%)	
	Total assets > 109.028 (N: 534; S: 59%)	Liquidity <= 1.382 (N: 403; S: 55%)
		Liquidity > 1.382 (N: 131; S: 73%)
ROA (0.015, 0.168] (N: 2106; S: 63%)	Total assets <= 29.348 (N: 170; S: 38%)	
	Total assets (29.348, 109.028] (N: 609; S: 56%)	Group membership 0 (N: 389; S: 60%)
		Group membership 1 (N: 220; S: 49%)
	Total assets (109.028, 300.433] (N: 697; S: 63%)	Liquidity <= 1.039 (N: 213; S: 67%)
		Liquidity (1.039, 1.382] (N: 276; S: 52%)
		Liquidity > 1.382 (N: 208; S: 73%)
	Total assets (300.433, 496.183] (N: 239; S: 77%)	Industry entry <= 0.030 (N: 136; S: 69%)
		Industry entry > 0.030 (N: 103; S: 86%)
	Total assets (496.183, 1115.402] (N: 190; S: 85%)	
	Total assets > 1115.402 (N: 201; S: 69%)	
ROA > 0.168 (N: 705; S: 55%)	Total assets <= 75.816 (N: 280; S: 38%)	Industry concentration <= 0.733 (N: 140; S: 50%)
		Industry concentration > 0.733 (N: 140; S: 25%)
	Total assets (75.816, 151.819] (N: 115; S: 76%)	
	Total assets > 151.819 (N: 310; S: 64%)	Industry entry <= 0.037 (N: 201; S: 58%)
		Industry entry > 0.037 (N: 109; S: 74%)

Table A6-4. Success prediction of manufacturing industry at age 2 with adjusted variables (Correct percent: 65.4%; N: 7021)

Adjusted ROA <= -0.479 (N: 699; S: 29%)	Group membership 0 (N: 542; S: 25%)	Adjusted Indebtedness <= 2.227 (N: 154; S: 36%) Adjusted Indebtedness > 2.227 (N: 388; S: 21%)
	Group membership 1 (N: 157; S: 42%)	
Adjusted ROA (-0.479, -0.193] (N: 705; S: 38%)	Industry concentration <= 0.650 (N: 158; S: 20%)	
	Industry concentration (0.650, 0.713](N: 139; S: 45%)	
	Industry concentration (0.713, 0.724](N: 147; S: 29%)	
	Industry concentration > 0.724 (N: 261; S: 52%)	
Adjusted ROA (-0.193, -0.0002] (N: 2106; S: 43%)	Adjusted Total assets <= 0.114 (N: 356; S: 25%)	
	Adjusted Total assets (0.114, 0.183] (N: 146; S: 62%)	
	Adjusted Total assets (0.183, 0.362] (N: 395; S: 36%)	Industry entry <= 0.030 (N: 124; S: 49%) Industry entry > 0.030 (N: 271; S: 30%)
	Adjusted Total assets (0.362, 1.098] (N: 672; S: 48%)	Industry concentration <= 0.713 (N: 231; S: 61%) Industry concentration > 0.713 (N: 441; S: 41%)
	Adjusted Total assets (1,098, 2.485] (N: 230; S: 57%)	Adjusted liquidity <= 0.787 (N: 102; S: 73%) Adjusted liquidity > 0.787 (N: 128; S: 45%)
	Adjusted Total assets > 2.485 (N: 307; S: 43%)	Industry entry <= 0.031 (N: 205; S: 32%) Industry entry > 0.031 (N: 102; S: 66%)
Adjusted ROA (-0.0002, 0.011] (N: 703; S: 53%)	Adjusted Total assets <= 0.183 (N: 118; S: 41%)	
	Adjusted Total assets (0.183, 2.485] (N: 476; S: 59%)	
	Adjusted Total assets > 2.485 (N: 109; S: 42%)	
Adjusted ROA (0.011, 0.165] (N: 2106; S: 63%)	Adjusted Total assets <= 0.114 (N: 318; S: 49%)	Adjusted liquidity <= 0.787 (N: 116; S: 64%) Adjusted liquidity > 0.787 (N: 202; S: 41%)
	Adjusted Total assets (0.114, 0.183] (N: 211; S: 64%)	
	Adjusted Total assets (0.183, 0.259] (N: 255; S: 53%)	Adjusted ROA <= 0.064 (N: 147; S: 62%) Adjusted ROA> 0.064 (N: 108; S: 42%)
	Adjusted Total assets (0.259, 0.718] (N: 628; S: 68%)	Industry growth <= -0.027 (N: 195; S: 68%) Industry growth (-0.027, -0.005] (N: 224; S: 56%) Industry growth > -0.005 (N: 209; S: 80%)
	Adjusted Total assets (0.718, 1.098](N: 264; S: 58%)	Adjusted ROA <= 0.029 (N: 114; S: 45%) Adjusted ROA > 0.029 (N: 150; S: 67%)
	Adjusted Total assets (1.098, 2.485] (N: 235; S: 82%)	Industry growth <= -0.010 (N: 134; S: 74%) Industry growth > -0.010 (N: 101; S: 93%)
	Adjusted Total assets > 2.485 (N: 195; S: 71%)	
Adjusted ROA > 0.165 (N: 702; S: 55%)	Adjusted Indebtedness <= 0.609 (N: 226; S: 54%)	Industry entry <= 0.030 (N: 123; S: 37%) Industry entry > 0.030 (N: 103; S: 73%)
	Adjusted Indebtedness (0.609, 1.196] (N: 326; S: 68%)	Industry concentration <= 0.681 (N: 148; S: 57%) Industry concentration > 0.681 (N: 178; S: 76%)
	Adjusted Indebtedness > 1.196 (N: 150; S: 30%)	

Table A6-5. Success prediction of manufacturing industry at age 3 with original variables (Correct percent: 66.7%; N: 5732)

ROA <= -0.482 (N: 572; S: 26%)	Industry growth <= -0.089 (N: 107; S: 38%)	
	Industry growth (-0.089, -0.086] (N: 104; S: 8%)	
	Industry growth (-0.086, -0.020] (N: 187; S: 23%)	
	Industry growth > -0.020 (N: 174; S: 31%)	
ROA (-0.482, -0.226] (N: 574; S: 32%)		
ROA (-0.226, 0.002] (N: 1720; S: 47%)	Total assets <= 81.411 (N: 428; S: 36%)	
	Total assets (81.411, 165.851] (N: 333; S: 44%)	Indebtedness <= 0.997 (N: 197; S: 51%) Indebtedness > 0.997 (N: 136; S: 34%)
	Total assets (165.851, 232.801] (N: 164; S: 63%)	
	Total assets (232.801, 328.543] (N: 216; S: 39%)	
	Total assets (328.543, 1144.558] (N: 365; S: 52%)	Liquidity <= 1.213 (N: 244; S: 43%) Liquidity > 1.213 (N: 121; S: 70%)
	Total assets > 1144.558 (N: 214; S: 64%)	
ROA (0.002, 0.151] (N: 2293; S: 65%)	Indebtedness <= 0.390 (N: 213; S: 58%)	Industry concentration <= 0.733 (N: 100; S: 40%) Industry concentration > 0.733 (N: 113; S: 73%)
	Indebtedness (0.390, 0.726] (N: 548; S: 72%)	Industry concentration <= 0.733 (N: 210; S: 74%) Industry concentration (0.733, 0.814] (N: 236; S: 59%) Industry concentration > 0.814 (N: 102; S: 94%)
	Indebtedness (0.726, 0.814] (N: 352; S: 59%)	Industry growth <= -0.064 (N: 148; S: 43%) Industry growth > -0.064 (N: 204; S: 71%)
	Indebtedness (0.814, 0.896] (N: 332; S: 75%)	Industry concentration <= 0.686 (N: 125; S: 62%) Industry concentration > 0.686 (N: 207; S: 83%)
	Indebtedness (0.896, 1.181] (N: 711; S: 65%)	Industry growth <= -0.089 (N: 158; S: 47%) Industry growth (-0.089, -0.064] (N: 140; S: 66%) Industry growth (-0.064, -0.020] (N: 118; S: 80%) Industry growth (-0.020, 0.043] (N: 152; S: 61%) Industry growth > 0.043 (N: 143; S: 79%)
	Indebtedness > 1.181 (N: 137; S: 39%)	
ROA > 0.151 (N: 573; S: 57%)	Total assets <= 119.443 (N: 299; S: 42%)	
	Total assets > 119.443 (N: 274; S: 74%)	Industry growth <= -0.020 (N: 158; S: 62%) Industry growth > -0.020 (N: 116; S: 90%)

Table A6-6. Success prediction of manufacturing industry at age 3 with adjusted variables (Correct percent: 64.9%; N: 5732)

Adjusted ROA <= -0.487 (N: 571; S: 25%)	Industry growth <= -0.089 (N: 107; S: 38%)	
	Industry growth (-0.089, -0.086] (N: 104; S: 8%)	
	Industry growth (-0.086, -0.020] (N: 187; S: 23%)	
	Industry growth > -0.020 (N: 173; S: 31%)	
Adjusted ROA (-0.487, -0.218] (N: 578; S: 33%)		
Adjusted ROA (-0.218, -0.030] (N: 1144; S: 47%)	Adjusted Total assets <= 0.126 (N: 186; S: 29%)	
	Adjusted Total assets (0.126, 0.415] (N: 361; S: 45%)	Adjusted ROA <= -0.096 (N: 172; S: 51%) Adjusted ROA > -0.096 (N: 189; S: 40%)
	Adjusted Total assets > 0.415 (N: 597; S: 53%)	Industry entry <= 0.030 (N: 155; S: 65%) Industry entry (0.030, 0.044] (N: 303; S: 52%) Industry entry > 0.044 (N: 139; S: 40%)
Adjusted ROA (-0.030, 0.010] (N: 1148; S: 55%)	Adjusted Total assets <= 0.198 (N: 244; S: 39%)	
	Adjusted Total assets > 0.198 (N: 904; S: 60%)	Adjusted Indebtedness <= 0.862 (N: 121; S: 85%) Adjusted Indebtedness (0.862, 1.272] (N: 287; S: 62%) Adjusted Indebtedness > 1.272 (N: 496; S: 52%)
Adjusted ROA (0.010, 0.029] (N: 572; S: 72%)	Industry entry <= 0.028 (N: 130; S: 72%)	
	Industry entry (0.028, 0.031] (N: 136; S: 87%)	
	Industry entry > 0.031 (N: 306; S: 65%)	
Adjusted ROA (0.029, 0.058] (N: 573; S: 58%)	Industry concentration <= 0.769 (N: 436; S: 53%)	
	Industry concentration > 0.769 (N: 137; S: 74%)	
Adjusted ROA (0.058, 0.147] (N: 571; S: 68%)	Adjusted Total assets <= 0.126 (N: 109; S: 45%)	
	Adjusted Total assets (0.126, 0.585] (N: 242; S: 68%)	Industry growth <= -0.034 (N: 136; S: 60%) Industry growth > -0.034 (N: 106; S: 77%)
	Adjusted Total assets > 0.585 (N: 220; S: 81%)	Industry entry <= 0.033 (N: 116; S: 95%) Industry entry > 0.033 (N: 104; S: 65%)
Adjusted ROA > 0.147 (N: 575; S: 57%)	Adjusted Total assets <= 0.126 (N: 175; S: 31%)	
	Adjusted Total assets > 0.126 (N: 400; S: 69%)	Industry growth <= -0.020 (N: 236; S: 62%) Industry growth > -0.020 (N: 164; S: 78%)

Table A6-7. Success prediction of distributive industry at age 1 with original variables (percent correct: 63.8%; N: 23638)

ROA <= -0.758 (N: 2366; S: 26%)	Concentration <= 0.787 (N: 446; S: 29%)	Liquidity <= 0.332 (N: 223; S: 22%)
		Liquidity > 0.332 (N: 223; S: 37%)
	Concentration (0.787, 0.796] (N: 598; S: 20%)	
	Concentration (0.796, 0.821] (N: 233; S: 34%)	
	Concentration > 0.821 (N: 1089; S: 25%)	Group membership = 0 (N: 813; S: 23%)
		Group membership = 1 (N: 276; S: 34%)
ROA (-0.758, -0.326] (N: 2358; S: 37%)	Indebtedness <= 0.905 (N: 331; S: 51%)	Liquidity <= 0.940 (N: 118; S: 35%)
		Liquidity > 0.940 (N: 213; S: 61%)
	Indebtedness (0.905, 1.721] (N: 1656; S: 36%)	Industry entry <= 0.051 (N: 520; S: 45%)
		Industry entry > 0.051 (N: 1136; S: 32%)
	Indebtedness > 1.721 (N: 371; S: 30%)	Industry concentration <= 0.796 (N: 162; S: 22%)
		Industry concentration > 0.796 (N: 209; S: 36%)
ROA (-0.326, -0.137] (N: 2367; S: 47%)	Total assets <= 94.152 (N: 1344; S: 39%)	Industry entry <= 0.042 (N: 114; S: 57%)
		Industry entry (0.042, 0.051] (N: 383; S: 38%)
		Industry entry (0.051, 0.053] (N: 223; S: 47%)
		Industry entry > 0.053 (N: 624; S: 34%)
	Total assets (94.152, 184.564] (N: 508; S: 52%)	Industry growth <= -0.143 (N: 144; S: 37%)
		Industry growth (-0.143, -0.077] (N: 155; S: 50%)
		Industry growth > -0.077 (N: 209; S: 63%)
	Total assets > 184.564 (N: 515; S: 63%)	Industry growth <= -0.143 (N: 165; S: 62%)
		Industry growth (-0.143, -0.077] (N: 157; S: 51%)
		Industry growth > -0.077 (N: 193; S: 75%)
ROA (-0.137, 0.001] (N: 4728; S: 51%)	Total assets <= 47.914 (N: 1065; S: 38%)	Indebtedness <= 0.698 (N: 308; S: 27%)
		Indebtedness (0.698, 0.832] (N: 104; S: 46%)
		Indebtedness (0.832, 0.905] (N: 111; S: 62%)
		Indebtedness > 0.905 (N: 542; S: 37%)
	Total assets (47.914, 94.152] (N: 912; S: 47%)	Industry concentration <= 0.787 (N: 180; S: 46%)
		Industry concentration (0.787, 0.796] (N: 256; S: 34%)
		Industry concentration > 0.796 (N: 476; S: 54%)
	Total assets > 94.152 (N: 2751; S: 57%)	Liquidity <= 0.332 (N: 140; S: 60%)
		Liquidity (0.332, 0.587] (N: 184; S: 73%)
		Liquidity (0.587, 0.789] (N: 274; S: 62%)
		Liquidity (0.789, 1.022] (N: 898; S: 0,55)
		Liquidity (1.022, 1.105] (N: 262; S: 41%)
		Liquidity (1.105, 1.281] (N: 259; S: 51%)
		Liquidity > 1.281 (N: 734; S: 60%)
ROA (0.001, 0.033] (N: 4725; S: 59%)	Indebtedness <= 0.832 (N: 972; S: 69%)	Total assets <= 31.025 (N: 188; S: 44%)
		Total assets (31.025, 94.152] (N: 155; S: 91%)
		Total assets (94.152, 284.418] (N: 312; S: 66%)
		Total assets (284.418, 561.880] (N: 138; S: 85%)
		Total assets > 561.880 (N: 179; S: 69%)
	Indebtedness (0.832, 0.905] (N: 653; S: 52%)	Liquidity <= 1.022 (N: 243; S: 40%)
		Liquidity > 1.022 (N: 410; S: 59%)
	Indebtedness (0.905, 1.047] (N: 2906; S: 58%)	Total assets <= 184.564 (N: 1454; S: 54%)
		Total assets (184.564, 561.880] (N: 874; S: 66%)
		Total assets > 561.880 (N: 578; S: 58%)
	Indebtedness > 1.047 (N: 194; S: 42%)	

ROA (0.033, 0.193] (N: 4731; S: 63%)	Total assets <= 15.385 (N: 252; S: 44%)	
	Total assets (15.385, 67.859] (N: 1355; S: 53%)	Liquidity <= 0.940 (N: 301; S: 49%)
		Liquidity (0.940, 1.105] (N: 237; S: 65%)
		Liquidity (1.105, 1.281] (N: 332; S: 49%)
		Liquidity (1.281, 2.821] (N: 299; S: 65%)
		Liquidity > 2.821 (N: 186; S: 32%)
	Total assets (67.859, 94.152] (N: 446; S: 64%)	Industry concentration <= 0.821 (N: 287; S: 56%)
		Industry concentration > 0.821 (N: 159; S: 78%)
	Total assets (94.152, 130.363] (N: 453; S: 74%)	Liquidity <= 1.022 (N: 153; S: 59%)
		Liquidity (1.022, 1.281] (N: 142; S: 90%)
		Liquidity > 1.281 (N: 158; S: 73%)
	Total assets (130.363, 184.564] (N: 554; S: 62%)	Indebtedness <= 0.832 (N: 171; S: 80%)
		Indebtedness > 0.832 (N: 383; S: 54%)
	Total assets (184.564, 561.880] (N: 1169; S: 67%)	ROA <= 0.077 (N: 660; S: 61%)
		ROA > 0.077 (N: 509; S: 75%)
	Total assets > 561.880 (N: 502; S: 79%)	Indebtedness <= 0.698 (N: 116; S: 64%)
		Indebtedness > 0.698 (N: 386; S: 84%)
ROA > 0.193 (N: 2363; S: 60%)	Liquidity <= 0.940 (N: 360; S: 44%)	Industry concentration <= 0.796 (N: 176; S: 36%)
		Industry concentration > 0.796 (N: 184; S: 51%)
	Liquidity (0.940, 2.821] (N: 1399; S: 69%)	Total assets <= 31.025 (N: 253; S: 67%)
		Total assets (31.025, 47.914] (N: 180; S: 53%)
		Total assets (47.914, 130.363] (N: 469; S: 63%)
		Total assets > 130.363 (N: 497; S: 82%)
	Liquidity > 2.821 (N: 604; S: 49%)	Total assets <= 47.914 (N: 306; S: 38%)
		Total assets > 47.914 (N: 298; S: 60%)

Table A6-8. Success prediction of distributive industry at age 1 with adjusted variables (percent correct: 63.1%; N: 23638)

Adjusted ROA <= -0.763 (N: 2361; S: 26%)	Adjusted liquidity <= 0.268 (N: 1248; S: 23%)	Adjusted total assets <= 0.049 (N: 675; S: 18%)
		Adjusted total assets (0.049, 0.148] (N: 336; S: 31%)
		Adjusted total assets > 0.148 (N: 237; S: 23%)
	Adjusted liquidity (0.268, 0.485] (N: 569; S: 34%)	Industry entry <= 0.053 (N: 279; S: 42%)
		Industry entry (0.053, 0.058] (N: 163; S: 18%)
		Industry entry > 0.058 (N: 127; S: 34%)
	Adjusted liquidity (0.485, 1.045] (N: 361; S: 22%)	Adjusted indebtedness <= 1.579 (N: 202; S: 17%)
		Adjusted indebtedness > 1.579 (N: 159; S: 30%)
	Adjusted liquidity > 1.045 (N: 183; S: 31%)	
Adjusted ROA (-0.763, -0.332] (N: 2366; S: 37%)	Adjusted indebtedness <= 0.611 (N: 141; S: 40%)	
	Adjusted indebtedness (0.611, 1.060] (N: 140; S: 60%)	
	Adjusted indebtedness (1.060, 1.289] (N: 181; S: 34%)	
	Adjusted indebtedness (1.289, 1.579] (N: 345; S: 43%)	Industry entry <= 0.058 (N: 205; S: 52%)
		Industry entry > 0.058 (N: 140; S: 30%)
	Adjusted indebtedness > 1.579 (N: 1559; S: 33%)	Adjusted total assets <= 0.097 (N: 427; S: 23%)
		Adjusted total assets (0.097, 0.304] (N: 568; S: 38%)
		Adjusted total assets (0.304, 0.431] (N: 189; S: 30%)
		Adjusted total assets > 0.431 (N: 375; S: 38%)
Adjusted ROA (-0.332, -0.142] (N: 2368; S: 47%)	Adjusted total assets <= 0.049 (N: 131; S: 52%)	
	Adjusted total assets (0.049, 0.097] (N: 243; S: 40%)	Industry concentration <= 0.821 (N: 133; S: 47%)
		Industry concentration > 0.821 (N: 110; S: 30%)
	Adjusted total assets (0.097, 0.148] (N: 267; S: 29%)	
	Adjusted total assets (0.148, 0.213] (N: 297; S: 39%)	Industry entry <= 0.053 (N: 151; S: 49%)
		Industry entry > 0.053 (N: 146; S: 28%)
	Adjusted total assets (0.213, 0.304] (N: 267; S: 50%)	
	Adjusted total assets (0.304, 0.431] (N: 321; S: 41%)	
	Adjusted total assets (0.431, 1.699] (N: 684; S: 57%)	Adjusted indebtedness <= 1.289 (N: 207; S: 56%)
		Adjusted indebtedness (1.289, 1.579] (N: 295; S: 64%)
		Adjusted indebtedness > 1.579 (N: 182; S: 46%)
	Adjusted total assets > 1.699 (N: 158; S: 69%)	
Adjusted ROA (-0.142, -0.007] (N: 4725; S: 50%)	Adjusted total assets <= 0.213 (N: 1514; S: 39%)	Adjusted indebtedness <= 0.611 (N: 232; S: 25%)
		Adjusted indebtedness > 0.611 (N: 1282; S: 41%)
	Adjusted total assets (0.213, 0.913] (N: 1952; S: 54%)	Group membership = 0 (N: 1442; S: 53%)
		Group membership = 1 (N: 510; S: 59%)
	Adjusted total assets (0.913, 1.699] (N: 588; S: 61%)	Adjusted liquidity <= 0.641 (N: 142; S: 80%)
		Adjusted liquidity > 0.641 (N: 446; S: 54%)
	Adjusted total assets > 1.699 (N: 671; S: 55%)	Group membership = 0 (N: 467; S: 46%)
		Group membership = 1 (N: 204; S: 76%)

Adjusted ROA (-0.007, 0.026] (N: 4729; S: 59%)	Adjusted total assets <= 0.049 (N: 121; S: 42%)	
	Adjusted total assets (0.049, 0.097] (N: 248; S: 55%)	
	Adjusted total assets (0.097, 0.148] (N: 308; S: 43%)	
	Adjusted total assets (0.148, 0.913] (N: 2650; S: 57%)	Adjusted indebtedness <= 0.895 (N: 271; S: 72%) Adjusted indebtedness (0.895, 1.149] (N: 627; S: 63%) Adjusted indebtedness (1.149, 1.355] (N: 1596; S: 53%) Adjusted indebtedness > 1.355 (N: 156; S: 46%)
	Adjusted total assets (0.913, 1.699] (N: 629; S: 76%)	Adjusted indebtedness <= 1.060 (N: 130; S: 84%) Adjusted indebtedness (1.060, 1,149] (N: 109; S: 55%) Adjusted indebtedness (1.149, 1.211] (N: 138; S: 95%) Adjusted indebtedness > 1.211 (N: 252; S: 69%)
	Adjusted total assets > 1.699 (N: 773; S: 64%)	Industry growth <= -0.143 (N: 268; S: 53%) Industry growth (-0.143, -0.077] (N: 140; S: 80%) Industry growth > -0.077 (N: 365; S: 65%)
Adjusted ROA (0.026, 0.186] (N: 4728; S: 63%)	Adjusted total assets <= 0.148 (N: 1132; S: 50%)	Adjusted indebtedness <= 0.895 (N: 421; S: 48%) Adjusted indebtedness (0.895, 1.355] (N: 608; S: 55%) Adjusted indebtedness > 1.355 (N: 103; S: 25%)
	Adjusted total assets (0.148, 0.213] (N: 461; S: 57%)	Adjusted liquidity <= 1.045 (N: 273; S: 67%) Adjusted liquidity > 1.045 (N: 188; S: 44%)
	Adjusted total assets (0.213, 0.431] (N: 1024; S: 64%)	
	Adjusted total assets (0.431, 0.611] (N: 466; S: 77%)	Industry growth <= -0.143 (N: 129; S: 84%) Industry growth (-0.143, 0.019] (N: 136; S: 69%) Industry growth (0.019, 0.028] (N: 100; S: 86%) Industry growth > 0.028 (N: 101; S: 72%)
	Adjusted total assets (0.611, 1.699] (N: 1151; S: 64%)	Industry concentration <= 0.787 (N: 249; S: 69%) Industry concentration (0.787, 0.821] (N: 413; S: 56%) Industry concentration > 0.821 (N: 489; S: 69%)
	Adjusted total assets > 1.699 (N: 494; S: 80%)	Adjusted ROA <= 0.070 (N: 307; S: 75%) Adjusted ROA > 0.070 (N: 187; S: 89%)
Adjusted ROA > 0.186 (N: 2361; S: 60%)	Adjusted total assets <= 0.049 (N: 361; S: 46%)	Adjusted liquidity <= 2.278 (N: 182; S: 58%) Adjusted liquidity > 2.278 (N: 179; S: 34%)
	Adjusted total assets (0.049, 0.148] (N: 615; S: 54%)	Adjusted liquidity <= 0.817 (N: 129; S: 46%) Adjusted liquidity (0.817, 1.329] (N: 174; S: 68%) Adjusted liquidity > 1.329 (N: 312; S: 51%)
	Adjusted total assets (0.148, 0.213] (N: 301; S: 47%)	Industry entry <= 0.053 (N: 146; S: 38%) Industry entry > 0.053 (N: 155; S: 55%)
	Adjusted total assets (0.213, 0.304] (N: 286; S: 58%)	
	Adjusted total assets > 0.304 (N: 798; S: 76%)	Industry growth <= -0.143 (N: 267; S: 69%) Industry growth (-0.143, -0.077] (N: 133; S: 95%) Industry growth > -0.077 (N: 398; S: 75%)

Table A6-9. Success prediction of distributive industry at age 2 with original variables (percent correct: 65.8%; N: 21428)

ROA <= -0.621 (N: 2142; S: 21%)	Liquidity <= 0.278 (N: 1156; S: 15%)	Group membership = 0 (N: 899; S: 13%)
		Group membership = 1 (N: 257; S: 24%)
	Liquidity (0.278, 0.914] (N: 732; S: 25%)	Total assets <= 38.735 (N: 327; S: 19%)
		Total assets > 38.735 (N: 405; S: 31%)
	Liquidity > 0.914 (N: 254; S: 31%)	Industry entry <= 0.056 (N: 107; S: 21%)
		Industry entry > 0.056 (N: 147; S: 38%)
ROA (-0.621, -0.281] (N: 2143; S: 32%)	Indebtedness <= 0.441 (N: 151; S: 21%)	
	Indebtedness (0.441, 0.989] (N: 321; S: 37%)	Industry growth <= 0.004 (N: 151; S: 21%)
		Industry growth > 0.004 (N: 170; S: 51%)
	Indebtedness (0.989, 1.297] (N: 566; S: 27%)	
	Indebtedness (1.297, 1.936] (N: 754; S: 39%)	Industry concentration <= 0.804 (N: 290; S: 32%)
		Industry concentration > 0.804 (N: 464; S: 43%)
	Indebtedness > 1.936 (N: 351; S: 26%)	Industry concentration <= 0.804 (N: 134; S: 22%)
		Industry concentration (0.804, 0.855] (N: 105; S: 40%)
		Industry concentration > 0.855 (N: 112; S: 19%)
ROA (-0.281, -0.127] (N: 2143; S: 39%)	Group membership = 0 (N: 1569; S: 36%)	Liquidity <= 0.278 (N: 193; S: 24%)
		Liquidity (0.278, 0.751] (N: 508; S: 41%)
		Liquidity (0.751, 3.026] (N: 730; S: 38%)
		Liquidity > 3.026 (N: 138; S: 29%)
	Group membership = 1 (N: 574; S: 45%)	
ROA (-0.127, -0.036] (N: 2144; S: 43%)	Indebtedness <= 0.441 (N: 151; S: 44%)	
	Indebtedness (0.441, 0.989] (N: 754; S: 55%)	Industry concentration <= 0.821 (N: 384; S: 47%)
		Industry concentration > 0.821 (N: 370; S: 64%)
	Indebtedness (0.989, 1.095] (N: 502; S: 40%)	Liquidity <= 0.914 (N: 193; S: 53%)
		Liquidity (0.914, 1.129] (N: 194; S: 28%)
		Liquidity > 1.129 (N: 115; S: 39%)
	Indebtedness > 1.095 (N: 737; S: 33%)	
ROA (-0.036, 0.003] (N: 2143; S: 49%)	Total assets <= 19.382 (N: 103; S: 18%)	
	Total assets (19.382, 87.360] (N: 485; S: 42%)	
	Total assets (87.360, 235.191] (N: 649; S: 50%)	Liquidity <= 0.532 (N: 109; S: 36%)
		Liquidity (0.532, 0.914] (N: 125; S: 66%)
		Liquidity (0.914, 1.129] (N: 182; S: 42%)
		Liquidity (1.129, 1.696] (N: 111; S: 62%)
		Liquidity > 1.696 (N: 122; S: 48%)
	Total assets (235.191, 349.218] (N: 256; S: 62%)	Industry entry <= 0.058 (N: 124; S: 72%)
		Industry entry > 0.058 (N: 132; S: 52%)
	Total assets (349.218, 694.248] (N: 342; S: 43%)	Industry concentration <= 0.821 (N: 217; S: 32%)
		Industry concentration > 0.821 (N: 125; S: 61%)
	Total assets > 694.248 (N: 308; S: 64%)	Indebtedness <= 0.989 (N: 179; S: 73%)

		Indebtedness > 0.989 (N: 129; S: 51%)
ROA (0.003, 0.014] (N: 2141; S: 60%)	Liquidity <= 0.532 (N: 138; S: 44%)	
	Liquidity (0.532, 0.914] (N: 295; S: 72%)	Group membership = 0 (N: 176; S: 80%) Group membership = 1 (N: 119; S: 59%)
	Liquidity (0.914, 1.019] (N: 444; S: 53%)	Total assets <= 163.794 (N: 152; S: 40%) Total assets > 163.794 (N: 292; S: 59%)
	Liquidity (1.019, 1.129] (N: 374; S: 63%)	Industry growth <= 0.028 (N: 261; S: 57%) Industry growth > 0.028 (N: 113; S: 75%)
	Liquidity (1.129, 1.318] (N: 315; S: 51%)	Indebtedness <= 0.897 (N: 149; S: 62%) Indebtedness > 0.897 (N: 166; S: 41%)
	Liquidity > 1.318 (N: 575; S: 68%)	Indebtedness <= 0.687 (N: 181; S: 77%) Indebtedness (0.687, 0.897] (N: 154; S: 50%) Indebtedness > 0.897 (N: 240; S: 74%)
ROA (0.014, 0.034] (N: 2146; S: 64%)	Indebtedness <= 0.441 (N: 140; S: 50%)	
	Indebtedness (0.441, 0.687] (N: 159; S: 78%)	
	Indebtedness (0.687, 0.950] (N: 1187; S: 63%)	Total assets <= 87.360 (N: 302; S: 68%) Total assets (87.360, 349.218] (N: 607; S: 56%) Total assets (349.218, 694.248] (N: 156; S: 69% Total assets > 694.248 (N: 122; S: 83%)
	Indebtedness (0.950, 0.989] (N: 363; S: 75%)	Group membership = 0 (N: 252; S: 69%) Group membership = 1 (N: 111; S: 87%)
	Indebtedness (0.989, 1.095] (N: 154; S: 59%)	
	Indebtedness > 1.095 (N: 143; S: 41%)	
ROA (0.034, 0.072] (N: 2140; S: 58%)	Total assets <= 19.382 (N: 111; S: 31%)	
	Total assets (19.382, 61.593] (N: 376; S: 48%)	
	Total assets (61.593, 120.205] (N: 410; S: 61%)	
	Total assets (120.205, 163.794] (N: 255; S: 48%)	Industry concentration <= 0.804 (N: 147; S: 38%) Industry concentration > 0.804 (N: 108; S: 61%)
	Total assets (163.794, 349.218] (N: 483; S: 62%)	Liquidity <= 0.914 (N: 136; S: 49%) Liquidity (0.914, 1.318] (N: 195; S: 71%) Liquidity > 1.318 (N: 152; S: 63%)
	Total assets (349.218, 694.248] (N: 216; S: 77%)	Industry growth <= 0.026 (N: 103; S: 86%) Industry growth > 0.026 (N: 113; S: 69%)
	Total assets > 694.248 (N: 289; S: 69%)	Industry concentration <= 0.804 (N: 179; S: 80%) Industry concentration > 0.804 (N: 110; S: 49%)
ROA (0.072, 0.181] (N: 2144; S: 63%)	Total assets <= 19.382 (N: 187; S: 36%)	
	Total assets (19.382, 61.593] (N: 351; S: 64%)	
	Total assets (61.593, 120.205] (N: 481; S: 51%)	Industry concentration <= 0.821 (N: 211; S: 67%) Industry concentration > 0.821 (N: 270; S: 38%)
	Total assets (120.205, 694.248] (N: 885; S: 70%)	Indebtedness <= 0.950 (N: 768; S: 74%) Indebtedness > 0.950 (N: 117; S: 46%)

	Total assets > 694.248 (N: 240; S: 80%)	Group membership = 0 (N: 127; S: 67%) Group membership = 1 (N: 113; S: 94%)
ROA > 0.181 (N: 2142; S: 55%)	Total assets <= 19.382 (N: 423; S: 30%)	
	Total assets (19.382, 38.735] (N: 305; S: 47%)	
	Total assets (38.735, 61.593] (N: 213; S: 64%)	Industry entry <= 0.058 (N: 109; S: 74%) Industry entry > 0.058 (N: 104; S: 53%)
	Total assets (61.593, 87.360] (N: 254; S: 50%)	
	Total assets (87.360, 163.794] (N: 332; S: 62%)	Group membership = 0 (N: 205; S: 69%) Group membership = 1 (N: 127; S: 50%)
	Total assets (163.794, 694.248] (N: 456; S: 74%)	
	Total assets > 694.248 (N: 159; S: 65%)	

Table A6-10. Success prediction of distributive industry at age 2 with adjusted variables (percent correct: 65.8%; N: 21428)

Adjusted ROA <= -0.626 (N: 2142; S: 21%)	Adjusted indebtedness <= 1.419 (N: 263; S: 25%)	Industry concentration <= 0.804 (N: 146; S: 18%) Industry concentration > 0.804 (N: 117; S: 34%)
	Adjusted indebtedness (1.419, 2.483] (N: 386; S: 33%)	Industry concentration in year <= 0.825 (N: 153; S: 45%) Industry concentration in year > 0.825 (N: 233; S: 25%)
	Adjusted indebtedness > 2.483 (N: 1493; S: 17%)	Group membership = 0 (N: 1130; S: 15%) Group membership = 1 (N: 363; S: 21%)
Adjusted ROA (-0.626, -0.286] (N: 2140; S: 32%)	Adjusted indebtedness <= 0.572 (N: 152; S: 22%)	
	Adjusted indebtedness (0.572, 1.670] (N: 910; S: 30%)	Adjusted liquidity <= 0.603 (N: 421; S: 25%) Adjusted liquidity > 0.603 (N: 489; S: 34%)
	Adjusted indebtedness (1.670, 2.483] (N: 754; S: 39%)	Industry concentration <= 0.804 (N: 341; S: 32%) Industry concentration > 0.804 (N: 413; S: 44%)
	Adjusted indebtedness > 2.483 (N: 324; S: 27%)	
Adjusted ROA (-0.286, -0.131] (N: 2143; S: 39%)	Adjusted indebtedness <= 1.152 (N: 511; S: 41%)	Adjusted total assets <= 0.287 (N: 216; S: 32%) Adjusted total assets > 0.287 (N: 295; S: 48%)
	Adjusted indebtedness (1.152, 1.419] (N: 415; S: 53%)	Adjusted total assets <= 0.287 (N: 116; S: 64%) Adjusted total assets (0.287, 0.746] (N: 196; S: 36%) Adjusted total assets > 0.746 (N: 103; S: 73%)
	Adjusted indebtedness (1.419, 2.483] (N: 1094; S: 35%)	Adjusted liquidity <= 0.229 (N: 166; S: 24%) Adjusted liquidity (0.229, 0.437] (N: 148; S: 48%) Adjusted liquidity (0.437, 0.603] (N: 385; S: 29%) Adjusted liquidity > 0.603 (N: 395; S: 42%)
	Adjusted indebtedness > 2.483 (N: 123; S: 20%)	
Adjusted ROA (-0.131, -0.041] (N: 2145; S: 43%)	Adjusted indebtedness <= 0.572 (N: 172; S: 43%)	
	Adjusted indebtedness (0.572, 1.052] (N: 326; S: 55%)	Adjusted total assets <= 0.544 (N: 175; S: 44%) Adjusted total assets > 0.544 (N: 151; S: 68%)
	Adjusted indebtedness (1.052, 1.152] (N: 158; S: 65%)	
	Adjusted indebtedness (1.152, 1.419] (N: 733; S: 44%)	Adjusted total assets <= 0.544 (N: 315; S: 44%) Adjusted total assets (0.544, 0.746] (N: 128; S: 29%) Adjusted total assets > 0.746 (N: 290; S: 49%)
	Adjusted indebtedness > 1.419 (N: 756; S: 33%)	Adjusted total assets <= 0.287 (N: 200; S: 37%) Adjusted total assets (0.287, 0.544] (N: 219; S: 23%) Adjusted total assets (0.544, 1.114] (N: 190; S: 30%) Adjusted total assets > 1.114 (N: 147; S: 48%)
Adjusted ROA (-0.041, -0.003] (N: 2144; S: 49%)	Adjusted total assets <= 0.059 (N: 110; S: 24%)	
	Adjusted total assets (0.059, 0.396] (N: 725; S: 40%)	Industry entry <= 0.056 (N: 317; S: 34%) Industry entry > 0.056 (N: 408; S: 45%)
	Adjusted total assets (0.396, 0.746] (N: 417; S: 56%)	
	Adjusted total assets (0.746, 1.114] (N: 330; S: 43%)	Industry concentration <= 0.804 (N: 188; S: 33%) Industry concentration > 0.804 (N: 142; S: 56%)

	Adjusted total assets > 1.114 (N: 562; S: 65%)	Adjusted indebtedness <= 1.052 (N: 114; S: 88%) Adjusted indebtedness > 1.052 (N: 448; S: 59%)
Adjusted ROA (-0.003, 0.008] (N: 2143; S: 60%)	Adjusted liquidity <= 0.730 (N: 480; S: 65%)	Adjusted total assets <= 0.544 (N: 210; S: 53%) Adjusted total assets > 0.544 (N: 270; S: 74%)
	Adjusted liquidity (0.730, 0.903] (N: 781; S: 52%)	Adjusted total assets <= 2.053 (N: 661; S: 49%) Adjusted total assets > 2.053 (N: 120; S: 71%)
	Adjusted liquidity (0.903, 1.367] (N: 492; S: 62%)	Adjusted indebtedness <= 1.152 (N: 250; S: 69%) Adjusted indebtedness (1.152, 1.222] (N: 138; S: 44%) Adjusted indebtedness > 1.222 (N: 104; S: 66%)
	Adjusted liquidity (1.367, 2.427] (N: 223; S: 72%)	
	Adjusted liquidity > 2.427 (N: 167; S: 58%)	
Adjusted ROA (0.008, 0.028] (N: 2143; S: 63%)	Industry growth <= -0.075 (N: 143; S: 46%)	
	Industry growth (-0.075, 0.028] (N: 1500; S: 66%)	Group membership = 0 (N: 1081; S: 63%) Group membership = 1 (N: 419; S: 75%)
	Industry growth > 0.028 (N: 500; S: 59%)	Adjusted total assets <= 0.287 (N: 130; S: 62%) Adjusted total assets (0.287, 0.746] (N: 195; S: 46%) Adjusted total assets > 0.746 (N: 175; S: 72%)
Adjusted ROA (0.028, 0.066] (N: 2146; S: 58%)	Adjusted total assets <= 0.059 (N: 112; S: 25%)	
	Adjusted total assets (0.059, 0.195] (N: 380; S: 52%)	Adjusted liquidity <= 1.367 (N: 268; S: 58%) Adjusted liquidity > 1.367 (N: 112; S: 38%)
	Adjusted total assets (0.195, 0.287] (N: 233; S: 43%)	
	Adjusted total assets (0.287, 0.746] (N: 684; S: 60%)	Adjusted indebtedness <= 1.0527 (N: 192; S: 78%) Adjusted indebtedness > 1.0527 (N: 492; S: 53%)
	Adjusted total assets > 0.746 (N: 737; S: 70%)	Industry growth <= 0.019 (N: 250; S: 69%) Industry growth (0.019, 0.026] (N: 130; S: 89%) Industry growth (0.026, 0.028] (N: 199; S: 54%) Industry growth > 0.028 (N: 158; S: 73%)
Adjusted ROA (0.066, 0.175] (N: 2137; S: 63%)	Adjusted liquidity <= 0.603 (N: 237; S: 59%)	Adjusted indebtedness <= 1.313 (N: 118; S: 70%) Adjusted indebtedness > 1.313 (N: 119; S: 47%)
	Adjusted liquidity (0.603, 0.730] (N: 158; S: 42%)	
	Adjusted liquidity (0.730, 0.811] (N: 143; S: 71%)	
	Adjusted liquidity (0.811, 0.903] (N: 286; S: 56%)	Industry concentration <= 0.821 (N: 172; S: 72%) Industry concentration > 0.821 (N: 114; S: 32%)
	Adjusted liquidity (0.903, 1.060] (N: 373; S: 77%)	Adjusted total assets <= 0.396 (N: 142; S: 80%) Adjusted total assets (0.396, 0.746] (N: 117; S: 58%) Adjusted total assets > 0.746 (N: 114; S: 94%)
	Adjusted liquidity (1.060, 1.367] (N: 418; S: 63%)	Industry entry <= 0.058 (N: 275; S: 72%) Industry entry > 0.058 (N: 143; S: 46%)
	Adjusted liquidity (1.367, 2.427] (N: 285; S: 78%)	Adjusted total assets <= 0.544 (N: 182; S: 69%) Adjusted total assets > 0.544 (N: 103; S: 93%)
	Adjusted liquidity > 2.427 (N: 237; S: 47%)	

Adjusted ROA > 0.175 (N: 2145; S: 55%)	Adjusted total assets <= 0.059 (N: 437; S: 28%)	Adjusted indebtedness <= 0.572 (N: 214; S: 25%)
		Adjusted indebtedness (0.572, 1.313] (N: 109; S: 42%)
		Adjusted indebtedness > 1.313 (N: 114; S: 20%)
	Adjusted total assets (0.059, 0.287] (N: 829; S: 53%)	Adjusted indebtedness <= 1.222 (N: 637; S: 57%)
		Adjusted indebtedness > 1.222 (N: 192; S: 38%)
	Adjusted total assets (0.287, 0.544] (N: 334; S: 66%)	Group membership = 0 (N: 206; S: 73%)
		Group membership = 1 (N: 128; S: 56%)
	Adjusted total assets (0.544, 1.114] (N: 227; S: 81%)	Industry concentration <= 0.821 (N: 111; S: 94%)
		Industry concentration > 0.821 (N: 116; S: 70%)
	Adjusted total assets > 1.114 (N: 318; S: 67%)	Adjusted indebtedness <= 0.572 (N: 101; S: 79%)
		Adjusted indebtedness > 0.572 (N: 217; S: 61%)

Table A6-11. Success prediction of distributive industry at age 3 with original variables (percent correct: 67.9%; N: 17323)

ROA <= -0.591 (N: 1732; S: 19%)	Industry growth <= -0.075 (N: 145; S: 30%)	
	Industry growth (-0.075, -0.025] (N: 794; S: 15%)	
	Industry growth > -0.025 (N: 793; S: 21%)	Total assets <= 23.230 (N: 302; S: 15%)
		Total assets > 23.230 (N: 491; S: 24%)
ROA (-0.591, -0.269] (N: 1730; S: 33%)	Group membership = 0 (N: 1316; S: 30%)	Industry entry <= 0.057 (N: 731; S: 26%)
		Industry entry > 0.057 (N: 585; S: 34%)
	Group membership = 1 (N: 414; S: 45%)	Total assets <= 69.590 (N: 127; S: 62%)
		Total assets (69.590, 137.488] (N: 136; S: 29%)
		Total assets > 137.488 (N: 151; S: 44%)
ROA (-0.269, -0.044] (N: 3467; S: 41%)	Indebtedness <= 0.426 (N: 300; S: 32%)	Total assets <= 137.488 (N: 200; S: 22%)
		Total assets > 137.488 (N: 100; S: 52%)
	Indebtedness (0.426, 0.658] (N: 212; S: 60%)	ROA <= -0.128 (N: 109; S: 50%)
		ROA > -0.128 (N: 103; S: 71%)
	Indebtedness (0.658, 0.987] (N: 878; S: 49%)	Group membership = 0 (N: 640; S: 45%)
		Group membership = 1 (N: 238; S: 62%)
	Indebtedness (0.987, 1.098] (N: 592; S: 43%)	Liquidity <= 0.917 (N: 280; S: 51%)
		Liquidity > 0.917 (N: 312; S: 37%)
	Indebtedness > 1.098 (N: 1485; S: 35%)	Liquidity <= 0.543 (N: 481; S: 41%)
		Liquidity (0.543, 0.917] (N: 730; S: 28%)
		Liquidity > 0.917 (N: 274; S: 43%)
ROA (-0.044, -0.0004] (N: 1732; S: 46%)	Total assets <= 23.230 (N: 116; S: 12%)	
	Total assets (23.230, 100.560] (N: 373; S: 49%)	Indebtedness <= 0.879 (N: 109; S: 67%)
		Indebtedness > 0.879 (N: 264; S: 41%)
	Total assets (100.560, 137.488] (N: 226; S: 34%)	
	Total assets (137.488, 828.877] (N: 823; S: 48%)	Indebtedness <= 0.987 (N: 415; S: 58%)
		Indebtedness > 0.987 (N: 408; S: 38%)
	Total assets > 828.877 (N: 194; S: 63%)	

ROA (-0.0004, 0.025] (N: 3465; S: 63%)	Total assets <= 23.230 (N: 111; S: 30%)	
	Total assets (23.230, 42.654] (N: 146; S: 42%)	
	Total assets (42.654, 194.508] (N: 1225; S: 60%)	Industry entry <= 0.039 (N: 150; S: 68%) Industry entry (0.039, 0.058] (N: 824; S: 57%) Industry entry > 0.058 (N: 251; S: 67%)
	Total assets (194.508, 424.394] (N: 964; S: 65%)	Industry entry <= 0.056 (N: 381; S: 57%) Industry entry (0.056, 0.058] (N: 413; S: 67%) Industry entry > 0.058 (N: 170; S: 75%)
	Total assets > 424.394 (N: 1019; S: 73%)	Indebtedness <= 0.658 (N: 130; S: 86%) Indebtedness (0.658, 0.879] (N: 262; S: 73%) Indebtedness (0.879, 0.939] (N: 202; S: 61%) Indebtedness > 0.939 (N: 425; S: 75%)
ROA (0.025, 0.058] (N: 1733; S: 68%)	Indebtedness <= 0.426 (N: 130; S: 54%)	
	Indebtedness (0.426, 0.788] (N: 463; S: 69%)	Total assets <= 2740.775 (N: 321; S: 63%) Total assets > 2740.775 (N: 142; S: 83%)
	Indebtedness (0.788, 0.879] (N: 353; S: 78%)	
	Indebtedness (0.879, 0.939] (N: 382; S: 70%)	Group membership = 0 (N: 264; S: 66%) Group membership = 1 (N: 118; S: 80%)
	Indebtedness (0.939, 0.987] (N: 144; S: 79%)	
	Indebtedness > 0.987 (N: 261; S: 54%)	Liquidity <= 0.752 (N: 107; S: 66%) Liquidity > 0.752 (N: 154; S: 45%)
ROA > 0.058 (N: 3464; S: 65%)	Total assets <= 23.230 (N: 420; S: 33%)	Group membership = 0 (N: 313; S: 29%) Group membership = 1 (N: 107; S: 44%)
	Total assets (23.230, 42.654] (N: 399; S: 46%)	Industry entry <= 0.056 (N: 118; S: 59%) Industry entry (0.056, 0.057] (N: 119; S: 29%) Industry entry > 0.057 (N: 162; S: 48%)
	Total assets (42.654, 100.560] (N: 713; S: 60%)	Industry concentration <= 0.804 (N: 190; S: 62%) Industry concentration (0.804, 0.813] (N: 234; S: 46%) Industry concentration (0.813, 0.862] (N: 147; S: 84%) Industry concentration > 0.862 (N: 142; S: 54%)
	Total assets > 100.560 (N: 1932; S: 78%)	Indebtedness <= 0.788 (N: 1262; S: 81%) Indebtedness (0.788, 0.879] (N: 267; S: 91%) Indebtedness > 0.879 (N: 403; S: 58%)

Table A6-12. Success prediction of distributive industry at age 3 with adjusted variables (percent correct: 67.7%; N: 17323)

Adjusted ROA <= -0.594 (N: 1732; S: 19%)	Industry growth <= -0.075 (N: 144; S: 29%)	
	Industry growth (-0.075, -0.025] (N: 794; S: 15%)	Adjusted total assets <= 0.074 (N: 299; S: 10%)
		Adjusted total assets > 0.074 (N: 495; S: 18%)
	Industry growth > -0.025 (N: 794; S: 21%)	Adjusted total assets <= 0.074 (N: 296; S: 15%)
		Adjusted total assets > 0.074 (N: 498; S: 24%)
Adjusted ROA (-0.594, -0.273] (N: 1732; S: 33%)	Group membership = 0 (N: 1318; S: 30%)	Industry entry <= 0.057 (N: 741; S: 26%)
		Industry entry > 0.057 (N: 577; S: 34%)
	Group membership = 1 (N: 414; S: 45%)	Adjusted total assets <= 0.230 (N: 115; S: 58%)
		Adjusted total assets (0.230, 0.655] (N: 178; S: 36%)
		Adjusted total assets > 0.655 (N: 121; S: 45%)
Adjusted ROA (-0.273, -0.130] (N: 1731; S: 40%)	Adjusted total assets <= 0.074 (N: 141; S: 19%)	
	Adjusted total assets (0.074, 0.230] (N: 395; S: 36%)	
	Adjusted total assets (0.230, 0.655] (N: 599; S: 43%)	Group membership = 0 (N: 449; S: 40%)
		Group membership = 1 (N: 150; S: 52%)
	Adjusted total assets (0.655, 0.935] (N: 148; S: 59%)	
	Adjusted total assets (0.935, 2.643] (N: 283; S: 45%)	
	Adjusted total assets > 2.643 (N: 165; S: 35%)	
Adjusted ROA (-0.130, -0.006] (N: 3468; S: 44%)	Adjusted indebtedness <= 0.561 (N: 287; S: 39%)	Adjusted total assets <= 0.338 (N: 136; S: 25%)
		Adjusted total assets > 0.338 (N: 151; S: 52%)
	Adjusted indebtedness (0.561, 1.225] (N: 1163; S: 56%)	Adjusted liquidity <= 0.606 (N: 202; S: 50%)
		Adjusted liquidity (0.606, 1.445] (N: 738; S: 56%)
		Adjusted liquidity (1.445, 2.440] (N: 121; S: 80%)
		Adjusted liquidity > 2.440 (N: 102; S: 35%)
	Adjusted indebtedness (1.225, 1.760] (N: 1652; S: 40%)	Industry entry <= 0.057 (N: 1094; S: 41%)
		Industry entry (0.057, 0.058] (N: 224; S: 54%)
		Industry entry > 0.058 (N: 334; S: 28%)
	Adjusted indebtedness > 1.760 (N: 366; S: 26%)	Industry growth <= -0.025 (N: 210; S: 20%)
		Industry growth > -0.025 (N: 156; S: 35%)
Adjusted ROA (-0.006, 0.021] (N: 3463; S: 64%)	Adjusted total assets <= 0.147 (N: 253; S: 43%)	Adjusted indebtedness <= 1.027 (N: 115; S: 32%)
		Adjusted indebtedness > 1.027 (N: 138; S: 52%)

	Adjusted total assets (0.147, 0.230] (N: 243; S: 56%)	
	Adjusted total assets (0.230, 0.479] (N: 609; S: 65%)	Adjusted indebtedness <= 1.225 (N: 334; S: 71%)
		Adjusted indebtedness > 1.225 (N: 275; S: 56%)
	Adjusted total assets (0.479, 0.935] (N: 899; S: 59%)	Adjusted ROA <= 0.006 (N: 489; S: 53%)
		Adjusted ROA > 0.006 (N: 410; S: 65%)
	Adjusted total assets > 0.935 (N: 1459; S: 72%)	Adjusted indebtedness <= 1.027 (N: 313; S: 81%)
		Adjusted indebtedness (1.027, 1.225] (N: 601; S: 68%)
		Adjusted indebtedness (1.225, 1.320] (N: 192; S: 78%)
		Adjusted indebtedness > 1.320 (N: 353; S: 66%)
Adjusted ROA > 0.021 (N: 5197; S: 66%)	Adjusted total assets <= 0.074 (N: 492; S: 35%)	Group membership = 0 (N: 375; S: 31%)
		Group membership = 1 (N: 117; S: 49%)
	Adjusted total assets (0.074, 0.147] (N: 625; S: 48%)	Industry entry <= 0.056 (N: 233; S: 61%)
		Industry entry > 0.056 (N: 392; S: 40%)
	Adjusted total assets (0.147, 0.230] (N: 508; S: 60%)	Adjusted indebtedness <= 1.320 (N: 395; S: 67%)
		Adjusted indebtedness > 1.320 (N: 113; S: 36%)
	Adjusted total assets (0.230, 0.338] (N: 442; S: 73%)	Industry growth <= -0.025 (N: 259; S: 65%)
		Industry growth > -0.025 (N: 183; S: 84%)
	Adjusted total assets (0.338, 0.479] (N: 551; S: 63%)	Industry entry <= 0.056 (N: 168; S: 71%)
		Industry entry > 0.056 (N: 383; S: 59%)
	Adjusted total assets (0.479, 0.655] (N: 491; S: 74%)	Adjusted ROA <= 0.054 (N: 197; S: 63%)
		Adjusted ROA > 0.054 (N: 294; S: 82%)
	Adjusted total assets (0.655, 0.935] (N: 445; S: 82%)	Adjusted ROA <= 0.137 (N: 338; S: 77%)
		Adjusted ROA > 0.137 (N: 107; S: 100%)
	Adjusted total assets (0.935, 2.643] (N: 1088; S: 75%)	Industry concentration <= 0.813 (N: 454; S: 80%)
		Industry concentration > 0.813 (N: 634; S: 71%)
	Adjusted total assets > 2.643 (N: 555; S: 79%)	Group membership = 0 (N: 305; S: 72%)
		Group membership = 1 (N: 250; S: 88%)

Chapter 7

The study of the impacts of financial and accounting-based factors on profitability in high and low technology manufacturing sectors: evidence from food products sector and computer, electronic and optical products sector.

7.1 Background

High-tech firms play an important role in technology development and economic growth (Spatareanu, 2008). Previous literature already contributed much on financial studies of high and low technology industries — for example, the research of Madrid-Guijarro et al. (2011) on financial distress in high and low technology industries. Carpenter and Petersen (2002) point out some financing features of high-tech investment: skewness and uncertainty in returns, information asymmetries between firms and potential investors, and limitation in collateral value.

As Cabrero Bravo and Tiana Álvarez (2012) put it, compared to France and Germany the share of output of high or medium-high technology in Spain is lower, whereas the similarities in the productive structure of the food and beverages industry — as the leading industrial sector (excluding agriculture, construction, and service) in the weight of output in Spain — are obvious. Therefore, this thesis chooses food products sector and computer, electronic and optical products sector separately as the case sectors of high-technology and low-technology industries and tries to enrich the empirical studies from financial perspective on the profitability of new firms in high-technology and low-technology manufacturing industries in crisis period.

As pointed out by Raykov (2017), crisis (with the circumstance of falling sales and clients´s failure) makes the role of financial management (burdening company´s liquidity, solvency, and finally owners´ capital) more important for the economic growth and the development of companies; so the firms incorporated in recent crisis

period (2008 and 2009) are the studying targets here. In concrete, two sectors (food products sector and computer, electronic and optical products sector) are chosen separately as the case sectors of low-technology and high-technology manufacturing industries for comparing the differences in impacting factors (mainly financial and accounting-based factors) on profitability.

Here, it is necessary to introduce a new factor employed in this chapter — intangible assets. Intangible assets play an important role in modern knowledge economy (Arrighetti et al., 2014). As for high-technology enterprises, intangible assets occupy an important part (Elston and Audretsch, 2011). Guzić (2014) points out some features of intangible assets (which usually contain three categories — intellectual property, relations, and rights): on the one hand, intangibility, invisibility and immensity are the basic characteristics; on the other hand, intangible assets can also be depicted as no generally accepted meaning, no single definition in theory (sometimes being defined very broadly and sometimes very narrowly), and not being treated in the same way in practice.

7.2 Methodology

From SABI database, the firms incorporated in 2008 and 2009 are chosen for building the samples for manufacture of food products sector as the case sector of low technology industry and manufacture of computer, electronic and optical products sector as the case sector of high technology industry (sector 10 and 26 according to NACE Rev.2 2-digit level high-tech classification of manufacturing industries from Eurostat). Each firm in the sample is tracked for three years after the incorporation year (at age 1, age 2 and age 3) and must at least report operating revenues at age 1. Here, due to taking past profitability into consideration, the firms at age 3 should also report operating revenues at age 2. In order to enlarge sample size, the 2008 and 2009 cohorts are combined as a whole.

Most independent variables (shown in Table 7-1) are representative of financial and accounting-based factors, considering that financial ratios can reflect firm´s internal decisions and external conditions as well as managerial behavior and company fortunes (Voulgaris et al., 2000). Particularly, the ratios of debt, liquidity, and assets turnover are used by Barbosa and Louri (2005) as the proxies of financial risk and efficiency in asset management that are related to generating heterogeneity within industry; some other variables are also calculated on the basis of financial statements and financial data — firm size (based on total assets), market share (based on operating revenues), intangible assets, turnover growth, bank credit, trade credit, and previous profitability. Besides, group membership works here in the format of dichotomous variable to describe the ownership situation. Because only part of the firms report bank loans and intangible assets in their financial statements, these two are also built as dichotomous variable for identifying whether reporting bank loans and intangible assets.

Similar to the study of Tsipouri et al. (2016), here Stepwise Linear Regression is used; in particular, linear regressions are operated respectively on the data at age 1, 2, and 3 (1, 2 and 3 years after firm´s founding) and separately for the two industry sectors. Previous profitability and growth rate are only introduced in age 2 and 3 regressions, which means that the data at age 2 and 3 are regressed twice (one without previous profitability and growth rate and the other with these two added in).

Table 7-1: Variable definition

Variables	Definitions
Dependent variable	
Return on total assets (ROA)	Profits before tax/Total assets
Independent variables	
Solvency	Indebtedness: (Total shareholders funds and liabilities — Shareholders equity)/Total shareholders funds and liabilities
Liquidity	Current ratio: Current assets/Current liabilities
Efficiency	Asset rotation: Sales/Total assets; the reciprocal of asset rotation (total assets/sales) in regressions in order to reduce collinearity problem
Trade credit	Accounts receivable to total assets; accounts payable to total liabilities
Bank credit	Bank credit, equals 1 if the firm has bank loan showing in liability; equals 0 if the firm does not have bank loan.

Intangible assets	Intangible assets, equal 1 if the firm reports intangible assets in the financial statement; equal 0 if the firm does not report intangible assets in the financial statement.
Firm size	Total assets in thousands of Euros; Ln (1+Total assets in thousands of Euros) in the regressions
Market share	Firm´s operating revenues/The total amount of operating revenues in the industry sector where that firm is
Group membership	Membership in a group, equals 1 if the number of companies in corporate group is more than zero; equals 0 if the number of companies in corporate group is zero.
Growth	(Operating revenues in current year — Operating revenues one year before)/ Operating revenues one year before
Previous profitability	Return on total assets (ROA) one year before

7.3 Regression results

This section focuses on the statistically significant variables in the regressions (shown from Table A7-1 to Table A7-6 with the summary in Table A7-7). The first issue that should be noted is collinearity problem. With citing the results of Hair et al. (2010), Karabag and Berggren (2014) state that, for avoiding the multi-linearity problem, the variance inflation factor (VIF) of the variables should be lower than 10. Here all the VIF are far below 10, so there is no severe collinearity problem. Standardized coefficients can work for identifying the relative importance between statistically significant variables in one regression.

Indebtedness serves as a statistically significant and negative variable in all the models; it also shows the largest absolute value of standardized coefficient in every model, meaning most importance. Liquidity and the reciprocal of asset rotation are also negative variables in food products sector but they are only statistically significant in age 3 models. In computer, electronic and optical products sector, again they have negative effects when being statistically significant.

As for trade credit, accounts receivable and accounts payable separately have positive effect and negative effect when they are statistically significant in food products sector; by contrast, both receivables and payables are not statistically significant in computer, electronic and optical products sector. Intangible assets only show statistical significance in age 2 models (being negatively related to profitability) of computer, electronic and optical products sector.

It is interesting that market share (when being statistically significant) has negative effect in food products sector and positive effect in computer, electronic and optical products sector. As for the two added variables, previous ROA is statistically significant (with negative impact) only in food products sector, while growth (being a positive factor) only shows statistical significance in age 3 model in computer, electronic and optical products sector. Bank credit, total assets, and group membership are not statistically significant at all.

7.4 Summary of this chapter

Indebtedness is the strongest negative indicator, because it shows statistical significance in every model. This is in accord with the empirical studies of (for example) Pervan and Višić (2012) and Enqvist et al. (2014) showing negative relationship between indebtedness and profitability and, as stated by Denčić-Mihajlov (2014), indicates high costs of debt financing and high exposure to financial risk. The statistically significant negative impacts of liquidity and positive impacts of asset rotation (which is represented by the negative impact of the reciprocal of asset rotation in the regressions) tend to be observed more in high-technology sector. This stresses the importance of financial management in high-technology sector and is not surprising, given the financing features of high-tech investment (uncertainty, information asymmetries, and limitation) pointed out by Carpenter and Petersen (2002).

The negative relationship between liquidity and profitability is also supported by Raykov (2017) who points out that liquidity needs to extract profitable funds and this may impact operating cycle, turnover, and profitability. As for asset rotation, the study of Alcalde-Fradejas and Ramírez-Alesón (2015) shows that, after analyzing ROA and its two components (profit margin and asset turnover ratio), the crisis since 2008 and 2009 significantly lowers down the ROA and especially profit margins of Spanish SMEs. So efficiency plays an important role in crisis period.

Accounts receivable and accounts payable separately work as positive and negative indicators of profitability in low technology sector, which show positive effect of supplying trade credit. In fact, the results here are to some extent close to the studies of Yazdanfar and Öhman (2015a) and Martínez-Sola et al. (2014); for new firms, the most important benefit for supplying trade credit — among the benefits summarized by Norden and van Kampen (2015) — should be being helpful to build long-term business relationship. The statistical insignificance of bank credit may be due to the studying period (the crisis period from 2008 to 2012). In fact, the recent crisis impacted much on Spanish bank credit. McGuinness and Hogan (2016) cite the survey of European Central Bank showing that new bank lending to SMEs decreased by 66 percent in Spain from 2008 to 2011. So it should be more difficult for new firms to obtain bank loans considering the high instability of new firms. With regard to high technology sector, both bank credit and trade credit are not statistically significant, thus indicating the insignificance of these two traditional financing sources.

Different to the empirical findings of Serrasqueiro (2009) and Salman and Yazdanfar (2012), here previous profitability is a negative indicator in the age 2 and 3 models in low-technology sector. The negative relationship between previous and current profitability may be to some extent explained by learning theory of new firms —for example the theory proposed by Ericson and Pakes (1995): because new firms are in the process of learning, bad previous profitability may stimulate the managers (or owners) of those firms to explore the reasons for under-performance in profitability, which may pave the way for bettering profitability.

Growth serves as positive indicator in the age 3 model in high-technology sector. Given that high-technology SMEs grow faster by virtue of the advantages in internal organization, strategic flexibility and strategic cooperation networks (Nunes et al., 2012), the importance of growth in high-technology sector should be reasonable. The positive effect of growth corresponds to the empirical study of Estrin et al. (2009) as well as the theories (especially regarding cost reudction) supporting positive relationship listed by Steffens et al. (2009).

The impact of market share is unstable when being statistically significant (as negative indicator in low technology sector and positive indicator in high technology sector). For explaining this phenomenon, it is necessary to consider competition in different industrial sectors. Compared to in high technology sector, there are much more firms in low technology sector, thus resulting in higher competition; as for the new firms increasing market share rapidly, it is more possible to suffer retaliation from the existing firms in highly competitive industrial sector.

Interestingly, intangible assets do not show statistically significant positive effect. Notwithstanding that, the results here are to some extent close to the study of Tiron-Tudor et al. (2014) where diversity of the relationship between intangibles and profitability in different industries is reported. A possible explanation about failing to support statistically significant positive effect of intangible assets may be found from the research of Chappell and Jaffe (2016) — showing that intangible investment is positively related to growth rather than productivity or profitability, and proposing that the benefits of intangibles are reflected in the “soft” facets of firm performance rather than short-run productivity and profitability.

The statistical insignificance of total assets support neither the advantages of larger size nor the benefits of smaller size. This may be caused by the selection of sectors, given the viewpoint of Yazdanfar and Öhman (2015a) that the impacts of size on profitability

could be different in different industrial sectors. The insignificance of group membership is similar to the finding of Roper (1999). The explanation of this may be found in the study of Sykes (1990) who points out that strategic goals (rather than financial goals) are the main incentives for most corporate venture capital programs.

To put it in a nutshell, though there are many differences between the two sectors selected here in the profitability study, the importance of indebtedness should be highlighted because it is an overwhelming factor (compared to other factors in standardized coefficients) in both the two sectors. So, similarity is stressed by this chapter on profitability study of new firms in the sectors of high technology and low technology.

Appendix of chapter 7

Note: standardized coefficients (Beta) are only to the statistically significant variables (95% confidence).

Table A7-1 Food products sector age1

Adjusted R Sequare = 0.913; N=419					
Dependent Variable: ROA	B	Beta	t	Sig.	VIF
Indebtedness	-0.428	-0.959	-65.805	0.000	1.016
General liquidity	-0.024		-1.630	0.104	1.022
1/Asset rotation	-0.018		-1.221	0.223	1.018
Receivables to total assets	0.108	0.031	2.145	0.033	1.016
Payables to total liabilities	0.010		0.662	0.508	1.130
Bank loans	0.011		0.741	0.459	1.010
Intangible assets	-0.027		-1.870	0.062	1.002
Ln Total assets	-0.001		-0.050	0.960	1.032
Market share	-0.016		-1.075	0.283	1.002
Group membership	0.013		0.924	0.356	1.013
(Constant)	0.299		15.599	0.000	

Table A7-2 Food products sector age2

	Adjusted R Sequare = 0.679; N = 363					Adjusted R Sequare = 0.702; N=363 (added model)				
Dependent Variable: ROA	B	Beta	t	Sig.	VIF	B	Beta	t	Sig.	VIF
Indebtedness	-0.579	-0.836	-27.657	0.000	1.031	-0.641	-0.925	-27.698	0.000	1.357
General liquidity	-0.015		-0.509	0.611	1.009	-0.017		-0.601	0.548	1.003
1/Asset rotation	-0.040		-1.342	0.181	1.022	-0.036		-1.250	0.212	1.004
Receivables to total assets	0.058		1.819	0.070	1.144	0.025		0.850	0.396	1.015
Payables to total liabilities	-0.095	-0.071	-2.339	0.020	1.028	-0.051		-1.759	0.079	1.042
Bank loans	0.040		1.257	0.210	1.160	0.048		1.659	0.098	1.007
Intangible assets	-0.019		-0.614	0.540	1.080	-0.013		-0.429	0.668	1.061
Ln Total assets	-0.025		-0.631	0.528	1.706	0.020		0.546	0.585	1.657
Market share	-136.485	-0.061	-2.040	0.042	1.012	-151.522	-0.068	-2.357	0.019	1.008
Group membership	0.028		0.893	0.372	1.069	0.035		1.189	0.235	1.071
Growth						-0.031		-1.082	0.280	1.012
Previous ROA						-0.250	-0.195	-5.862	0.000	1.348
(Constant)	0.525		15.899	0.000		0.525		21.105	0.000	

Table A7-3 Food products sector age3

	Adjusted R Sequare = 0.790; N = 323					Adjusted R Sequare = 0.848; N = 323 (added model)				
Dependent Variable: ROA	B	Beta	t	Sig.	VIF	B	Beta	t	Sig.	VIF
Indebtedness	-0.755	-0.903	-34.742	0.000	1.036	-0.866	-1.036	-41.260	0.000	1.338
General liquidity	-0.046		-1.739	0.083	1.075	-0.007	-0.044	-1.968	0.050	1.076
1/Asset rotation	-0.002	-0.059	-2.312	0.021	1.009	-0.002	-0.053	-2.342	0.020	1.080
Receivables to total assets	0.043		1.583	0.114	1.145	0.181	0.051	2.191	0.029	1.146
Payables to total liabilities	-0.218	-0.090	-3.484	0.001	1.035	-0.242	-0.100	-4.284	0.000	1.167
Bank loans	0.009		0.314	0.754	1.132	-0.001		-0.030	0.976	1.148
Intangible assets	-0.014		-0.551	0.582	1.045	-0.028		-1.223	0.222	1.120
Ln Total assets	-0.016		-0.616	0.538	1.077	-0.018		-0.586	0.558	1.979
Market share	-0.035		-1.356	0.176	1.008	-199.984	-0.052	-2.369	0.018	1.013
Group membership	0.004		0.136	0.892	1.015	0.015		0.665	0.506	1.105
Growth						-0.023		-0.993	0.321	1.159
Previous ROA						-0.642	-0.263	-10.775	0.000	1.267
(Constant)	0.744		16.850	0.000		0.811		20.059	0.000	

Table A7-4 Computer, electronic and optical products sector age1

Adjusted R Sequare = 0.825; N = 82					
Dependent Variable: ROA	B	Beta	t	Sig.	VIF
Indebtedness	-0.852	-0.943	-19.478	0.000	1.087
General liquidity	-0.010	-0.119	-2.467	0.016	1.077
1/Asset rotation	-0.001	-0.110	-2.333	0.022	1.026
Receivables to total assets	0.042		0.893	0.375	1.031
Payables to total liabilities	-0.007		-0.148	0.883	1.033
Bank loans	-0.007		-0.150	0.881	1.048
Intangible assets	0.015		0.322	0.749	1.039
Ln Total assets	-0.005		-0.111	0.912	1.102
Market share	-0.065		-1.398	0.166	1.004
Group membership	0.016		0.326	0.745	1.074
(Constant)	0.707		11.926	0.000	

Table A7-5 Computer, electronic and optical products sector age2

	Adjusted R Sequare = 0.949; N = 71					Adjusted R Sequare = 0.949; N = 71 (added)				
Dependent Variable: ROA	B	Beta	t	Sig.	VIF	B	Beta	t	Sig.	VIF
Indebtedness	-0.739	-0.996	-35.609	0.000	1.072	-0.739	-0.996	-35.609	0.000	1.072
General liquidity	-0.025	-0.079	-2.858	0.006	1.046	-0.025	-0.079	-2.858	0.006	1.046
1/Asset rotation	0.007		0.236	0.814	1.092	0.007		0.236	0.814	1.092
Receivables to total assets	0.001		0.053	0.958	1.027	0.001		0.053	0.958	1.027
Payables to total liabilities	0.012		0.433	0.667	1.103	0.012		0.433	0.667	1.103
Bank loans	0.008		0.294	0.770	1.030	0.008		0.294	0.770	1.030
Intangible assets	-0.132	-0.060	-2.208	0.031	1.027	-0.132	-0.060	-2.208	0.031	1.027
Ln Total assets	0.041		1.331	0.188	1.321	0.041		1.331	0.188	1.321
Market share	0.015		0.531	0.597	1.055	0.015		0.531	0.597	1.055
Group membership	0.032		1.161	0.250	1.023	0.032		1.161	0.250	1.023
Growth						0.019		0.703	0.485	1.016
Previous ROA						-0.052		-0.839	0.405	5.232
(Constant)	0.734		13.130	0.000		0.734		13.130	0.000	

Table A7-6 Computer, electronic and optical products sector age3

	Adjusted R Sequare = 0.252; N = 61					Adjusted R Sequare = 0.347; N = 61 (added)				
Dependent Variable: ROA	B	Beta	t	Sig.	VIF	B	Beta	t	Sig.	VIF
Indebtedness	-0.183	-0.382	-3.385	0.001	1.022	-0.239	-0.500	-4.448	0.000	1.160
General liquidity	0.048		0.386	0.701	1.245	0.025		0.210	0.835	1.251
1/Asset rotation	-0.008	-0.307	-2.729	0.008	1.018	-0.007	-0.277	-2.621	0.011	1.027
Receivables to total assets	0.070		0.579	0.565	1.170	-0.013		-0.111	0.912	1.242
Payables to total liabilities	0.061		0.492	0.625	1.203	0.020		0.174	0.863	1.219
Bank loans	-0.013		-0.111	0.912	1.057	-0.023		-0.215	0.831	1.058
Intangible assets	-0.197		-1.688	0.097	1.128	-0.187		-1.719	0.091	1.129
Ln Total assets	-0.081		-0.627	0.533	1.331	-0.073		-0.604	0.548	1.332
Market share	64.566	0.292	2.594	0.012	1.014	69.901	0.316	2.996	0.004	1.019
Group membership	0.055		0.472	0.638	1.089	0.044		0.404	0.688	1.090
Growth						0.038	0.341	3.041	0.004	1.154
Previous ROA						0.308		1.387	0.171	4.608
(Constant)	0.161		2.800	0.007		0.190		3.482	0.001	

Table A7-7 Summary of statistically significant variables

	Indebtedness	Liquidity	1/asset rotation	Receivables	Payables	Bank	Intangible	Total assets	Market share	Group	Growth	Previous ROA
Food products sector age 1	N			P								
Food products sector age 2	N				N				N			
Food products sector age 2 (added)	N								N			N
Food products sector age 3	N		N		N							
Food products sector age 3 (added)	N	N	N	P	N				N			N
Computer, electronic and optical products sector age 1	N	N	N									
Computer, electronic and optical products sector age 2	N	N					N					
Computer, electronic and optical products sector age 2 (added)	N	N					N					
Computer, electronic and optical products sector age 3	N		N						P			
Computer, electronic and optical products sector age 3 (added)	N		N						P		P	

Chapter 8

Conclusions

With regard to the hot research topic of entrepreneurship, this thesis studies the impacting factors on new firm success in Spain from the angles of survival-based success (in manufacturing and distributive industries) and profitability (in food products sector and computer, electronic and optical products sector). Generally speaking, as for the research on survival-based success, different research methods show different results with different focuses. Logistic regressions focus on building the general relationships between factors and success, whereas decision trees draw the detailed and relatively complex relationships. In fact, the two types of method can be seen as complement to each other. The correct percents of decision trees are a little higher than those of logistic regressions (but not too much), which may be because of the relatively detailed results. Based on the finding of the overwhelming impacts of indebtedness on profitability in the sectors of high technology and low technology, the similarities are stressed by this thesis on profitability study of new firms.

8.1 Comparison of firm-specific factors in logistic regression of survival-based success and linear regression of profitability study

With regard to the positive effects of firm size and profitability to the survival-based success, these results are in accord with most empirical studies (Görg and Strobl, 2003), the efficient scale theory of size and cost disadvantage in small size (Audretsch, 1991 and Audretsch and Mahmood, 1995), and the commonsense of positive impacts of gaining profit. Because firm size is a crucial factor in the studies of post-entry performance (especially survival) of new entrants, which has been discussed in depth in the research articles published in industry organization journals — like those written by Mata et al. (1995), Boeri and Bellmann (1995), and Audretsch et al. (1999), the results obtained here again confirm the contribution of industrial organization research on start-up.

Obviously different to the impacts on survival-based success, total assets show statistical insignificance in the profitability study in Chapter 7, which to some extent negates both the traditional theory of the efficient scale and the theoretical benefits for small firms (for example, less overhead costs (Brüderl et al., 1992) or more flexible production technologies (Mills and Schumann, 1985)). Notwithstanding that, there are also empirical studies showing similar results: for instance, Serrasqueiro and Nunes (2008) too find no statistically significant relationship between size and profitability (albeit for large companies). In addition, as pointed out by Yazdanfar and Öhman (2015a), size may influence profitability differently in different industry sectors. So, it is possible that the statistical insignificance between firm size and profitability is caused by the selection of sectors.

The positive impact of group membership on survival-based success corresponds to the theoretical expectation of Audretsch and Mahmood (1995) as well as the statement of Shrader and Simon (1997) about the easiness of corporate ventures to get more resources from parent companies to avoid liability of newness. The positive relationship between being in a group and survival is also supported by the empirical studies of Bridges and Guariglia (2008) and Disney et al. (2003).

On the other hand, group membership is observed as a statistically insignificant variable in the profitability study, which is similar to the finding of Roper (1999). Here, as for the new firms with group background, the features (which are different to independent firms) should be taken into account. In fact, as pointed out by Zahra (1993), the purpose of corporate venturing includes both profitability and competitiveness. Further explanation can be found in the study of Sykes (1990): private venture capitalist usually focuses only on financial goals, whereas strategic goals (such as identifying new opportunities, developing business relationships, changing corporate culture, and finding potential acquisitions) for developing new business are the main targets of most corporate venture capital programs. Ernst et al. (2005) too highlight that short-term financial goals may not correspond with strategic goals.

The positive impact of liquidity is quite clearly shown in the logistic regressions (in either Chapter 4 or Chapter 5), although its influence is not as wide as the above factors. In fact, it should be reasonable for firms to keep liquidity after taking fragility into account, because of the positive effects of liquidity on performance (for example, advancing the capacity to deal with the changes of competitive markets as well as meeting short-term commitment, as pointed out by Serrasqueiro and Nunes (2008)). This is especially true for small firms due to relatively lacking sources for financing, thus advising to prepare more assets in liquid form for daily transactions and in emergent situation (Bolek, 2013).

On the other hand, statistically significant negative impact of liquidity on profitability is observed mainly in high-technology sector. Raykov (2017) too supports negative relationship between liquidity and profitability, based on the fact that profitable funds could be sources for keeping liquidity. As Carpenter and Petersen (2002) and Elston and Audretsch (2011) put it, the firms in high-tech sector may be more uncertain in returns, more serious in information asymmetries, and more hard to finance on the basis of collateral. Therefore, externally borrowed funds may be limited and not quite important for high-tech firms, and then it is not necessary to keep high liquidity. In fact, firms can benefit from reducing liquidity by putting excess current assets into fixed assets for enhancing production potential or into long-term capital investments (Bolek and Wiliński, 2012), thus increasing productivity and profitability.

The impacts of indebtedness are cloudy in the logistic regressions not only due to the double-sided effects but also because of less frequently showing statistical significance. In fact, as pointed out by Myers (2001), the expectation of universality in the theory of debt-equity choice is unrealistic; theoretical studies propose different and even opposite arguments (Weill, 2008). Take the most popular three as an example: trade-off theory highlights the trade-off between the benefits and costs of debt (Frank and Goyal, 2009); agency theory stresses agency costs and the conflicts among manager, shareholder, and debt-holder (Jensen and Meckling, 1976; Jensen, 1986); pecking order theory believes

that the order for financing is retained earnings, debt, and then equity, which is caused by adverse selection problem (Myers and Majluf, 1984; Myers, 1984).

As an overwhelming result, indebtedness is the most popular statistically significant indicator, which is negatively related to profitability in ever model of profitability study. This negative relationship corresponds to the majority of empirical studies (Denčić-Mihajlov, 2014). Although many scholars propose different explanations for this negative relationship, considering the features of new firms, here more suitable are the viewpoint of Asimakopoulos et al (2009) that repayment of debt consumes resource and then negatively impacts on investment as well as the viewpoint of Baños-Caballero et al. (2012) regarding higher borrowing costs and the constraints on valuable investments.

Asset rotation (as the proxy of efficiency) does not work well in predicting survival-based success, either because of the double-sided effects or due to its low frequency of showing statistical significance. Here the results tend to be close to the research of Altman (1968) and Charitou et al. (2004) showing the problem of the significance of asset rotation, or tend to be in favour of the research of Zingales (1998) which proposes existence of living space for inefficient firms. In the study of profitability, statistically significant positive impacts of asset rotation are shown more in high-technology sector, which stresses the importance of efficiency management in high-technology sector.

Bank credit and trade credit (as two major sources of debt-financing for start-ups (Huyghebaert et al., 2007)) are weak indicators in predicting the survival-based success of new firms, because of the low frequency of showing statistical significance. And the predictability of these financing factors is different in different industries. Here in distributive industry, positive effects of bank loans and accounts payable as well as negative effect of accounts receivable are shown, which highlight the importance of financing (because holding more accounts payable and less accounts receivable means increment in trade credit).

On the other hand, in the profitability study, both bank credit and trade credit are not statistically significant in high technology sector (thus saying the insignificance of these two traditional financing sources), while statistical insignificance of bank credit and positive effect of supplying trade credit are shown in low technology sector (based on the positive effect of accounts receivable and negative effect of accounts payable). The statistical insignificance of bank credit should be reasonable in the studying period (the crisis period from 2008 to 2012), as new bank lendings to SMEs decreased much in Spain from 2008 to 2011 (McGuinness and Hogan, 2016), especially impacting on new firms if taking the smallness in size and high instability of new firms into account. The positive effect of supplying trade credit may stress the importance of building long-term business relationship for new firms, which is one benefit of supplying trade credit (among the benefits summarized by Norden and van Kampen (2015)).

Market share does not work as a statistically significant variable in predicting the survival-based success of new firms. As pointed out by Audretsch et al. (1999), the gross market share of entrants usually is not as high as the rate of new firm formation, so generally speaking the market shares of new firms are too small to cause effects. In the profitability study in specific sectors, market share is a negative indicator in low technology sector but a positive indicator in high technology sector. There are much more firms in low technology sector than in high technology sector, so the competition should be stronger in low technology sector than in high technology sector. Therefore, increasing market share rapidly may suffer retaliation from the existing firms in highly competitive sector.

8.2 Particular firm-specific factors in profitability study

In low-technology sector, previous profitability is negatively related to current profitability, which is contrary to the empirical findings of Serrasqueiro (2009) and Salman and Yazdanfar (2012). The reason for this negative relationship may be related to learning theory of new firms (for example the theory of Ericson and Pakes (1995)). The managers (or owners) of new firms usually do not have sufficient experience, and

in learning period bad previous profitability could lead the managers to explore the reasons and try to make profitability better in the next year.

In high-technology sector, growth is positively related to profitability, which corresponds to the empirical study of Estrin et al. (2009) and the theories (especially about costs) supporting positive relationship listed by Steffens et al. (2009). In fact, rapid growth is a feature of high-technology SMEs because of the advantages in internal organization, strategic flexibility and strategic cooperation networks (Nunes et al., 2012). Intangible assets work as a negative indicator, which may be because intangibles benefit in the "soft" areas of firm performance rather than short-run productivity and profitability (Chappell and Jaffe, 2016).

8.3 Comparison of industry-specific factors in logistic regression and decision tree model

In the logistic regressions, there is a tendency that industrial growth changes from being negative to being positive with the increase of age, which is to some extent similar to the research of Audretsch et al. (2000) (where the negative effect of industry growth is kept at early ages) and corresponds to their explanation regarding uncertainty in industry's high growth. In the decision tree models of both manufacturing and distributive industries, industry growth appears at the second level in late ages (age 2 or 3 models), which means the increase in influence with ageing.

In the logistic regressions of distributive industry, entry rate takes negative effect which is in accord with the competition theory of Fritsch et al. (2006). Concentration takes positive effect, which may support the view of Baldwin and Rafiquzzaman (1995) that entrants could not threaten the existing firms immediately due to smallness. In the decision tree models, industry entry and concentration appear more at the second level than industry growth does in manufacturing industry.

8.4 Comprehensive comparison of the results

As is shown in Chapter 4, crisis tends to reduce the predictability of liability-related factors including liability liquidity and indebtedness — especially in manufacturing industry as one of the industries influenced most by the crisis (Fariñas and Martín-Marcos, 2015) — which may be because of the difficulty for new firms to access debt-financing during the crisis period. There are also many differences observed between the results of logistic regression in Chapter 5 and decision tree in Chapter 6, though both focus on the firms founded in crisis period: for example, logistic regression shows that industry entry and concentration are more important in distributive industry, while in decision tree model industry entry and concentration frequently appear at the second level in manufacturing industry.

In spite of those differences, some similar results can still be observed. The most obvious one is that the results of both logistic regression and decision tree highlight the important impacts of firm size and profitability on success: in particular, strong and positive effects of firm size and profitability are supported by the logistic regressions in Chapter 4 and 5; the impacts of those two factors are also stressed by decision tree model in Chapter 6 by virtue of frequently ranking them at the first and second levels of the trees. Besides, in the results of both the logistic model and decision tree model, group membership tends to be more important in distributive industry, working as an important positive success indicator in logistic model but showing unstable relationship to success in decision tree model. This is not quite surprising, because the coordination between parent company and subsidiary and among subsidiaries in distributive industry should be more important than it is in manufacturing industry considering the features (for example the fluidity of stocks) in distributive industry.

Different to the research on survival-based success, the study on profitability (in Chapter 7) shows that: indebtedness is a crucial negative impacting factor on

profitability, whereas firm size is not as important as it is for survival. Thus, although the close relationship between profitability and survival-based success is supported by both the logistic model and decision tree approach, survival and profitability (as two key standards of success) should be studied separately with considering different impacting factors. Perhaps, the most important contribution of this thesis is that it finds diversity in the influence of the same factor on different targets and in different situations, and it is advocated to do more research in more detailed situations or on more industries to enrich the empirical studies on new firm success.

8.5 Limitation and future research

Though this thesis in depth studies the influence of different factors on different targets in different situations, the research is still limited especially by the availability of information. Aside from the already mentioned constraints of industrial data, there are also some other limitations. For example, the number of employee and the variables based on that cannot work here because of incompleteness of the related information. Besides, it is also suggested to lengthen the observation period (if possible) for the sake of analyzing factors´ long-term impacts and predictability. As a prototype, the study of Bellone et al. (2008) shows the differences of factor´s impact in young, middle-aged, and old firms, so future research could do more contributions in this direction.

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