Venture capital activities in Europe

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Dedication

I dedicate this dissertation to my always loving and supportive friend, Ellis. You have been my inspiration from the beginning of this amazing journey and I couldn't have done it without you.

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List of abbreviations

ASCRI – Spanish Association of Capital, Growth in investment

BVCA - British Venture Capital Association

ENISA – European Union Agency for Network and Information Security

ESIF - The European Structural and Investment Funds

EUROSTAT - The statistical office of the European Union

EU/EEA European Union/ European Economic Area

EVCA- European Venture Capital Association

FOND ICO Global –The Instituto de Credito Oficial

GDP - Gross domestic product

GMM – Generalised method of moments

IPO - Initial Public Offering

INFLA - Inflation

INT - Interest rate

LP - Limited Partner

M&A - Mergers & Acquisitions

MBO – Management buyout

MON - Money supply

NVCA - National Venture Capital Association

OECD - Organisation for Economic Co-operation and Development

PREP _ ANALYTICS – The Private Equity Research Exchange Platform

PE - Private Equity

R&D - Research & Development

SVB - Silicon valley bank

UNEM - Unemployment rate

VC - Venture Capital

VCs – Venture Capitalist

VIF - Variance Inflation Factor

WB - World Bank

WHO – World Health Organisation

Abstract

The aspects of venture capital activities in Europe are explored in this manuscript. A panel data covering 23 EU/EEA countries between 2000-2017 from a macro perspective are empirically analyzed with results that support theoretical research from entrepreneurial finance literature. Venture capital to be used as alternative innovative financing scheme for businesses during crisis periods, variations as regards the impact of the financial crisis on venture capital fundraising and investment activities in Europe, health sector growth being explained by venture capital investments directed to the sector, and the influencing role of macroeconomic factors on European venture capital exits, are all important issues in explaining the relevance of venture capital activities in Europe. The results are robust even when controlling for other macroeconomic variables such as venture capital funds as a percentage of GDP, healthcare cost as a percentage of GDP and per-capita expenditure on health, political risk, capital gains tax etc.

Resumen

Los aspectos de las actividades de capital de riesgo en Europa se exploran en este trabajo. Un conjunto de datos de panel que cubre 23 países de la UE/EEE entre 2000-2017 desde una perspectiva macro se analiza empíricamente con resultados que apoyan la investigación teórica de la literatura de finanzas empresariales. El capital de riesgo se utilizará como plan de financiación innovador alternativo para las empresas durante los períodos de crisis. Las variaciones en cuanto al impacto de la crisis financiera en la recaudación de fondos de capital de riesgo y las actividades de inversión en Europa, el crecimiento del sector sanitario a raíz de las inversiones de capital de riesgo dirigidas al sector, y el papel influyente de los factores macroeconómicos en las salidas de capital de riesgo europeo, son todas cuestiones importantes para explicar la pertinencia de las actividades de capital riesgo en Europa. Los resultados son sólidos incluso cuando se controlan otras variables macroeconómicas, como los fondos de capital de riesgo como porcentaje del PIB, el costo de la atención médica como porcentaje del PIB y el gasto per cápita en salud, riesgo político, impuesto sobre las ganancias de capital, etc.

CHAPTER ONE

Introduction

1.1 Background of the study

Venture capital is regarded as a catalyst to fuel innovation and growth by governments in Europe and the world (Bocken, 2015). Venture capital (henceforth VC) is equity funding provided to companies and entrepreneurs. It can be provided at different stages of a firm's evolution. VC has passed through various stages of evolution as a niche activity just after the end of the second world war into a complex industry with multiple participants playing important roles in driving innovation and entrepreneurial activities (Avnimelech & Teubal, 2004). The activities of the industry have become increasingly intriguing and need to be demystify to deepen interest in the sector and also to underscore its relevance to the growth agenda of EU/EEA countries. VC activities provide innovative liquidity options and significantly contribute to the creation, sustenance and survival of businesses and by extension sectors within an economy.

Driven by the essence of venture capital finance models (Bottazzi & Da Rin, 2002) to the growth of businesses, many developed countries including Europe has established funds with the need to support the development of the venture capital market (Bottazzi & Da Rin, 2002; EIF, 2018). The relevance of venture capital, not only for young and innovative companies but also for the economy as a whole, ranks high in the toolbox of policy recommendations (Tykvová et al., 2012; Frontier Economics, 2013; Breuer & Pinkwart, 2018). However, there continues to be a lack of in-depth knowledge on the relevance of venture capital activities in Europe because of the scarcity of publicly available research on its impact in explaining the growth of sectors in an economy. This study therefore attempts to provide in-depth insights into the relevance of venture capital by empirically analyzing aspects of VC activities.

VC in Europe has been growing steadily since the year 2000, until the crisis led to severe funding gaps in the financing of technological development and innovation in most countries including Europe. This research contributes to the knowledge of VC in Europe by studying the relevance of VC on important sectors of the European economy. European VC Industry is being modelled after the US VC Industry and therefore detailed research on relevant

aspects of VC activities in Europe will be of great interests to various VC practitioners and policy makers. The result of this thesis is unique and should be of interest to practitioners, policymakers, and scholars concerned with investment, corporate decision, and economic growth in Europe. Again, given the growing economic impact of venture capital and the limited amount of scholarly work in this field, an assessment of the relevance and value of venture capital to the European economy is appropriate. To better understand the usefulness of VC, the study employed a quantitative methodology to explaining aspects of VC activities relative to the European economy. The motivation for this thesis revolves around three areas. The first is the impact 2007/2008 financial crisis had on the supply of equity capital for businesses and the need to identify and promote alternative financing schemes to close the financing gap that was created. Second, is whether or not the growth of the health sector can be explained by venture capital investments in the health sector. And lastly in order to sustain the interest of investors in the VC industry, liquidity of the market is of essence, and therefore the study attempts to explore macroeconomic factors that can stimulate VC exits in Europe.

The role of venture capital is considered a promising approach to stimulate the innovation and growth-oriented agenda of small businesses need to acquire capital (equity investment) from external sources because they do not have their own or cannot access loans (European Commission Report, 2015). Businesses or firms typically may use venture capital to expand, break into new markets, and grow faster. Although only relevant to a smaller group, venture capital is essential for the growth of innovative firms. The phenomenon of venture capital activities has until recently attracted considerable attention from researchers and some literature sheds light on several ways in which venture capital are important to impacting economic growth.

The remainder of the dissertation's introduction is structured as follows: Section 1.2 highlights the problem statement for the study, while Section 1.3 proposes the objectives of the study. Subsequently, section 1.4 outlines the dissertation's scope and motivation, while section 1.5 summarizes the dissertation's studies by outlining the underlying structure.

1.2 Research Problem

Most of the studies on the relevance of VC has been examined from the perspective of some sectors of the economy (Guler & Guillén, 2010; Champenois, Engel & Heneric, 2006; Ahlstrom & Bruton, 2006; Davila, Foster & Gupta, 2003; Bottazzi & Da Rin, 2002; Seppä & Laamanen, 2001). Interestingly few of the contemporary studies on venture capital from the perspective of sectors within an economy have suggested that relevance of venture capital strategically makes positive impact on the growth and development of critical sectors within an economy (Cavallo, Ghezzi, Dell'Era & Pellizzoni, 2019; Popov & Roosenboom, 2013; Samila & Sorenson 2011).

From the perspective of most economic analysts and policy markers, it is primarily venture capital that has the potential to drive innovation and entrepreneurial activities. Unforturnately the financial crisis situation led to a substantial decline in venture capital and slowed down economic activity (Block & Sandner 2009; Cecchetti, Kohler & Upper, 2009). So if appropraite measures are instituted, they may be enough to help move venture capital activities back to the pre-crisis boom to drive innovation. Limited studies exist that relate the financial crisis to venture capital. So therefore aspects of this thesis would attempt to provide a comprehensive understanding of the effect of the crisis on venture capital in order to inform policy intervention that would encourage and support venture capital activities. Again because of the independent and private nature of this form of finance with no obligation to publicly disseminate information regarding their operations and activities, it has resulted in lack of freely accesible data for purposes of research. In view of this not much attention has been given to this area compared to other financial disciplines like corporate finance. As a result, there exist significant gap in research on the actual relevance through which venture capital may explain the growth of sensitive sectors in an economy. This dissertation attempts to fill this research gap by developing theory-based hypotheses about aspects of VC activities through testing of the hypotheses using annual activity report data collected from EVCA now Invest Europe.

So in this dissertation, aspects of VC activities in Europe is examined from a macro perspective in relation to important sectors of the European economy. Thus, this present

dissertation focuses on establishing whether venture capital could be used as alternative innovative financing scheme during crisis periods, examining whether the effect of the financial crisis on geographical sources of VC fundraising and investment activities differ among countries in Europe, ascertain whether health sector growth can be explained by the increasing venture capital investments and also establish whether macroeconomic factors can stimulate VC exits in Europe. The main research problem can be defined as questions as follows:

Can venture capital financing be used as alternative financing scheme and explain the growth of sectors in an economy?

In order to tackle the research problem, the first challenge is to conceptualize the equity financing of entrepreneurial firms especially startups on the basis of the literature and theoretical reasoning as fuel to growth (Kang, 2018). In the event of financial crisis, capital markets face liquidity problems thereby calling for innovative ways of supplying funds for businesses. The research problem is broken into four generic research questions: the first generic research is

Could VC be used as innovative source of financing equity capital after the financial crisis period?

In addition to understanding how important this financial instrument is to businesses and measures that could be adopted to sustain its crucial role to providing the required equity capital to firms, it is necessary to understand in detail the true effect of the financial crisis on the various geographical sources of VC fundraising and investment activities, so as to ascertain whether there are variations in the effect of the crisis on VC fundraising and investment activities in Europe. Therefore, the second generic research question is

Which of the geographical source, investment stage and country were strongly hit by the financial crisis?

The private sector through venture capital makes significant investments in the health sector to cushion the load on the government in meeting healthcare needs. Despite the increasing

presence of VC investment in healthcare, to date empirical evidence on its impact on the sector's growth within the context of Europe is scarce. This study attempts to ascertain whether venture capital investment in health can explain health sector growth in Europe. Therefore, the third generic research question is

Can health sector growth in Europe be explained by venture capital investments in health?

In order to sustain the interest of VC investors in Europe, liquidity of the VC market is crucial since liquidity of the market makes it possible for investors to easily exit their investment without loss of value. And macroeconomic indicators or factors play a central role in determining the liquidity of the VC market. Therefore, understanding macroeconomic factors that can influence and stimulate VC exits in Europe is necessary. Hence, the fourth generic research question is

Do macroeconomic factors stimulate or influence VC exits in Europe?

1.3 Research objectives

The overall objective of this dissertation is to project the relevance of aspects of VC activities in Europe and inform policy intervention that can grow and develop the VC industry. The specific objectives of the dissertation are as follows:

- To establish whether VC could be used as alternative innovative source of financing equity capital for businesses during crisis periods.
- To examine whether the effect of the financial crisis on geographical sources of VC fundraising and investment activities differ among countries in Europe.
- To assess whether venture capital investments in health can explain health sector growth.
- To ascertain whether macroeconomic factors can stimulate VC exits in Europe.

1.4 Purpose or motivation of the study

As mentioned above, relevance of VC activities to the growth agenda within economies is important to the academic and practical discourse. Therefore, this dissertation sheds light on several aspects of venture capital related topics, thereby contributing to the growth agenda of sectors within an economy. The topics addressed in this dissertation do so by analyzing empirical issues and also underscoring the relevance of VC activities to the European economy.

Accordingly, in addition to the background study the first two essays address VC fundraising and the financial crisis. First, Venture capital as innovative source of financing equity capital after the financial crisis is examined. The aim of the study was to ascertain whether VC financing could be used as alternative innovative financing scheme for businesses during periods of funding gaps. This study is necessary given the important role small businesses play in an economy. The motivation for this study stems from the fact that small businesses are considered to be the backbone of every economy (Eggers, 2020). Their crucial role in the development of an economy is evident in the number of people employed in the sector hence the need for the creation of readily available financing schemes for the sector to close the financing gaps they experience during crisis periods (Harcourt & Wood, 2007). Small businesses are faced with numerous barriers that obstruct their growth and development at a point in their operations and one of the greatest barriers is access to capital (Trianni, Cagno & Farné, 2016; Leonidou, 2004). Their difficulty to access capital could be as a result of their inability to provide the required assets that can secure them credit from mainstream banks. Governments or policy makers acknowledging this deficiency of such an important sector and realising their contribution to economic growth are creating conducive environment necessary to attract the needed capital for the benefit of the business owners in this important sector. Hence, the need to explore alternative financing schemes that could be available to businesses to close the financing gaps being experienced by the sector. Since limited availability of capital could have staunted effect on the survival and success of businesses.

In order for firms or businesses to continue to look to VC as their financing source, it is important to understand in detail the true effect of the financial crisis on sources contribution

to fundraising and investments activities, so as to inform appropraite policy intervention that can encourage fundraising and investment activities. Undoubtedly the crisis affected economies of the world including Europe (Persakis & Iatridis, 2015; Malliaris & Bhar, 2011). However, the nature and the magnitude of the effect of the crisis could vary especially among European countries (Dijkstra, Garcilazo & McCann, 2015; European Union, 2013). Therefore, this study aims to enhance understanding of the effect of the crisis on sources contribution to total VC fundraising and investment activities by way of ascertaining whether the effect of the crisis differ among countries in Europe so as to inform policy measures that could encourage fundraising and investment activities. I believe that above reason creates favourable and justifiable condition for research to examine the true effect financial crisis had on sources contribution to total VC fundraising and investment activities in Europe.

This study is essential because VC industry plays a fundamental role in fostering the development of new business ventures that can improve society and the economy in general. Therefore, any negative effect on this financial instrument would be of great concern to policy makers, hence the need for a public policy that can support the development of this financial instrument. Furthermore, the creation of competitive economy has become increasingly linked to the presence of an environment that supports innovation and entrepreneurial activities (Da Rin, Nicodano & Sembenelli, 2006). And governments in the world including Europe having made innovation a key issue on its developmental agenda to stimulate growth and increase income, would have to design policy frameworks that support innovation in the private sector. It is without doubt that a key barrier to entrepreneurship is a lack of capital that is needed to formalise creative ideas into concrete and realistic business plans, therefore public intervention and involvement to bridge the financing gap is useful and necessary. Research have established that public policy interventions play an important role in supporting the development of the VC industry (Mason, 2009; Da Rin, Nicodano & Sembenelli 2005; Mason & Pierrakis 2003; McGlue 2002). Therefore, such a study could inform the require public intervention that support the industry.

Venture capital stimulate critical sectors of the European economy as suggested by (Jeng & Wells, 2000; Davila, Foster & Gupta 2003; Tykvová et al., 2012), and contributes more

significantly to the aggregate economy (Bottazzi & Da Rin, 2002) and above all its absence could lower aggregate growth by 28% (Rosenbusch, Brinckmann & Müller, 2013). VC is also vital and an important source of funding for innovative startups firms (Jell, Block & Henkel, 2010; Gompers, 1994), therefore any cataclysm ought to be given the necessary attantion. The financial crisis situation led to a substantial decline in consumer wealth and slowed down economic activity. So therefore an empirical study detailing the effect of the crisis on VC fundraising and investments is impertaive to inform the required policy respeonses needed to encourage fundraising and investment activities in Europe. This is necessary in view of the fragmented nature of the VC industry in Europe. The study deviates from previously published article of Block & Sandner, (2009) by focusing on the effect of the financial crisis on geographical sources of VC fundraising and investment activities from a macro perspective.

Availability of personnel for the VC industry is also of essence since VC is a specialized area that requires certain skilled personnel for the industry. The health of the personnel is important so as to guarantee prompt and timely skilled personnel needed for the industry. Therefore continous upgrade of healthcare facilities targeted at enhancing healthcare delivery of personnel would be encouraged. Giving that the continuous improvement of healthcare is ideal, as overall wellbeing of a citizenry in contributing to economic growth largely depended on sector (Cervellati & Sunde 2011; Weil 2007). Therefore, investment in the sector's innovation could invariably improve the health and social welfare of the people. Accordingly, this study focuses on examining whether venture capital investments directed to the health sector in Europe have resulted in the growth of the sector. Thus, the study aims to ascertain whether health sector growth could be explained by venture capital investment directed to the health sector.

The health sector was chosen for this study in view of the major role it plays in the economies of Europe and also the fact that European Union (EU) has the health of its members as primary competence on its development agenda. Furthermore, the motivation for the study revolves around the critical role the sector plays in the attainment of overall EU strategic goals and also the fact that demand for health services would continue to increase in Europe (WHO, 2016). Therefore, studies to ascertain whether VC investments directed to the health

sector over the years have translated into any growth at all is imperative. Research has it that the health of nation is the wealth of the nation and that governments within EU have made the healthcare of their citizens a key concern (Salter & Martin, 2001). The health of each individual affects not just themselves but also society as a whole. It is therefore not suprising that healthcare expenditure accounts for 10% of the world's gross domestic product (Sulku & Caner, 2011). The European health sector is an important sector because it provides employment openings to many individuals directly associated with the sector. It has been reported that the sector employs more than 10% of the continent's working population (European Observatory on Health Systems and Policies report, 2010).

Healthcare industry plays an important part in the economy of every nation (Dollard & Neser, 2013). The sector does not only determines the GDP of a country but also contributes significantly to creating employment, capital investment etc. and therefore investments directed to the sector must be empirically analysed to ascetain whether the increasing investments have been worthwhile (Fleming, 2015).

To sustain continuous interest of VC investors in the health sector, it is necessary to create the required conditions that can stimulate or aid successful exits of European funds. Therefore, the final study attempts to analyse macroeconomic factors that can influence exits in Europe. The aim of the study was to ascertain macroeconomic factors that can facilitate or stimulate exits in Europe and also determine whether additional liquid options could be available apart from the traditional liquid exit options being used by European VC funds.

This study is needful in view of the important nature of exiting VC contractual relationship and also the fact that it helps VC firms define success made in businesses. Furthermore, businesses know that right exiting protect their wealth, attracts valuable employees, and ensure a smooth transition in business operations. Therefore, macroeconomic policies that can improve the liquidity of the market and facilitate exits would be a welcoming idea for businesses. For a VC market to be self-sustaining, it is essential to have not only a sufficient, high-quality potential deals, but also viable exit routes therefore the required economic conditions that facilitate exits must be cretated. The study seeks to establish macroeocnomic factors that can stimulate VC exits in Europe as volatility of the market raises the compensation that shareholders may have to demand for bearing systematic risk. Research

based on macroeconomic factors influence on exits is also rare, therefore I am confident the study contributes to the ongoing discussion.

As a whole the dissertation aims to shed light on several research questions projecting the aspects of VC activities. The dissertation also contributes to the general development and academic rigor of the whole research front by introducing new procedures and measurements that pave the way for future research and also underscore the relevance of venture capital activities in Europe.

1.5 Underlying structure of the study

This dissertation comprises a background study and four empirical studies that shed light on relevant aspects of VC activities in Europe. To provide an overview, Figure 1-1 summarizes the dissertation's structure and collates further information about each study highlighting the applied analytical methods and information regarding the data set. The following paragraphs outline the topics incorporated in this dissertation by briefly introducing purpose and scope of each study.

Figure 1-1 (Overview of studies included in this dissertation)

Chapter 1: Introduction			
Chapter 2: Theoretical perspective of the relevance of venture capital activities.			
Chapter 3: Research methodology and data considerations			
Chapter 4	**Chapter 5**	**Chapter 6**	**Chapter 7**
Venture Capital as innovative source of financing equity capital after the financial crisis.	The effect of the financial crisis on sources of VC fundraising and investment activities.	Venture Capital Investments and healthcare sector growth in Europe.	An Analysis of macroeconomic factors influence on venture capital exits in Europe.
Country: Spain	**Country:** 22 EU/EEA	**Country:** 23 EU/EEA	**Country:** 22 EU/EEA
Sample period: 2000-2016	**Sample period:** 2007-2017	**Sample period:** 2000-2017	**Sample period:** 2000-2017
Analytical method used: • Cointergration and vector error correction model	Analytical method used: • Panel quantile regression	Analytical method used: • GMM	Analytical method used: • 2SLS
Databases: • ASCRI • Bolsa de Madrid Stock Exchange • Bank of Spain • Eurostat	**Databases:** • EVCA now Invest Europe • Eurostat • World Bank • OECD	**Databases:** • EVCA now Invest Europe • Eurostat • World Bank • OECD	**Databases:** • EVCA now Invest Europe • Eurostat • World Bank • OECD
Chapter 8: Final conclusions			

The first topic *"Venture capital as innovative source of financing equity capital after the financial crisis in Spain"* is the only essay of the four that is based on a single country study. Spain was chosen because it is the fifth largest economy in Europe and it is one of the four most affected countries hit hard by the financial crisis. The financial crisis had devastating impact on Spain, including a strong economic downturn, a severe increase in unemployment, and bankruptcies of major companies resulting in the Spanish economy dipping into Great recession which began in 2008. The objective of the study was to investigate whether VC could be used as alternative innovative financing scheme for businesses in the country during crisis periods. The Spanish economy is a bank-centered economy and the financial crisis seriously affected the financial sector including the banking sector that appears to be the main source of financing for businesses and so therefore it was necessary to explore other financing sources for businesses. David & Whittam, (2015) examined how government VC funds have addressed the equity financing gap since the onset of the recent financial crisis. They drew their inspiration from Lerner, (2010) call for public intervention in the VC market to close the equity financing gap that has the potential to stunt growth in innovative SMEs. They further justified government catalytic role in addressing the equity financing gap through private sector led funds and not governments engineering the management of the funds. It is not unreasonable to suggest that the financial crisis created equity funding gaps for businesses, thus calling for innovative risk capital financing methods to close the financing gaps. The ramifications of the crisis had probable significant implication for the overall performance of SMEs (Harrison & Baldock, 2015). As alternative financing options were made available to businesses to close their financing gaps, meant businesses had access to grow and develop their businesses.

Giving the fact that access to finance is so important for the survival of businesses, and the growth of firms, it stands to reason that the likelihood of survival or growth of firms largely depended on available alternative financing options. I first establish short run and long run causal relations between VC fundraising, stock market returns and market capitalization when VC fundraising and stock market returns are used as dependent variables. However, such relations do not exist when the model is dependent on market capitalization. The results show that the VC market raise funds from diversified

(geographical and institutional) sources. The findings support the persuasive and risk diversification theories of VC financing.

I then proceeded to investigate whether VC could be relied upon as alternative equity risk financing option in event of crisis and the evidence suggest that VC could be relied upon as alternative financing option in times of crisis. The study further provides implications for using alternative innovative ways of financing equity risk capital to spur economic growth. The empirical evidence presented in chapter 4 is consistent with the theory developed by Casey & O'Toole, (2014) that suggest firms would turn to alternative financing schemes when they are denied credit by mainstream banks.

The next topic in this thesis is *to examine the effect of the financial crisis on geographical sources of VC fundraising and investment activities in Europe.* In many ways the results of this essay appears very interesting and revealing because the results support the claim that the impact of the crisis differ among countries, contrary to Block & Sandner (2009) study appearing to suggest that VC fundraising and investment activities in countries were in like manner affected by the financial crisis. The study revealed that the effect of the crisis on sources of VC fundraising and investment activities were impactful with the strongest effect occurring in unknown and outside Europe sources of VC fundraising as well as seed stage investments in countries with high levels of VC activity.

The rationale for the study is to affect regulations and corporate decision making targeted at improving fundraising and investment activities during such periods. Contrary to expectations, I find that the crisis had significant effect on geographical sources of VC fundraising in countries with high levels of VC activity, partial effect on countries with moderate levels of VC activity and close to no effect or negligible effect on countries with low levels of VC activity. Whereas the crisis affected seed and later stage investments in countries with high and moderate levels of VC activities, it affected only seed stage investments in countries with low levels of VC activity. The study further found that the impact of the crisis on sources of VC fundraising and investment activities differ among countries in Europe. The evidence presented in chapter 5 is consistent with the theory as reported by (Lerner, Moore & Shepered, 2005) justifying the need for public intervention.

Again *The impact of venture capital investments allocation towards the growth of the healthcare sector is examined in chapter 6*. VC investors have for some time now made

significant investments into the health sector in Europe. Such investments have been motivated by high returns, high exits etc. The aim of this study was to examined whether health sector growth can be explained by venture capital investments in the health sector. Some studies have ascertained the impact of venture capital financing towards the growth of sectors within an economy (Croce, Martí & Murtinu, 2013; Martí, Menéndez-Requejo & Rottke, 2013; Bertoni, Croce & D'Adda, 2010). The nature of the subject matter in this chapter is necessary in view of the critical nature a population's health play towards economic growth. Cervellati & Sunde, (2011) report that overall wellbeing and continuous improvement in the healthcare of the citizenry is ideal in contributing to economic growth and overall development of a country. The European healthcare sector is faced with an ageing population, reduction in public spending and other challenges that affect the industry, a situation which requires more investments to meet the health needs of the citizenry (BVCA Report, 2016; Kirigia et al. 2011; Schneider 2009). The private sector through the venture capital (VC) industry have in recent times been making significant investments in the health sector to cushion the load on the government in meeting healthcare needs. Therefore, a question that has arisen is to ascertain whether VC investments directed to the healthcare increases health sector growth in Europe.

I then proceeded to investigate the impact of VC investments on healthcare sector growth in Europe in a fixed and random effects models. Empirical findings from the panel data indicates that VC healthcare investments and age of the VC industry are important variables in explaining healthcare sector growth in Europe when controlling for socio-economic factors including per-capita expenditure on health, healthcare cost as a percentage of GDP and VC fund as a percentage of GDP. Again from the study, VC healthcare investments affect healthcare sector growth in Europe but in different directions. Even though life expectancy (proxy for health sector growth) shows increasing trends, VC healthcare investment decrease health sector growth. The study therefore conjecture that VC investors may enjoy returns on investments, but may not decipher into social returns to health sector outcomes. The study makes justification for private-public partnership to support health sector growth. The empirical evidence presented in chapter 6 is consistent with economic theories related to health sector economics (Levaggi, Moretto & Pertile, 2012).

The final topic in this thesis *macroeconomic factors influence on venture capital exits in Europe is examined in chapter 7.*

Studies on market liquidity has been on the radar of researchers over the past years, as practitioners, policy-makers and academics use liquidity of market as a barometer for the 'healthy functioning' of an economy (Huang, 2008). The study aimed to ascertain whether macroeconomic factors can stimulate venture capital exits in Europe. This is necessary and useful given that successful exits of venture capital deals would encourage and attract more investments. Liquidity of the VC market has many connotations and would help affect regulation and corporate decision making. The illiquid nature of the VC market also poses serious threat to investors in Europe, hence the need to ascertain whether macroeconomic factors can improve the liquidity of the VC market. There are at least eight (8) exit strategies for European VC funds. While IPO and trade sale exits have been extensively researched (Black & Gilson, 1998; Cumming & Macintosh, 2003), academic research has not focused much on the other types of exits to comprehensively ascertain the liquidity or illiquid nature of the various exit types in relation to macroeconomic factors. A liquid VC market provides investors the opportunity for an asset to be easily transferable without any loss of capital. This study therefore attempts to examine how macroeconomic factors may influence the liquidity or otherwise of exits in Europe so as to guide policy relating to the VC industry.

The study revealed that GDP has positive association with trade sale, sale to PE firm and MBO exit strategies but has negative association with the remaining exit types available to European VC funds. Money supply was found to have positive influence on almost all the exit types available to European VC funds while interest rate had negative influence on almost all the exit strategies. Apart from MBO and divestments by other means exits, inflation has positive insignificant association with the remaining types of the exits. The study further found MBO and sale to financial institution exit strategies as additional liquid exit options that could be used by European VC funds. The evidence presented in chapter 7 reflect Cumming and Maclatosh, (2003) theory on VC exits indicating that a variety of factors influence VC choice and timing to exit an investment choice.

CHAPTER TWO

Exploring the perspectives of VC activities: A systemetic review

2.1 Introduction

Venture capital is defined as a professionally managed capital fund used to finance private companies at various stages of their development where the providers of the capital influence the decisions made by their portfolio companies (Sahlman 1990; Barry 1994). As a result of its increasing relevance and impact on the national economy, academic research also appears to be growing in key aspects of venture capital process (e.g. fundraising [Gompers & Lerner 1999; Bernile, Cummings & Lyandres 2007; Kollmann, Kuckertz & Middelberg, 2014; Kuckertz, Kollmann, Röhm & Middelberg, 2015], investment [Gompers 1995; Zacharakis & Meyer, 2000; Zacharakis & Shepherd 2001, Mason & Harrison, 1996; Klonowski, 2010], and exiting activities [Cochrane 2005; Cumming, Flemming & Schwienbacher, 2006; Giot, & Schwienbacher, 2007]). The focus on VC activities research has emanated from varying fields, as regard (e.g. fundraising and the financial crisis, investment and health sector growth, exiting and macroeconomic factors) in relation to Europe are explored in this thesis.

Since the advent of this financial instrument after second world war, the academic world has investigated and tries to explain the relevance of VC activities to the growth of sectors within an economy (Davila, Foster & Gupta, 2003: Bettignies & Brander, 2007; Bertoni, Colombo & Grilli 2011). Consequently, in recent times, a number of studies on the relevance of VC activities have emerged, some of which points to the fact that VC is of immense benefit to an economy (Meglio, Destri & Capasso, 2017; Cavallo, Ghezzi, Dell'Era & Pellizzoni, 2019). Grounded in the entrepreneurial finance theory, venture capital (VC) is seen as equity capital provided to firms in return for minority or majority stake in a business (Bates & Bradford, 2008). "The European Venture Capital Association (EVCA) now Invest Europe, defines venture capital as 'a subset of private equity investments made for the launch, early development or expansion of a business' and private equity as "equity capital to enterprises not quoted on a stock market" In other words, venture capital is a type of financing provided to startup firms and small businesses believed to have high growth potential. They are funding that generally comes from well-off investors, investment banks, ccorporations and any other financial institutions.

The VC industry in Europe started operations in the early 1980s with the establishment of VC firms. This was followed by the setting up of professional associations like the European Private Equity and Venture Capital Association (EVCA) now Invest Europe and the British Venture Capital Association (BVCA) in 1983 (Kaur, 2007). The VC market in Europe according to Manigart (1994) began in the UK and Ireland, followed by continental Europe with active participation by domestic banks. The European VC market is following the US Venture capital model but have differences in their institutional environment as well as tax and securities laws regarding activities in the industry (Manigart, 1994).

VC activities in Europe have seen signficant growth from virtually a fundraising, investing and divestment values of €48 billion, €34.9 billion and €9.1 billion in the year 2000 to €91.9 billion, €67.7 billion and €42.1 billion of fundraising, investment and divestment values in the year 2017, a significant increase of 91.5%, 94% and 362.6% (Invest Europe, 2017). Venture capital has proven to impact important sectors within the European economy with notable investment successes that have birth unicorns (privately held startups valued at more than $1 billion) namely Roivant Science, Nucom Group, Cabify, Deezer, Monzo etc in 2018. The most recent venture capital successes being Veeam and Luxoft in Switzerland, Collibra in Belgium and eMAG in Romania that have crossed the over $1billion dollar value in 2019.

VC activities have evolved around the world in the past decades, with a particular rapid expansion phase being seen in the late 1990s, early 2000s and now remarkable growth being recorded after the financial crisis. This development has been fueled by both public and private efforts, with the latter being dominant in terms of fundraising, investing and exiting. Most VC markets especially Europe are modelling the development of their market after the USA VC industry, which has led the global VC market. The European VC market is expected to grow significantly in the next couple of years with the right policies being implemented based on available information (Invest Europe 2017). VC activities are gaining the necessary attention as European Commission regard VC as an important driving force to grow the European economy and create wealth as well as jobs for the people and has therefore remained enthusiastic about its relevance and prospects. This dissertation focuses attention on aspects of VC activities including ascertaining whether VC could be used as an alternative innovative financing instrument during crisis

periods by businesess, whether the impact of the crisis on VC fundraising sources and investment activities differ among countries in Europe so as to inform policy, determine whether health sector growth can be explained by the impressive VC investments directed to the health sector and also assess the influence of macroeconomic factors on VC exits in Europe. In so doing, the phenomenon of VC activities relative to sectors of an economy is highlighted.

2.2 Venture capital activities in the midst of the financial crisis

Different theories of knowledge on the relevance of VC activities have different implications for what is considered relevant and these fundamental views have implications for entrepreneurial finance field as well. The relevance of VC can catalyse innovation, job creation and economic growth. As a result, a vibrant VC market may bring direct economic benefits. The EU having recognized the link between innovation, entrepreneurship, venture capital and economic growth identified and listed this form of finance in the EU strategic agenda (EU Special Report, 2019).

Based on the tremendous success of the VC industry in the U.S., and the impact it has had on technological development and progress (Davila, Foster & Gupta, 2003; Florida & Kenney 1988), new firm creation, innovation and growth (Popov & Roosenboom, 2012; Samila & Sorenson 2011), this type of financial instrument is touted as a key financing ingredient for economic development (Gompers & Lerner 2004). This notwithstanding, relevance of VC actvtities has not been diffused as sufficiently and successfully as expected especially in Europe. Moreover, despite the impact of the crisis on VC financing, which could in turn enable venture capitalists to be relatively risk-averse, VC can still be considered as an important financing model for businesses (Bocken, 2015).

Researchers observed VC can be an important financing instrument for businesses (Pandey, 1998), its contribution to economic growth (Samila & Sorenson, 2011; Timmons & Bygrave, 1986), and the effect of macroeconomic factors on VC financing (Cherif & Gazdar, 2011). In addition to the contribution of VC, researchers have investigated its role in explaining economic growth (Pradhan, Arvin, Nair & Bennett, 2019; Pradhan, Arvin, Nair & Bennett, 2018; Manigart & Sapienza, 2017; Gornall & Strebulaev, 2015; Croce, Martí & Murtinu, 2013; Martí, Menéndez-Requejo & Rottke

2013; Samila & Sorenson 2011; Peneder, 2010; Suchard, 2009), and fostering innovation in an economy (Faria & Barbosa, 2014). In a broader sense, VC contributes not only equity capital but also provides mentorship and industry connections that help grow young businesses. As a consequence, not only is it beneficial to entrepreneurs, but also has several positive impacts, that fuels innovation and creativity in an economy. Therefore, it is necessary to underscore its relevance and role in explaining sectors within the European economy.

NVCA (2004) in their report underscored the impact of VC backed firms in the USA and their contribution to the growth of the US economy. Andersson & Napier, (2007) also in their study on the role of VC, Global trends and Issues from a Nordic perspective corroborated the claim made by NVCA (2004).

A lot of researchers have used the agency theory, trust theory, stewardship theory, signalling theory and few others, the institutional theory to provide theoretical support for topics related to VC activities. The research has been approached by different authors from several perspectives. Among some of the theories used include agency theory by (Cumming et al., 2017; Cherif & Elouaer, 2008; Bruining & Herst, 2008; Gompers (1995, 1999), stewardship theory by (Collewaert and Manigart, 2016; Scarlata and Alemany, 2010; Smith, 2005), trust theory by (Bottazzi, Da Rin & Hellmann, 2016; Kollmann, Kuckertz & Middelberg, 2014; Clercq & Sapienza, 2006) signaling theory by (Busenitz, Fiet & Moesel, 2005; Islam, Fremeth & Marcus, 2018) and institutional theory by (Bruton & Ahlstrom, 2003; Isaksson, Cornelius, Landström & Junghagen, 2004). However, the use of agency theory in particular has been dominant in the study of VC activities because it appears to provide comprehensive explanations to the behaviours of parties in the contractual relationship.

Entrepreneurs at certain stage in their business life may seek VC investments to aid their growth, and venture capitalist (hereafter VCs) firms may provide the required equity capital in return for a stake in the business. Given the equity stake VCs typically take in a firm, comes with management of the relationship between the VCs as principals and the entrepreneurs as agents (Jain & Kini, 1995). Efforts have been made in entrepreneurial finance literature by authors relying on agency theory to explain the complicated VCs/Entrepreneur relationship in an investment activity (Bebchuk, Cohen & Hirst, 2017; Dalmácio & Nossa, 2004; Lerner, 1998; Sapienza & Gupta, 1994;

Sahlman, 1990; Barney et al., 1989). Agency theory attempts to address actions that focus on protecting investment of the principal (venture capitalist) as against harmful behaviors of the agent (entrepreneur) (Jensen & Meckling, 1976; Shepherd & Zacha 2001). This theory brings to the fore misunderstandings that may arise between parties in an investment relationship. The limitation of this theory is however reported by Panda (2018) in his attempt to underscore the adequacy of the agency theory in venture capitalists and entrepreneur investment relationship. He indicated that the relationship of the parties suffers agency risks especially in the advance stages but appears less affected at the early stages. Another limitation is that though the agency theory seems useful for explaining the VCs-Entrepreneur relationship before the VC's decision to invest in the new venture, its explanatory power becomes more limited once the VCs decides to invest in the new venture as reported by (Arthurs & Busenit, 2003). In spite of the above limitation, this theory explains in more detail the relationship between parties in VC contractual relationship.

Cumming & Johan (2013) exmained venture capital and private equity contracting from an international perspective and reported that VC plays significant role in financing entrepreneurial activity over the past several decades. Though prior research point to somewhat mixed evidence of direct empirical impact of VC on innovation (Kortum & Lerner 2000; Romain & van Pottelsberghe 2006; Caselli, Gatti & Perrini 2009; Peneder 2010; Hirukawa & Ueda 2011), that notwithstanding, there has been growing research of the potential impact of VC on economic development in nations and regions (Gompers & Lerner 2001).

Firms faced severe financing challenges as a results of the financial crisis of 2007/2008. The crisis affected the supply of funds to finance equity capital of businesses and thus fueling calls to explore other alternative innovative risk capital financing options to address the financing needs of businesses (Burdekin & Siklos, 2012; Orduna & Pasquier, 2013). CNMV (2011) in their report indicated that SMEs in Spain were confronted with funding challenges after the financial crisis and therefore it was necessary to open up the debate on how to boost the funding of newly created companies and those with high growth potential through the market and other external sources other than bank credit. Therefore, most European governments and institutions have suggested that bolstering VC and revamping the regulation of stock markets as appropriate remedies to Europe's

economic slugginesh and dismal unemployment is a necessary requirement. EVCA (2013) in their report on exploring the impact of private equity on economic growth, provides evidence that identifies and describes the most relevant dimensions of the activities, outcomes and impacts associated with private equity thus explaining the way such investment activity influences economic growth. In a similar study, Carbó-Valverde, Rodríguez-Fernández, & Udell, (2016) using a firm-level Spanish data, also found evidence suggesting that firms particularly SMEs in Spain suffered significant credit crunch as a result of the financial crisis. This impact created concerns for policy makers, to promote alternative financing schemes other than bank and stock market financing options necessary to close the financing gaps for businesses. In a related studies by Anagnostidis, Varsakelis, & Emmanouilides, (2016), the authors found that the 2007/2008 financial crisis has adversely affected stock price efficiency in most of the Eurozone capital markets, leading to the emergence of significant mean-reverting patterns in stock price movements. The impact made it difficult for businesses to raise the required financing for their businesses thus making the promotion of alternative financing options necessary in event of recurrence of such crisis. Lim, Brooks & Kim, (2008) on their part investigated the effect of the 1997 Asian financial crisis on the efficiency of eight Asian stock markets. They found that on a country to country basis, the crisis had severe impact on the efficiency of the markets in Asian. Thus confirming severe effect of the 1997 Asain financial crisis on public equity market.

With the use of data from 50 equity markets, Kotkatvuori-Örnberg, Nikkinen & Äijö, (2013) on their part analysed stock market correlations during the financial crisis of 2008-2009 and found that from both the unconditional and conditional correlation analyses, the impact of the financial crisis on stock markets is significant for all regions. The study found evidence that though the crisis affected both the private equity market and the public equity market, the impact however of the crisis on the public market was much more severe than the private equity market.

Bottazzi & Da Rin, (2002) also studied venture capital in Europe and the financing of innovative companies using a unique data set of 500 listed firms in Europe. The authors found evidence suggesting that VC could be considered as the most appropriate form of financing innovative firms in high-tech sectors. Therefore, it was necessary to promote this financial instrument for use by high-tech firms. Furthermore studies by Tsay &

Ando, (2012) using the Bayesian panel data analysis for exploring the impact of subprime financial crisis on the US stock market concluded that the structure of US stock market has changed drastically after the subprime crisis. The authors again indicated that their empirical analysis showed US stock market was subject to 8 common factors before the outbreak of the subprime crisis, whereas the number of common factors reduced substantially after the outbreak. They further claimed that a small number of common factors has been governing the fluctuations of stock market after Lehman brother's failure. In their study in China, Yiu, Su, & Xu, (2013) also investigated alternative financing and the performance of private firms with a sample of 284 firms and concluded that there was value-adding effects of alternative financing for firms in emerging economies like China. They further highlighted informal financing as a void-filling institution in the capital markets in China.

Harrison & Baldock, (2015) on their part studied financing of SMEs growth in the United kingdom and highlighted the emergence and the role of alternative forms of finance. They claimed that any form of continuous constrained supply of finance to SMEs has the potential to impact the overall performance of developed and developing economies. Furthermore, they reported that new forms of financing were emerging in place of traditional banking and other equity sources. SMEs are the backbone of most economies including Spain and account for almost 60% of total employment and value addition. They are key to strengthening productivity and promoting economic growth and therefore continous availability of funding to support them is necessary.

Venture capital is important in strengthening entrepreneurial and innovative activities and serve as a necessary tool to addressing barriers to growth caused by prevailing conditions. Governments in Europe having acknowledged the valuable role a vibrant VC industry could play in stimulating innovation and technological development, have committed to embarking on policies to encourage its growth and development (EIF, 2000). The unique role of VC as connected to healthcare growth could be of relevance to overall economic growth. Policy makers in developed and developing countries alike recognize that, one of the surest ways to achieve economic growth and improve the social well-being of her citizens depended largely on their ability to support the creation and renewal of businesses in delivering high socio-economic impact (Mason and Brown

2013). And as such one support being proffered is financing which appears to be a major constraint affecting the creation of businesses.

Every business firm at a point in time may require funding. While they may have initially financed the business with their own money or loans from family and friends, there comes a time when institutional capital is necessary for sustained growth. Alternative financing here refers to the process of turning to nontraditional lenders to invest in your company. To sustain the promotion and reliance of VC as alternative equity financing scheme for businesses, targeted policy measures aimed at supporting the development of the VC industry is the necessary. These policies are best developed and implemented when informed by empirical research. Most of the VC markets globally have received continuous support from government in the respective countries (Lerner, 2009, 2010). Since the global financial crisis, governments have intensified their support through the establishment of investment and funding schemes to assist VC fundraising activities (Owen, North, & Bhaird, 2019). This is necessary in view of the critical role government can play to support fundraising activities for the benefit of businesses. According to Milosevic, (2018) the VC industry has been dominated by government funding and incentives since the global financial crisis. And this has been necessary in order to close up funding deficit that the financial crisis may have created.

Ribeiro & Carvalho (2008) in their study examined private equity and venture capital in an emerging economy with data from Brazil and found that majority of the VC fundraising commitments are from domestic sources with pension funds contributing more to domestic fundraising while the remaining is from international source with corporations being the main contributor. In a similar study, Chen (2020) reports that foreign venture capital fundraising has been dominant to total VC fundraising activities in China since the inception of the Chinese VC Industry but has since lost its dominant position prior to the 2008 financial crisis. He further indicates that notwithstanding efforts have to made to improve legal framework and market environments to attract foreign fundraising investors to China. Schertler & Tykvová, (2011) also studied venture capital and internationalization with a worldwide dataset of 38,125 deals involving both domestic and cross-border deals and concluded that factors capturing benefits and costs of investing abroad as determinants of international VC flows. Harrison, Yohanna & Pierrakis, (2020) on their part studied using VC investment data

from the United Kingdom and concluded that the geography of VC invstments has been shaped by significant increase of foeign VC investments mainly in the form of co-investments with local funds. The authous further report that more than 80% of the increase is however concentrated in London. This is to say that factors such as economic activity, development of stock markets, corporate governance practices, social and environmental development matters, entrepreneurship and taxation among others as reported also in literature are some of the issues that infom international investors decisión to invest in the VC industry (Ning, Wang & Yu, 2015).

An appraisal of the 2008 financial crisis with data from USA internet industry showed that angel and earlier-stage investments were less affected by the financial crisis as reported by Block & Sandner (2009). They further indicate that this was so due to the fact that firms already at the later stage of the venture cycle were less attractive as investment targets, simply because raising large funds were difficult under the circumstances. They authors again report that the effect of the crisis seems to differ according to stage of the VC cycle.

2.3 Relevance of venture capital activity in the health sector

For the spotlight on the health sector to be sustained as a result of the essential nature and its fundamental pillar in society, appropriate policies that support the VC industry ought to be promoted to encourage fundraising and investment activities. This will ensure continuous flow of investments directed into the health sector. Unlike the US healthcare industry which rely heavily on private markets, the European healthcare industry rely mostly on public financing and therefore little is known about the increasing presence of venture capital financing in the sector. The manifold problems confronting the European healthcare industry such as ageing population, reduction in public expenditure etc. has also brought to the fore the urgent need of investments into the sector, hence private equity touted as crucial to meeting the demand. Again the growing burden of diseases in Europe and elsewhere in the world suggest the need for more financial investments in healthcare industry innovation products and services to address same. Innovation in healthcare industry sector requires financing to develop those ideas into real and physical products or services. Undoubtedly advancement in the provision of medical suppliers and services as a result of research and development could have significant impact on

healthcare growth in Europe. Healthcare sector innovation has the potential to cause a major shift from complicated and risky service delivery to less risky service delivery (Lagomarsino, Garabrant, Adyas, Muga & Otoo, 2012).

This study in relation to health sector growth and venture capital investments is motivated by a research work by Rodrigues, Zólyomi, Kalavrezou & Matsaganis (2013) on the impact of the financial crisis on the unmet needs of healthcare among Europeans which was sponsored by the European Commission. Rodrigues et al (2013) reported that the financial crisis of 2007/2008 resulted in reduced national spending on social protection and cuts in healthcare industry budgets in particular had the potential in worsening the healthcare situation of the people. It is in the light of these cuts that the study proposes VC financing as a complementary financing tool to close the funding gaps created as a result of the cuts. Another study by Simou & Koutsogeorgou (2014) also motivates this study. The authors corroborate the claim made by Rodrigues et al (2013) that reductions in public healthcare industry expenditure, changes in healthcare services and the pharmaceutical market were impacted negatively by the crisis. Furthermore, the study is motivated by the call made by the World Health Organization in their report on the effect of the global financial crisis on healthcare industry sector financing (WHO High-level consultative Report, 2009). With most European countries hardly hit by the global financial crisis and the seemingly impact on public spending, it apparantly became necessary to explore alternative financing modules to close up the gaps created as a reuslt of cuts in public spending occasioned by the crisis. This study therefore proposes an assesement of alternative financing module like VC finance to support healthcare sector delivery.

Over the years, the relationship between healthcare and the economy of a country has been regarded as a complex one. Even though recognition of the relationship is being established in low income countries, evidence of the relationship in European Union member states appear fragmented and require further examination (Suhrcke *et al.*, 2006). Regarding the relationship and possible effect of VC financing on economic growth and other growth indicators, there is extant literature on the effect of VC financing in developed and developing countries alike. However, not much is known about the role of VC investments directed towards health sector growth, hence the need to examine the role of VC investments in explaining health sector growth in Europe.

The growth of a health sector could not be exclusively dependent on only providers or supplies within it only but increasingly from innovators and financiers outside of it. Therefore, ascertaining the crucial role of VC financing to healthcare sector cannot be underestimated. VC backed health related firms create opportunities that could affect the growth of the healthcare industry. Analytical framework for understanding the role of VC finance in explaining health sector growth and also to identify the relationship between VC financing and health sector growth is a necessity. Despite years of research in relation to the impact of VC on health innovation, the relation between the two has not been fully explained and reported. Existing literature has focused on the role and impact of VC finance on firm level performance and even in limited instances on the relationship between VC and health innovation at the micro level but this study focuses on explaining the role of VC in relation to the health sector from a macro perspective, thus the study focuses on presenting evidence of the role of VC financing in explaining the growth of healthcare sector in Europe.

The recognized role of innovation to health growth and by extension economic growth also has triggered the need for VC financing (Rossi, Thrassou & Vrontis 2012) and its relevance to healthcare sector in particular. According to Robinson (2015) innovative health firms contribute to the improvement of healthcare delivery. The European Commission (2009) in their report on Knowledge for growth prospects for science, technology and innovation indicates that private sector expenditures through various kinds of incentives and demand-side initiatives aimed at developing an EU comparative advantage in certain innovation areas ought to be encouraged. It has been reported that venture-backed businesses are important driving force of global healthcare sector innovations, economic growth, and employment generation in both developed and developing countries alike (Halila & Rundquist, 2011). However, not much is known of the role whether the increasing presence of invstments has positive effect or otherwise in Europe. Several authors have proffered interest in the study of the role and impact of VC investments on innovations (Bertoni & Tykvová 2015; Sprague 2015; Rossi, Thrassou & Vrontis 2012; Popov & Roosenboom, 2012; Tucker, Chakma, Fedak & Cimini 2011; Lazonick & Tulum 2011; Rosiello & Parris 2009) and also appreciable studies have been done to examine the relevance of VC to innovation especially health innovation (Lehoux, Miller & Daudelin, 2016; Smith & Shah, 2013; Ackerly, Valverde, Diener,

Dossary & Schulman, 2008) and what remains unclaer is whether or not VC investments directed has yeilded the desired results.

The unique role of VC as connected to healthcare sector growth could be of relevance to overall economic growth. Venture capital is important in strengthening entrepreneurial and innovative activities and serve as a necessary tool to addressing barriers to growth caused by prevailing conditions. Governments in Europe having acknowledged the valuable role a vibrant VC industry could play in stimulating innovation and technological development, have committed to embarking on policies needed to encourage its growth and development (EIF, 2000). Policy makers in developed and developing countries alike recognize that, one of the surest ways to achieve economic growth and improve the social well-being of her citizens depended largely on their ability to support the creation and renewal of businesses in delivering high socio-economic impact (Mason & Brown 2013). And as such one support being proffered is financing which appears to be a major constraint affecting the creation of businesses.

Global trends of VC investments in the last three decades in health sector points to investors' interest motivated by potential for big profits that may accrue to them as well as the premium price put on healthcare (Pitchbook, 2018). Dibner, Trull & Howell (2002) in their survey conducted in the U.S, claimed that VC investment in biotechnology were showing improvement and that poor economy did not deter VC investment in biotechnology in 2002 that notwithstanding it was unclear what looms ahead of the sector. In a related study, Lee & Dibner (2005) focusing on U.S and Europe reported that biotechnology-based businesses have historically looked to venture capitalist for funding. Their survey showed that unlike the public marketplace, where investors' appetite for biotechnology has waxed and waned in the last few years, venture capitalists are staying the course by investing in biotechnology. There has been appreciable level of VC investments to the health and biotechnology sector to augment public investments and this points to the attarctive nature of the sector to VC investors and therefore meausres ought to be put in place to sustain the interest (Festel & Rammer, 2015). Rosiello & Parris, (2009) with a database of 655 UK bio-healthcare deals studied to ascertain and map the geographical flows of VC investments and measure the co-location of dedicated biotechnology firms in the therapeutic and diagnostic sectors. The authors found attractive power of investor-ready opportunities being espoused by Mason &

Harrison (2003). Champenois, Engel, & Heneric, (2006) on their part also conducted an empirical analysis with a sample of 378 biotechnology firms in Germany and underscored the role of VC investors in the emergence of new biotechnology firm in Germany. They suggested the importance of access to VC funds by biotechnology firms and indicated that about 42% of early stage healthcare developers are being partnered by VC companies in Germany.

Salter (2009) also in a study focusing on China stated the position of venture capitalist in relation to VC investments in health biotechnology innovation. The author provided evidence of how the Chinese state has dealt with opportunities and threats that health biotechnology industry provides for VC investors. Although it takes a long lifespan period for an investment in the health sector to be successful according to Kim, Chatterjee & Higgins (2016), yet VC funding have been made available to hundreds of healthcare related firms and startups (Ackerly, Valverde, Diener, Dossary & Schulman 2009; Rosiello & Parris 2009). There is evidence that government VC investors are effective in complementing independent VC investors in impacting invention and innovation in the biotechnology sector (Bertoni & Tykvová, 2015). Studies points to the fact that future VC investment opportunities are gradually titling towards medical technology, pharmaceutical, service providers and IT health infrastructure firms according to (BVCA Report, 2016).

Using a sample of 138 venture financing rounds in the US and Europe, Behrens, Patzelt, Schweizer & Bürger, (2012) also studied how specific human capital in biopharmaceutical ventures' management teams impact the financial commitment of venture capital investors. The authors found that venture firms with greater portions of specific managerial human capital in the fields of management, law, medicine and biosciences acquire more money in VC financing rounds however the effect was contingent on the age of the venture.

2.4 Relevance of macroeconomic factors on venture capital exiting activity.

Apart from fundraising and investment activities, VC investor would prefer exiting from an investment after a period of time, typically four to six years or more after the initial investment using any of the liquid exit forms available to VC investors. VC exiting is an important activity and a driving force in venture capital relationship (Gompers & Lerner,

2001) and exiting is made posible when the market is liquid. Prior research has established the unique role of market liquidty in facilitating the likelihood of an exit (Andrieu & Groh, 2020; Espenlaub, Khurshed & Mohamed, 2015; Giot, & Schwienbacher , 2007; Cumming, Fleming & Schwienbacher, 2005). The exit forms a critical role in the VC firm, as successful exit can provide the necessary support for the dvelopment and growth of the VC firms (Cumming & Johan, 2008). There are two kinds of exits that are deemed successful and popular among Eurorpean VC funds. First include IPO (initial public offering) exit and second is trade sale (mergers and acquisitions and trade sale) exit, however trade sale exit appears more popular among European VC funds (NVCA 2004).

Research indicates that markets with higher liquidity and better economic environment has the higher probability of exiting successfully their investments (Minardi, Bortoluzzo, Rosatelli & Ribeiro, 2019). This is particularly important for investors as exiting forms a key role in an investment decision. Studies also point to macroeconomic factors affecting VC investment decisions (Gompers & Lerner, 1998; Groh, Liechtenstein & Lieser, 2010; Paik & Woo, 2014). Bertoni & Groh, (2014) using a sample of 429 firms in 7 European countries found that the probability of an investment exiting through trade sale is related to additional set of mergers and acquisition opportunities brought by cross-borders investments. The authors further point to the fact that though a similar effect was found with IPO exit but the effect was weak. Using short and long-term interactions between venture capital returns and the macro-economy as was done in the Füss & Schweizer, (2012) studies in the United States, the authors found that the value of VC investments was positively related to industrial production, the exit channel Nasdaq, and the long-term interest rate, but negatively related to the short-term interest rate. They again confirm that only industrial production influences VC performance based on the VEC Granger causality test they used. Their studies again point to the influnce of macroeconomic influnce on the returns of VC investments in the United States.

In a related study, Wang & Wang, (2012) also investigated the determinants of cross-border VC performance using a large sample of 10,205 cross-border VC investments by 1906 foreign VC firms (VCs) in 6535 domestic portfolio companies. The authors found that domestic country's economic freedom is critical to the performance of cross-border VC investment. They further indicated that in a more economically free country, as

measured by the ranking in the index of economic freedom (IEF), a foreign VC-backed portfolio company is more likely to exit successfully through an IPO or through M&A. Their findings were consistent with Füss & Schweizer, (2012) findings that found long interest rate to be related with venture capital returns. In a related study, Espenlaub et al., (2015) on their part compared and contrast the performance of cross-border and domestic VC investments in terms of the time it takes for the VC backers to exit portfolio companies through initial public offering (IPO), trade sale (M&A), or other routes with a sample of 4502 VC investments in UK. The authours found significant and pronounced difference between cross-border and domestic investments with respect to the time to exit for both IPO and M&A. Again their study found no significant difference between domestic región investments and most cross-border regions investments, in that the average times to exit was more than two thirds shorter in North America than anywhere else, including the domestic region of UK & Ireland. Their study is in line with Wang & Wang (2012), study that found cross-border investments exited more quickly than domestic investments.

Minardi et al, (2019) on their part used the hazard model to investigate the magnitude of the impact of market conditions on the exit rate of PE deals in Brazil volatile emerging economy with a sample of 470 PE funds between 1994-2014. Their analysis involved four variables related to market conditions in an emerging economy. They found that favorable market conditions more than double the exit rate and increase the probability of quick flips. In a study of innovation and VC exits by Schwienbacher, (2008), the author concluded that more innovative and profitable ventures are more likely to go public than ventures with more imitative or derivative projects. His analysis provides a possible rationale for the predictons that IPOs are more likely in markets with greater consumer heterogeneity. Furthermore his analysis generates a number of empirical implications for the link between innovation, valuation, VC exit routes and the existing market structure.

Dai, Jo & Kassicieh, (2012) also examine the investment behavior and exit performance of VCs that have pursued expansion outside their home locations with a sample of 468 VC firms in 6 Asain countries. Their findings indicate that foreign VCs have relative advantages over local VCs in terms of size and experience, though they are at a disadvantage in information collection and monitoring due to both geographic and

cultural distances. The authors further found that foreign VCs are more likely to invest in more information-transparent ventures when investing alone. In a related study, Cheng & Schwienbacher, (2016) using a sample of 2249 IPOs Chinese companies between 1994-2013, investigated venture capital investors and foreign listing choices. The authors showed that companies backed by Chinese domestic VCs are significantly less likely to list abroad while those backed by foreign VCs or co-invested by foreign and domestic VCs are significantly more likely to do so. They futher found evidence that the introduction of a domestic stock market for high-tech start-ups in China reduces the likelihood to list abroad in a significant way.

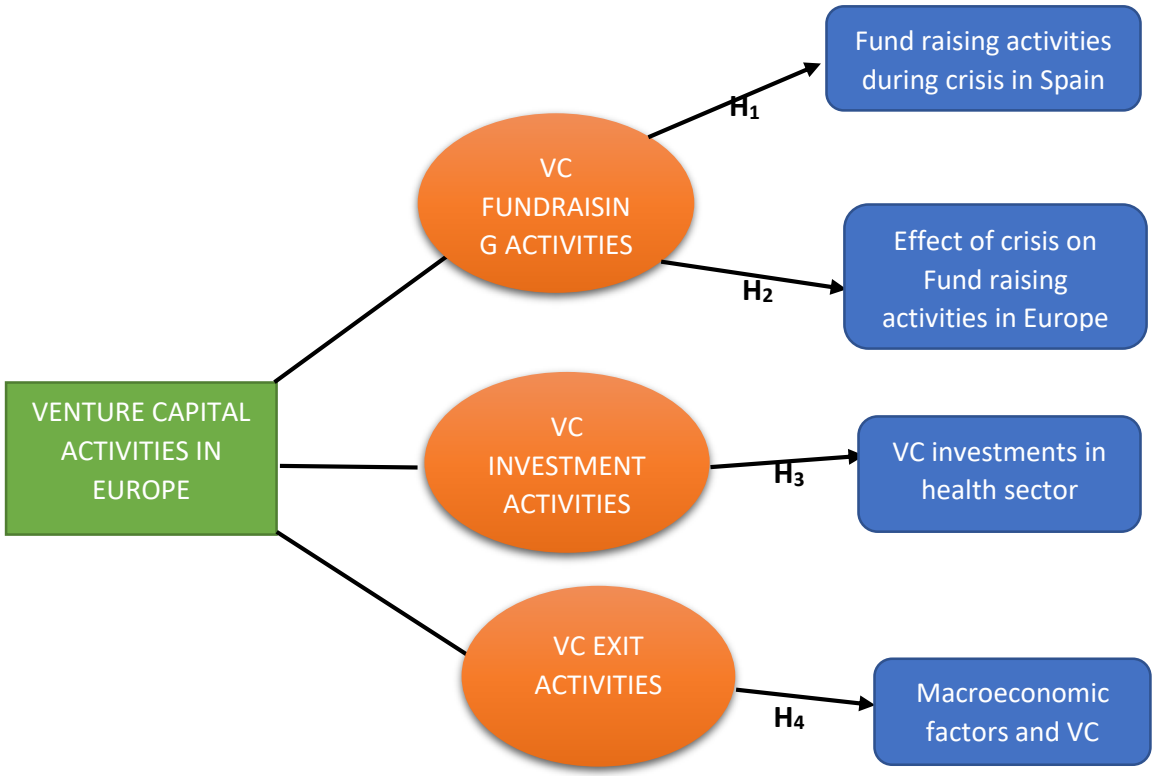
The reviewed literature points to the probability of economic factors influencing VC exits as indicated in literature that in some markets the higher the market liquidity, the better the legal rights and the better the economic environment, the higher the probability of successful exit of venture capital (Cumming & Johan, 2008). This study thereofre attempts to look at macroeconomic factors that can influnce and stimulate exits available to European VC funds.

2.5 Conceptual framework

In this thesis, the framework for aspects of VC activities in Europe comprising fundraising activities relative to the financial crisis, investment activity relative to the health sector and exiting activity relative to macroeonomic factors are explored. This framework is consistent with Balboa & Marti, (2004) who described VC as the interaction between supply and demand as directly affected by three conditions namely the size of the domestic market, the accessibility of a stock market for growing companies and the entrepreneurial environment. It is necessary to underscore the relevance of VC activities as a way of understanding the usefulness of this form of finance and the effect the crisis had on it so as to inform policy. Figure 2-1 illustrates the conceptual framework.

Figure 2-1: Conceptual framework

Source: Author's construct



Conclusion

To conclude, this review explored the prevailing literature within the aspects presented in the dissertation. The review uses systemetic analysis approach to emphasize the current trends and issues within the areas presented in this dissertation. Consequently, the analysis revealed that there is limited work on the areas presented in this thesis. The review outlines paths for further work and research gaps that might stimulate the academic discussion in VC actvtities.

CHAPTER THREE
Research Methodology

3.1 Introduction

This section discusses the methodology used in the research. It covers the research philosophy, approach, strategy, methodology and materials used.

3.2 Research philosophy

Venture capital as the business of investing in new or young companies with innovative ideas is a prominent branch of entrepreneurial finance that emerged in the beginning of the 20th century.

Innovative and growth-oriented small businesses need to acquire capital (equity investment) from external sources because they do not have their own or cannot access loans because they do not have the required assest to secure the loan. So therefore firms typically use VC to expand, break into new markets, and grow faster. Although only relevant to a smaller group, VC is essential for the growth of innovative firms. VC is the only financial asset management class that focuses on return/potential maximisation rather than risk management/minimization.

VC has, in recent years become a substantial and growing area of academic research. Though it is still a comparatively young field compared to other financial instruments and therefore has several fundamental questions that need to be answered. This dissertation aims to provide an overview of the current scholarly answers to several questions raised in this thesis. In doing so it attempts as far as possible to underscore the relevance of VC activities in Europe.

There has been considerable amount of research conducted in the past three decades on VC and how it provides entrepreneurs with critical financial resources necessary for growth and development of businesses. Most of these studies have followed positivist paradigms methodologies with limited authors having used interpretive paradigms methodologies (e.g., Saetre, 2003; Amatucci & Sohl, 2004; Cornelius & Persson, 2006; Mäkelä & Maula, 2008; Lu, Tan & Huang, 2011; Savaneviciene, Venckuviene & Girdauskienė, 2015). Though these studies appear to have limited coverage of concepts, researchers ended up providing detailed explanations leading to the in-depth

understanding of phenomena. The current paradigm adopts descriptive, correlational, quasi-experimental, experimental, comparative and relationship-based research questions to explaining the aspects of VC activities in Europe. This thesis makes use of the positivistic epistemology disposition to test existing theories of entrepreneurial finance in order to make generalizations of the aspects of VC actvtities. This objective approach provides justification for scientific research through replication and consistency of the research methods. It is a positivist philosophy because it follows structured, well-defined topics, hypotheses and research design.

3.3 Research approach

The limited research into the relevance of VC financing towards the growth of sectors in Europe raises a question of the most appropriate research approach. The limited previous studies could justify an explorative research approach. However, a wider perspective on the research problem suggests another research approach. While there are limited research into the specific topics of the present dissertation, studies on the aspects of VC financing towards the growth of sectors, appreciable handful research into related, relatively similar contexts of role of VC financing exists. By reviewing thoroughly relevant research in these related fields and identifying the commonalities in these literatures, it is possible to build relatively strong hypotheses on essays of the relevance of VC activities in Europe. While this approach both advances the understanding of relevance of VC further than what would be possible through an explorative survey, it will also help to consolidate the existing streams of how important VC is to the growth and development of the European economy and also identifying commonalities in these literatures, while validating the hypotheses in the context of critical role of venture capital. By conducting a thorough literature review of several related fields of VC, consolidating the literature, building robust hypotheses, and testing them empirically in the context of essays on aspects of VC activities, the present study attempts to contribute not only to the understanding of relevance of VC activities but also to a more general understanding of its role to the growth agenda of the European economy.

The conceptual frameworks and the hypotheses of the dissertation are developed on the basis of an extensive review of research into VC and related fields, and of theoretical

approaches relevant to the analyses of essays on the relevance of VC. Theoretical constructs are then operationalised by adopting measures from previous research, and by developing the hypotheses for the studies.

The hypotheses are tested empirically using statistical methods. The data used in the analyses is activity report data from EVCA now Invest Europe from 2000 – 2017. The secondary data collected VC fundraising, investment and divestment activities from EVCA now Invest Europe. The hypotheses are tested by confirmatory vector error correction model, quantile regression, Generalized methods of moments (GMM), and Two Stage Least Squares (2SLS) regression models.

The research approach is mainly deductive. By building on theories and empirical research and developing an integrated model of the relevance of VC activities in Europe and how important VC is to the growth of sectors by the use of secondary data, and by subjecting the hypotheses to rigorous empirical testing. This dissertation aims to consolidate and expand the existing literature on relevance of VC in Europe and to contribute also to a wider body of literature on the role of VC finance to economic growth.

3.4 Research strategy

The research strategy for this dissertation, quantitative was adopted as a way of achieving the objectives of the study. This strategy was identified based on the purpose of the study and the available data for the study. Quantitative research generally is objective in nature although some argue that it can be subjective as well (Madill, Jordan & Shirley 2000). Creswell, (1994) defines quantitative research as an enquiry into social related problem based on testing a hypothesis or a theory composed of variables, measured with numbers, and analysed with statistical procedures in order to determine whether the hypothesis or the theory holds true. Quantitative data therefore involves measurements of tangible, countable or numeric, sensate features of the world. (Bouman & Atkinson, 1995). Though it has limitation in the sense that it depends on available or readily statistical data that can be analysed; therefore, it is not suitable for testing new subjects/concepts with limited available data.

The study employed country-level data of annual VC activities report from EVCA now Invest Europe, ASCRI and reputable databases. This strategy is to allow for international generalization that firm level data may not offer.

3.5 Research design

This thesis adopts a quantitative research method as can be seen from the analyses, tests and estimation techniques. The sampling technique was probabilistic. All countries in EU/EEA were sampled for the study and countries that data was unavailable were dropped. Apart from the first study which was a single country-level research in Spain, the remaining three studies were cross-country research that used panel data. Panel data combines cross-sectional and longitudinal (time series) data thus studying various countries over a period of time.

The research adopts a quantitative analyses methodology of the data using static and dynamic panel method of analyses where various diagnostics, post-estimation techniques and robustness checks were performed. Figure 3-1. is a summary of the methodological flowchart.

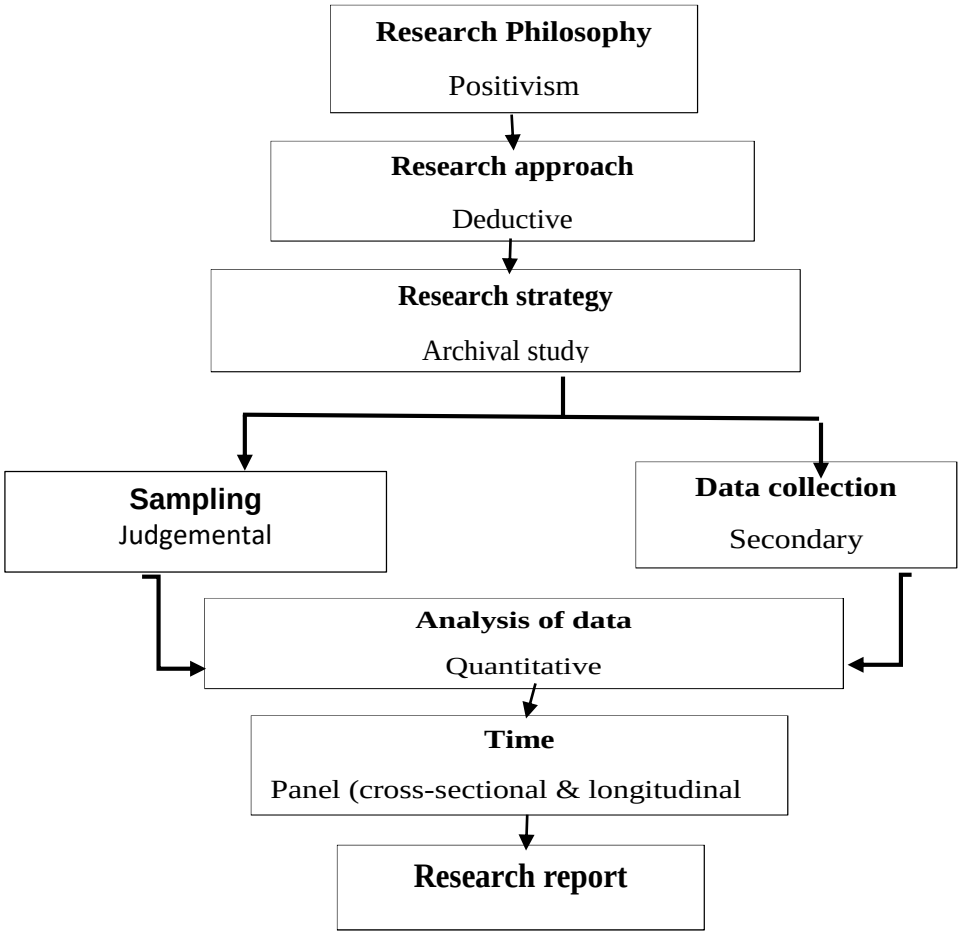


Figure 3.1: Research methodology flow chart

Source: Author's design

3.6 Data Set and Data Considerations

The main dataset is provided by the European Venture Capital Association (EVCA) now Invest Europe (an umbrella body of national venture capital Associations). Invest Europe is the world's largest association of private equity providers founded in 1983. EVCA became Invest Europe in 2015 representing the voice of private capital investors. Invest Europe is made up of private equity and venture capital, infrastructure investment firms, as well as their investors and insurers. The Association aims to promote better understanding of venture capital and private equity that affords its members the opportunity to prudently invest capital and expertise towards improving businesses and

generating returns for investors. The Association concerns itself to creating the enabling environment that is literally free from unnecessary regulations and constraints for the benefit of its members. The membership of the Association made up of 650 member firms and 500 affiliate members covers a full range of private equity activity, from early stage venture capital to largest private equity firms such as pension funds, insurance companies, fund of funds and family offices and associate members from related professions. The Association is committed to helping create an investment atmosphere that guarantees strong and sustainable returns on investment. EVCA now Invest Europe entered into an agreement with PEREP_ANALYTICS to launch data services in 2007. Data on private equity fundraising, investment and divestment by more than 1,800 private equity firms in Europe is gathered by PEREP_ Analytics, which is a joint Pan-European statistics platform owned by Invest Europe and several European private equity associations. The establishment of this private equity database was agreed upon in 2012 by the national associations of EVCA now Invest Europe.

Invest Europe data source is a reliable and comprehensive database that list annual information on venture capital fundraising, investing and exiting activities of its member associations. It is an institution that is recognized as authoritative data source for European private equity and venture capital by institutions such as European Commission and OECD. Rigorous and extensive research has underpinned Invest Europe's work with policymakers, press, the public and investors since 1984. The VC activities information data is available on request for academic research purposes. Invest Europe publishes information on the role of its members in an economy as well as industry trends and developments. Its data is used by a number of institutions including European Investment Fund (EIF) and the Organisiation for Economic Co-operation and Development (OECD).

Invest Europe data source has been used in previous studies by (Ooghe, Manigart & Fassin, 1991; Da Rin, Nicodano & Sembenelli, 2006; Schertler, 2007; Cumming, 2014; Precup, 2017) and this indicate that the data reflect well with other commercial data sources including Preqin Pro, VentureSource, CB insights, Pitch Book, VCgate data sources etc. I extracted annual country level data of 23 countries in Europe for a period covering 2000-2017. There are compelling reasons why it was necessary to undertake this country-level analysis. The prominent reasons include, but are not limited to the

following: (i) since there has been much research on firm-level data analysis on venture capital in Europe, research work through comparative studies at the country level is in need and necessary; (ii) lack of inexpensive available venture capital data at the firm level makes it impossible to conduct such research as this study intends to do; (iii) venture capital activities research at the firm level is available but, by contrast, knowledge accumulation of venture capital activities at the country level is poor, thereby this thesis serves to bridge the gap; (iv) most research in recent years has focused on venture capital activities at the firm level but little work has been done to validate the firm-level results to see whether they are applicable across national boundaries; and one way to validate the findings at the firm level is to compare the relevance of VC activities and impacts across different countries, meaning that the external validity of firm-level conclusions on relevance of VC activities is required; (v) it has been emphasized that a key dimension of external validity is international generalization and that a country-level study on relevance of VC activities is an international generalization; and (vi) methodologically, a careful review of the literatures on entrepreneurial finance reveals that there are limited country-level studies on relevance of VC activities that have ever applied in Europe.

The study also made use of data from Bolsa de Madrid, ASCRI, EUROSTAT, OECD, IMF, World Bank and World Health Organisation to complement the Invest Europe venture capital data.

CHAPTER FOUR

"VENTURE CAPITAL AS INNOVATIVE SOURCE OF FINANCING EQUITY CAPITAL AFTER THE FINANCIAL CRISIS IN SPAIN"

Abstract

The global financial crisis affected the supply of funds to finance equity capital, thus calling for innovative risk capital financing methods. The paper explores the sources of venture capital fundraising and determine the relationship between private and public equity financing. The study uses time series data of VC fundraising and stock market variables in cointegration and vector error correction model. The paper reports short run and long run causal relations between VC fundraising, stock market returns and market capitalization when VC fundraising and stock market returns are used as dependent variables. However, such relations do not exist when the model is dependent on market capitalization. The results show that VC market raise funds from diversified (geographical and institutional) sources. The findings support persuasive and risk diversification theories of VC financing. The study provides implications for using alternative innovative ways of financing equity risk capital to spur economic growth.

4.1 Introduction

The debate on equity risk financing continue to produce interesting outcomes in various study settings. Equity financing of entrepreneurial firms especially startups has been used to fuel growth (Kang, 2018). In the event of financial crisis, capital markets face liquidity problems thereby calling for innovative ways of supplying funds for firms. Black & Gilson (1998) provide evidence of a relationship between the US stock market and the venture capital market (hereafter VC). Their study reveals such relationship in the Anglo-Saxon stock-based market of the US and the bank-centered capital markets of Japan and Germany. Lin (2017) provides similar evidence on the relation between the stock market and VC market in China. The US operates a stock market-centered capital market whilst China's capital market is purely bank-based. Contrary to these findings, Mayer et al., (2005) report that variations in the VC fundraising and investment activities is not traceable to the financial system. These contrasting findings motivate further studies.

Research has underscored the effect of the 2007 global financial crisis on the supply of equity capital for businesses (Burdekin & Siklos, 2012; Orduna & Pasquier, 2013). The crisis-led financing gap was severe for most bank-based economies such as Spain. Even though the stock market-VC market relationship is known in the US and China, that of Spain remain unknown. Explaining why some countries have failed in replicating the US model of VC, Black & Gilson (1999) argue that a well-developed stock market that allows VCs to exit through IPOs is impetus for developing a strong and active VC market. They maintain that in the US, the VC market is a strong force to the stock market-based capital market. Lerner & Tåg (2013) report that institutions such as financial markets correlate with VC markets activities. As a reliable supplier of innovative finance, the VC market has helped transformed economies such as the US and Israel through economic and technological developments. Spain is the fifth largest economy in Europe but was severely affected by the 2007 financial crisis thereby constraining liquidity of the capital market (Banco de España, 2017). VC activities provide innovative liquidity options and significantly contribute to the creation, sustenance and survival of start-ups and other risky investments. However, research on venture capital have focused on the performance, investment activities or efficiency of VC investments with little to show on the fundraising activities as a means of providing liquidity for the equity markets.

From the deliberations above, three issues remain unaddressed. First, the relationship between the VC and stock market in Spain is yet to be researched. Second, there is a dearth of research on fundraising activities of VCs in Europe. Whilst some authors believe that the success of VC fundraising is not traceable to the financial system, others maintain that vibrant stock markets propels the VC industry or vice versa. The paper addresses these lacunas by exploring the sources of fundraising of the VC industry in Spain within the pre-crisis, crisis and post-crisis periods. The study also determines the relationship between VC fundraising and the stock market. Specifically, the paper tests the following hypotheses: Venture capital uses diversified funding sources to finance equity risk capital; VCs rely on internal sources to finance businesses in Spain; there is a long-run causality between VC fundraising (private equity financing) and the stock market (public equity financing).

The work of Burdiken & Siklos (2012) on financial market integration motivates this study. They report short and long run relationship between stock markets in the US and Asia-Pacific. The paper differs from their cross-sectional study of various stock markets across countries and focus on private and public equity finance markets within an economy. Toole & Conor (2013) studied SMEs bank-lending constraints and alternative financing during the financial crisis and concluded that the crisis constrained SMEs financing and that using alternative financing reduces the possibility of fixed investment. This study aligns with the argument to seek alternative financing during financial crisis and extends the argument to propose VC as alternative equity finance mechanism to revive and sustain economic growth. Another motivation for this paper is the work by Lin (2017). He confirms that VC market flourishes when they exit successfully through IPOs. This suggests that understanding the exact relationship between the VC and stock market will expand knowledge in capital market research. This study however, differs from that of Lin (2017) by examining whether there is a causal relation between the VC and the stock market.

The paper purports to examine the sources of VC fundraising and to determine the relationship between VC fundraising and stock markets. The paper employs Johansen cointegration and vector error correction models (VECM) to analyse time series data on VC and stock market activities in periods before, during and after the global financial

crisis. The study finds that, VC fundraising have diversified sources which absorb perceived risks. The sources of funds come from institutions, governments, internal and external sources. The study again reports significant short and long-run causality between VC fundraising, stock market returns and market capitalization. However, such relation does not exist when the study uses market capitalization as outcome variable.

The paper contributes to equity finance research by showing that VC provides alternative financing option for economies when the capital market has funding deficits. The study provides current evidence on the relationship between the VC market (private equity) and the stock market (public equity) in a bank-centred capital market. The study contributes to research by showing significant long-run causal relation between VC fundraising and the stock market return after adjusting for GDP (economic growth). This finding is contrary to prior research, which report that the financial system does not explain variations in VC fundraising. VC funds provide reliable source of financing risk capital to address a market failure resulting from financial crisis. The paper supports the risk diversification theory of VC financing by confirming a diversified fundraising model within the VC industry in Spain. The sources of VC funds in Spain reveal institutional and geographical diversification. Even though it is geographically peaked at internal fundraising (from Spain), there exist avenues of exploring and increasing the other sources. Again, the study proffers support for the persuasive theory to the extent that, VCs provide issue-relevant information to prospective fund suppliers from Spain, Europe and the rest of the world including the US. The paper provides justification for the Spanish government's continued support for the development of the VC industry to meet the capital needs of businesses in Spain. This study shed light for Spanish businesses to look to VC to address their financing needs especially in event of financial crisis. The next sections of the paper cover the literature review, methodology, analysis of results, discussion and conclusions.

4.2 Theory and Hypothesis development

4.2.1 The venture capital industry in Spain

The VC industry in Spain dates back in the early 1980s (Oehler et al., 2007), but it is still young and at the development stage (Jenkinson, 2008) as compared to the counterparts in continental Europe such as France, Germany and UK. Spain is the fifth largest economy in Europe (Eurostat, 2017) and very key in the development of continental Europe. The Spanish VC industry has undergone tremendous growth for over 30 years of its existence. There have been increasing levels of activities with respect to fundraising, investing and exiting after the financial crisis and this has been possible as a result of sustained investment growth and increasing number of successful exits that have characterized the industry after the crisis (ASCRI, 2018). It is not for nothing that Madrid and Barcelona are among the top European cities in terms of VC investments. Government institutions are also playing important role in the VC process through the fund of funds, **FONDICO** Global and through other grants and debt financing instruments such as **ENISA**. Nevertheless, the levels of growth are still below those in France, Germany and UK. The VC investments account for only 0.22% of Spanish GDP whereas those in France, Germany and UK account for 0.68%, 0.29% and 1.28% respectively (Eurostat, 2017). VC is an important form of equity financing for firms that have growth potential in the Spanish Economy (OECD, 2015).

The development of the sector could be an important driver of innovation and long-term success as well as sustained growth for Spain in her efforts to completely come out of the crisis (Gompers & Lerner, 2001; Samila & Sorenson, 2010). There is evidence that the revival of the Spanish economy out of the financial crisis largely depended on the country's ability to support and grow businesses (Lee et al., 2015). Hence, the need to encourage fundraising activities in the VC industry to make funds available to grow and develop businesses. There are theoretical explanations to VC fundraising activities.

Diversification and persuasive theories

The study employs modern portfolio theory of diversification proffered by Markowitz in 1959 and persuasive theory which aims at changing a person (or a group) attitude or behavious about an event, idea, object etc through written, spoken or visual presentation

as theorotical basis. These theories seek to address and explain the behaviour of investors in a capital market environment. Modern portfolio theory of diversification traditionally explains the investment decisions but this study approaches it from a financing perspective. The theory encourages the spread of risk by distributing expectation so that the associated risks cancels out by their unique characteristics. Studies by (Markowitz, 1992; Ariely et al., 2009) have corroborated this claim. There is evidence that a diversified investment portfolio is superior to any individual investment in terms of risk-return ratio no matter how well the individual investment may be selected (Ilmanen & Kizer, 2012). This study examines VC fundraising from different institutional and geographical sources to advance the argument for reliable funds to finance equity risk capital. There is little to report from VC fundraising research that have relied on the theory of diversification for theoretical support. In a study, which focused on investor activities, Bonnet & Wirtz (2012) used the agency theory to explain agency costs external financiers might incur in the intermediation process. This study adopts different theories because it did not investigate the detailed activities of the supplier and provider of funds. Closely related to the diversification for proposed theoretical framework for this study is the persuasive theory. Diversifying the sources of VC fundraising implies providing convincing and reliable business proposals to attract fund providers. In the VC process, there is the job selling stage where VC either through the services of a placement agent communicate the business idea to potential suppliers of funds (Caselli, 2010). VCs persuade financiers by showing readiness for funding especially when seeking funds from outside the area of jurisdiction (Brush et al., 2012). Ability to persuade an investor is a function of the information provided and the level of knowledge, a phenomenon Bonnet & Wirtz (2012) describes as cognitive approach to entrepreneurial finance. Allison et al. (2015) confirm that issue-relevant information is vital to the amount of funds financiers are willing to commit to a VC crowdfunding. Behavioural responses from prospective fund suppliers to funding proposals from VCs, determine whether the call for equity financing was persuasive.

4.2.2 Sources of Venture Capital Fundraising

Firms have difficulty raising public equity funds through the stock market perhaps due to dilution of ownership and loss of control. This makes VCs an important source of equity finance for firms (Wong et al., 2009) because they do not only provide funding, monitoring and useful connections but also add value to their portfolio firms (Metrick & Yasuda, 2011). Due to inadequate funds raised, venture capitalists have not been able to meet firms' demand for funds especially after the financial crisis (Vermeulen & Nunes, 2012). Banks are the main source of firms funding in Europe including Spain (European Commission, 2013). However, bank finance to firms in Spain has reduced after the 2007 financial crisis (OECD, 2014; Brown & Lee, 2016). To address the financing gap created, firms look for innovative equity finance such as VC funds. Although the financial crisis did not spare the VC industry, this study provides evidence that VC fundraising activities served as alternative finance, which is promising for businesses in Spain.

Gompers & Lerner (1998) in their study on VC fundraising sources underscored the relevance of pension funds to VC fundraising in the USA and indicated that pension funds alone accounted for over 40% of funds raised between 1993 -1997. They attributed the growth of the VC industry in the USA in the 1980s to the relaxation of the regulation governing pension funds' investments. Fundraising prospects and potential sources of capital for VC industry vary greatly depending on the supply factors, i.e. being the willingness of investors to commit funds and the expected rate of return for investors; and the demand factor, also being the desire of the entrepreneur to attract VC investment to the firm (Gompers & Lerner, 2001). Hellmann et al. (2004) examined the relation between banks provision of VC funds and loans, and reported that banks are reluctant to originate or participate in early stage deals, and are prone to syndicate VC fundraising deals to support entrepreneurs. Again good partnership relationship of VC firm with investee firm trigger follow-on funds and larger funds (Kaplan & Schoar, 2005). Mayer et al. (2005) study reports of differences relating to the sources of VC fundraising in the selected countries. They contend that, in Germany and Japan, banks are the main providers of VC funds but in the UK and Israel, VC funds come from pension funds and corporations respectively.

In a book chapter on VC fundraising, Caselli (2010) outlines that, based on the business idea, VC fundraising may be provided by business angels, private pool of funds,

corporate funds and mutual investment funds. The author adds that public venture companies, financial intermediaries such as insurance companies and public funds to promote innovative research are popular sources of VC fundraising.

Besides the institutional sources of VC fundraising, there is the geographical source of funds. Studies on geographical sources of VC fundraising indicates that competition arising from domestic markets has increased fundraising from international sources (Gupta & Sapienza, 1992; Martin et al., 2002; Mayer et al., 2005; Madhavan & Iriyama, 2009) . This has compelled local VC firms to look for investment opportunities in foreign markets indicating a shift in their investment focus in spite of the associated liabilities to investors (Wright et al., 2005). Brush et al. (2012) caution against sourcing for funding outside the local area. The authors explain that the perceptions of fund providers and the venture capitalists may be at variance with each other. Although developing the VC industry to be attractive to local investors is clear, an underlying clarity of the role of government must be well defined. Dossani & Kenney (2001) underscored the role of government in stimulating the development of the VC industry by providing the enabling environment for growth. This has been corroborated by Kenney et al., (2013). Kenney et al. (2013) further claimed that the establishment of the European Enterprise Development Company, international offices by US private equity and VC firms was very much instrumental in encouraging the flow of international funds. The government or state may provide VC funds for strategic purposes. The US started this strategy to finance new technology-based small businesses to grow the VC industry (Fisher, 1988). However, such state-funded VC firms make little economic impact since the focus is not profit but addressing employment gaps. In most European countries, there is common policy initiative where government serves as a source of VC fundraising purposely to address funding gaps plaguing the sector (Luukkonen et al., 2013). Usually, the target of such policy intervention is the early stage ventures. There are arguments that government funded VCs in Europe have crowded private equity funds but Cumming (2011) challenges such reports with data on 13 countries for the period 1989-2011. Government participation in entrepreneurial ventures follows a model of other hybrid forms of financing which the Spanish government employed to boost employment and sales during the global financial crisis (Bertoni et al., 2019). Scaruffi (2016) reports that

government agencies in Spain contributes more than a quarter of the total VC funds raised.

That notwithstanding, differences exist in the formation, commencement and execution of fundraising, investing and exiting activities of the VC industry. For example, in most developed economies, the origin of their VC fundraising activities have been domestic (Kenney et al., 2013). It may not necessarily be the case in developing countries as is being claimed by (Kenney et al., 2013) that in most developing economies, international agencies and institutions provide and support the sources of VC fundraising activities. It is worth mentioning that International Finance Corporation (IFC) and United States Agency for International Development (USAID) were instrumental in the establishment of the VC industries in Malaysia, Korea and most of the Eastern European countries. In India, the VC industry is 'international' and driven by a variety of interconnecting forces (Dossani & Kenney, 2002). The situation is not different elsewhere as the links between the Taiwan VC industry and the Silicon Valley in the USA has resulted in the VC industry of the former being one of the most active within the Asian block (Kenney et al., 2013). Countries that attract more foreign venture capital funds may not necessarily have great institutional environment but rather well-developed stock market to facilitate successful IPO exits of VC investments (Aizenman & Kendalls, 2012). Industry players regard VC as a domestic market (Cumming & Dai, 2010; Cumming & MacIntosh, 2001) however, the increasing competition from within is attracting investments in foreign markets thereby increasing the flow of funds from foreign sources (Madhavan & Iriyama, 2009).

The global financial crisis began from one geographical location, but the interconnectedness of the financial system, it affected trade partners making VC fundraising challenging. Klein (2010) studied drivers of VC fundraising and the financial crisis and concluded that the determinants of VC fundraising after the crisis included but not limited to initial public offering, overall economic growth, capital gains tax rates, labour market conditions, financial reporting requirements, existence and regulatory changes of private pension funds and governmental activities and support programmes.

From the deliberations above, VC fundraising comes from different sources such as governments, institutions and different geographical locations. Raising funds from

eclectic sources is confirmatory to the diversification theory. From the persuasive theory, VCs attract suppliers of funds from internal and external sources. I anticipate that financial crisis may have adverse impact on VC activities especially raising funds to finance equity risk capital. Flow of funds from external sources may not be forthcoming and might compel reliance on internal generation of VC funds. I therefore formulate two hypotheses that:

Hypothesis 1: Significant proportion of VC funds originate from domestic (internal) than external sources.

Hypothesis 2: VCs rely on diversified sources of fundraising to finance equity risk capital.

4.2.3 Venture Capital fundraising and IPO financing through the stock market

Some equity financing sources available for firms to grow their businesses include business angels, crowd funding, enterprise investment scheme, initial public offer (IPO) financing and VC finance (EU Monitor, 2015). The relationship between VC financing and lending are substitutable because they fund different investment types but at a point, they play complementary roles (Barry & Mihov, 2015). This study focuses on two equity-financing methods: VC and IPO financing from the stock market. Venture capitalists provide private equity whilst IPO through the stock market provides public equity financing.

The costs involved in firms using VC as alternative financing source is the return that the investors receive when the firm becomes successful and on the other hand, possibly management fee for the advice they offer as well as active monitoring of the management by shareholders (Wong et al., 2009) while the returns of IPO financing stock holders depends largely on the performance of the firm in a financial year.

The relationship between VC and other equity financing options like IPO financing points out unambiguous differences. Schwienbacher (2007) believes that VC angel investors sometimes provide more effort in sustaining the business because of the need to attract later on investments that IPO investors may not be able to provide until they

have experienced returns on their initial investment. Schwienbacher (2008) argues that VCs and public equity investors can play value-adding roles, however the key difference may be in relation to the provision of capital and the extent of control they may exert over the business. Alperovych & Hübner (2013) also did a study on the incremental impact of VC financing of firms using a unique handpicked data set of 990 VC-backed firms and a complete population of firms in Belgium. The authors concluded that the value-adding activities of the venture capitalist are the main drivers of the firms' performance. Chemmanur & Chen (2002) adds to the value addition argument contending that, contrary to venture capitalists who add value to the firms they finance, other equity investors like IPO shareholders cannot. The authors maintain that in spite of the seemingly asymmetric information issues arising out of the equity financing relationship, these asymmetries invariably solve along the way. Li et al. (2018) used hand-collected data from China and reported that VCs exert value-enhancing efforts to the firms they finance.

VC firms vigorously pursue value-adding activities for their portfolio firms to achieve high returns compared to the stock capital market. The value-adding activities of VC firms are complex and highly diverse, but also are very relevant to practice. Apart from provision of capital to portfolio firm, the VC firms support their portfolio firms in the areas such as helping them to obtain additional financing, strategic planning, management recruitment, operational planning and introduction to potential suppliers/customers (Proksch et al., 2017; Cumming et al., 2005; Black & Gilson, 1999).

VCs perform monitoring functions to their firms through trust considerations (Li et al., 2018). The writers explain three types of trusts namely strategic reputation-based, knowledge-based and identification-based. They maintain that the best way to make strategic reputation-based trust very important is by using complementary resources to improve firm performance. Their findings suggest that VC financing works better with the appropriate complements. For the knowledge-based and identification-based trusts, Li et al. (2018) indicate that they reduce transaction costs and foster team spirit.

Regarding the performance of VC funded firms, Luukkonen et al. (2013) compares government funded and independent VC firms and claimed that independent firms contribute significantly higher than government funded firms in areas such as

development of business ideas, professionalization and exit orientation. Venture capitalist firms have been financing start-up firms and small businesses that have the potential to succeed. The funding of these VCs for financing start-ups usually comes from wealthy investors, investment banks, and other financial institutions. The investment is usually not limited to finance, but also technical or managerial expertise (Li & Zahra, 2012). Private equity firms may prefer buying companies not doing well or on the verge of collapse and streamline their operations to turn their fortunes and increase revenues (Breuer & Pinkwart, 2018).

From the review so far, VC and the stock markets perform complementary roles for investee firms in their financing functions. Black & Gilson (1999) argue that a well-developed stock market permitting venture capitalists to exit through an IPO is critical to the existence of a vibrant VC market in an economy. They further explained that the successful exit of a start-up through an IPO allows the venture capitalists to enter into implicit contractual arrangement with the entrepreneur concerning the future control of the start-up in a way that is not available in a bank-centred capital market. The implicit contract over future control adds to the VC success especially in countries where the stock market is the primary source of accessing capital to grow a business. VC and stock markets play complementary role to themselves because there are many VC portfolio firms, listed on the stock exchange (Bottazzi, 2009). VCs provide steering and support services to their companies besides making funds available. Klein (2010) identified among other factors that IPO is a determinant of VC fundraising. There are situations where VCs prepare and graduate firms for IPO financing and such firms have higher post-IPO survival rate (Tian, 2011). The author reports that VCs positively stimulate firms' propensity to go public through IPOs but does not report on how VC fundraising affect stock market variables. I conjecture that, VC-backed firms exit through IPOs, but the relation might not be always proportional. There is paucity of research on the relationship between VC fundraising and public equity financing. I expect a long-run relation and therefore hypothesize that:

H_3: There is long-run relation between VC fundraising (private equity financing) and the stock market (public equity financing).

Figure 4-1 shows the conceptual framework for this study. The paper proposes two main sources of VC fundraising namely institutional and geographical sources. These sources suggest diversified forms of mobilizing VC funds. I show the relationship between VC fundraising, stock market returns and market capitalization.

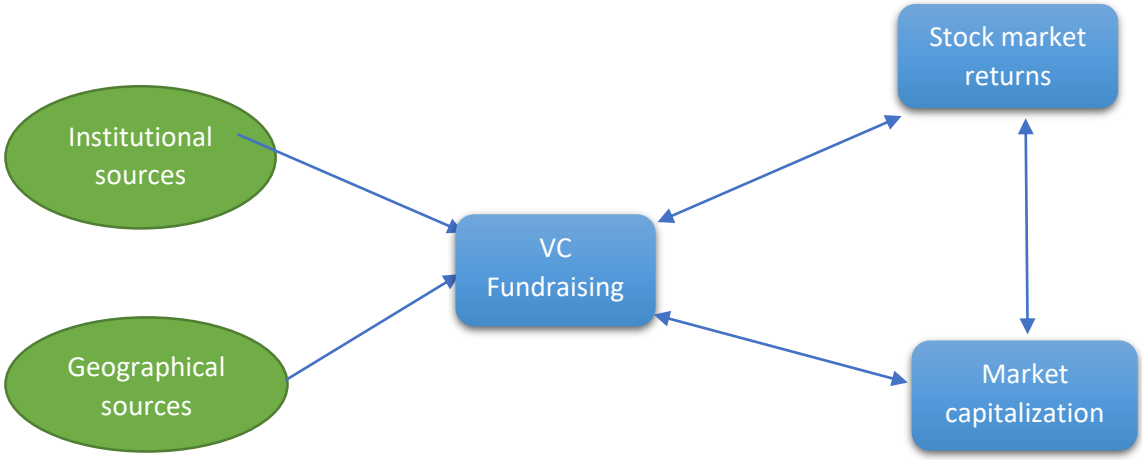


Figure 4-1: Conceptual framework

Source: Authors' construct

4.3 Methodology

The study uses stock market data from the official website of Madrid Stock Exchange (BME) because it is the largest and most internationally recognised stock market in Spain and VC data from ASCRI, Bank of Spain, EUROSTAT databases covering the period 2000 to 2016. The reason for choosing this period is to compare fundraising activities and stock market developments for the periods before, during and after the global financial crisis. To address the hypotheses on the sources of VC fundraising, I compute the percentages of VC fundraising from institutional and geographical sources. For the third hypothesis which addresses the long-run causality between private and public equity capital and standardize the respective values (VC fundraising and market capitalization) by estimating their natural logarithms. The study is very relevant to the economy of this study area so I adjust these figures by GDP in order to capture economic growth.

The choice of cointegration is occasioned by the need to identify the variables that move with VC fundraising in the long-run. This is to ensure in-depth understanding of related factors, which affect capital available in the equity market in order to maintain reliable and stable supply of funds for the growth of firms. The higher the degree of cointegration among variables, the greater the probability of sustaining a stable distance. The precondition for the Johansen test of cointegration states that, variables are non-stationary at level but when converted into first difference, they become stationary.

Given a vector of X_t of n potentially endogenous variables, it is possible to specify the following data generating process and model X_t as an unrestricted vector auto regression (VAR) involving up to K-lags of X_t. Thus;

$$X_t = A_1X_{t-1} + A_2X_{t-2} + \cdots + A_kX_{t-k} + U_t \text{----------(1)}$$

$$U_t \sim N(0, \sigma^2)$$

Reformulating equation (1) into a vector error correction (VEC) model;

$$\Delta X_t = \sum_i^{k-1} \tau_i \Delta X_{t-1} + \pi X_{t-k} + U_t$$

Where $\tau_i = -(I - A_1 - \cdots - A_i); (i = 1.2.3 \ldots k-1)$

and $\pi = -(I - A_1 - \cdots - A_k)$ and comprises both short-run and long-run aspects. I am interested in the long-run aspect to determine my cointegration,

$\pi = \alpha\beta'$; α is a vector of speed of adjustment; β' is the number of cointegrated vectors. The focus is on $\pi X_{t-k} = \alpha\beta' X_{t-k}$, meaning that I am interested in $\beta' X_{t-k}$. The aim is to find out if $\pi X_{t-k} \sim I(0)$ in order to conclude that the variables are cointegrated.

Vector Error-Correction (VEC) Model

For the purpose of this study, I apply the vector error-correction (VEC) model as it is the most efficient and appropriate. Granger & Wess (1983) has also demonstrated an equivalent characterization or representation of time-series which are cointegrated, namely; if X_t and Y_t are both I (1) and are cointegrated with a cointegrated vector A, then there always exist an error correction representation. $Y_t = AX_t$= cointegrated series.

The error representation:

$$\Delta Y_t = \alpha(Y_{t-1} - AX_{t-1}) + \beta\Delta X_t + Lagged(\Delta Y_{ts}, \Delta X_{ts})\varepsilon_t$$

This representation of the cointegrated time series in an error correction characterization forms an integral part of the Granger representation theory.

Note the dynamic equation;

$Y_t = \alpha_0 + \gamma_0 X_t + \gamma_1 X_{t-1} + \alpha_0 Y_{t-1} + \varepsilon_t$----------(1)

The long run counterpart of this model is; $Y_t = \beta_0 + \beta_1 X_t$. Thus, every short-run model has its long-run counterpart. This is the long-run;

$Y_t = Y_{t-1};\ X_t = X_{t-1}$, thus, $Y_t = \alpha_0 + \gamma_0 X_t + \gamma_1 X_t + \alpha_1 Y_t + U_t$

$= (1 - \alpha_1)Y_t = \alpha_0 + (\gamma_0 + \gamma_1)X_t + U_t$, thus, $Y_t = \frac{\alpha_0}{1-\alpha_1} + \frac{\gamma_0+\gamma_1}{1-\alpha_1} X_t + \frac{U_t}{1-\alpha_1}$, thus,

$Y_t = \beta_0 + \beta_1 X_t + V_t$ (long-run). Thus, $\Delta Y_t = \beta_1 \Delta X_t + \beta_2\left(Y_{t-1} - \hat{\beta}_0 - \hat{\beta}_1 X_t\right) + \varepsilon_t$

I employ three equations for the variables of interest in the cointegration and VECM analyses:

$VCFund/GDP = f(StockMktReturns, MktCap/GDP)$……..(1)

$MktCap/GDP = f(StockMktReturns, VCFund/GDP)$ ……. (2)

$StockMktReturns = f(VCFund/GDP, MktCap/GDP)$ …….. (3)

Where $VCFund/GDP$ represents Venture Capital fundraising to GDP ratio

$MktCap/GDP$ represents Market Capitalization to GDP ratio and

$StockMktReturns$ represents Stock Market Returns

4.4 Results and Discussion

This section covers the presentation and analysis of results. This includes the geographical and institutional sources of VC fundraising, summary statistics of geographical sources of funds categorized into periods before, during and after the financial crisis. The analysis section concludes with the cointegration and VECM, which analyses the relation between VC fundraising and stock market variables.

4.4.1 Sources of VC fundraising

Table 4-1: Geographical sources of VC fundraising in percentages

Year	Spain	Europe	USA	Asia	Others	Total outside Europe
Sources of VC funds						
2000	46.5	33.1	14.7	3.3	2.3	20.3
2001	47	24	27	1.1	0.9	29
2002	58.61	41.39	0	0	0	0
2003	63.6	21.5	11.8	0.6	0.5	12.9
2004	55.2	27	15	2.7	0	17.7
2005	26.6	30.4	40.7	1.9	0.4	43
2006	44.3	35.6	17.6	1.3	0.4	19.3
2007	72	21	6	1	0	7
2008	73	26	1	0	0	1
2009	61	37	0	2	0	2
2010	76	21	1	2	0	3
2011	96	2	0	1	1	2
2012	92	7	0	1	0	1
2013	74	12	1	0	13	14
2014	41	47	9	0	4	13
2015	36	42	11	5	7	12
2016	62	26	5	0	7	7

Table 4-1 shows the percentage contribution of geographical sources of VC fundraising activities for the period 2000-2016. The sources in geographical terms include Spain, Europe, USA, Asia and the rest of the world. The table also shows the total contributions from outside Europe. The Table shows that the VC industry in Spain raise most of its funds from internal sources, with Europe being the next major supplier of funds to finance risk capital.

For the purpose of analysis, the study adopts three distinctive timeframes covering the pre-crisis (2000-2006), crisis (2007-2010) and post-crisis (2011-2016) periods. During the pre-crisis period, VCs obtained a significant proportion of funds from Spain (see Table 4-1). However, most of the years during this period recorded less than half (average

of 47%) of total VC funds. The most reliable geographical source of VC fundraising came from outside Spain (predominantly Europe and the US) with standard deviations 6.9% and 10.3% respectively. In 2005, the US supplied the highest source of VC funds (41%) with Europe following with 30%. From Table 4-1, it is during the pre-crisis period that the US supplied the highest proportions of VC fundraising. Perhaps, this might account for some of the reasons behind the effect of the global financial crisis on Spain because there is the perception that the 2007/2008 global financial crisis originated from the US.

I extend the analysis on the geographical sources of VC funds in Table 4-2 using descriptive statistics for Spain, Europe, USA and others. During the period before the crisis, Spain provided less than half of total VC funds with Europe, USA and the rest of the world almost equally providing between 20-26% each. The spread across the sources of VC funds was somehow even with less variability. The crisis periods saw heavy reliance on Spain for most of VC funds with a minimum and mean contributions being 61% and 71% of total funds raised for VC activities respectively. Europe provided the next higher source of VC funds during the crisis period. From the period under review, it was during the crisis period that Spain provided the highest funds. Perhaps, this explains the notion that the VC industry provided alternative source of equity capital for Spain during the financial crisis.

In the post-crisis period, Spain continued to provide the main source of VC funds but there was a drop in value (mean=67%) as compared to the crisis period. Consistently, Europe has provided between 23-27% (see mean values) of VC funds in the periods before, during and after the financial crisis. This consistency is informative for planning and policy purposes. Funds from outside Spain and Europe saw downward trends during the crisis but have since doubled in the post-crisis periods. These are positive signals for the industry to seek external funds to provide liquidity for the equity market.

Table 4-2: Summary statistics for geographical sources of VC fundraising

Period	N	mean	sd	min	max
Pre-crisis					
Spain	6	49.585	13.068	26.6	63.6

Europe	6	29.565	7.15	21.5	41.39
USA	6	18.2	13.988	0	40.7
Others	6	2.283	1.89	0	5.6
Crisis					
Spain	4	62.575	13.341	44.3	73
Europe	4	29.9	7.688	21	37
USA	4	6.15	8.072	0	17.6
Others	4	1.175	.888	0	2
Post-crisis					
Spain	7	68.143	23.27	36	96
Europe	7	22.429	17.155	2	47
USA	7	3.857	4.562	0	11
Others	7	5.857	4.947	1	13

Table 4-2 shows summary statistics for the geographical sources (Spain, Europe, USA and rest of the world) of VC fundraising for the periods before, during and after the financial crisis in Spain. The table also show the totals for the whole period under review. In the periods during and after the crisis, there were occasions where no funds came from the USA. However, average figures show that funds from outside Spain and Europe have seen increases in the post-crisis periods.

Table 4-3: Institutional source of venture capital funds

Year	Financial Institutions	Pension funds	Insurance Companies	Fund of funds	Non-financial Companies	Individuals	Public Investors	Academic Institutions	Stock Markets	Other sources	Reinvestment Capital Gains
2000	0.35	0.10	0.06	0.12	0.08	0.04	0.04	0	0.04	0.001	0.18
2001	0.44	0.09	0.11	0.12	0.04	0.14	0.03	0.001	0.03	0.02	0.02
2002	0.42	0.14	0.03	0.09	0.08	0.05	0.14	0	0.03	0	0.05
2003	0.42	0.09	0.04	0.10	0.15	0.03	0.14	0.004	0.006	0.03	0.001
2004	0.45	0.17	0.02	0.08	0.07	0.06	0.09	0	0.04	0.002	0
2005	0.28	0.39	0.03	0.12	0.12	0.02	0.02	0.003	0.02	0.003	0
2006	0.29	0.13	0.02	0.21	0.05	0.13	0.07	0.001	0.04	0.003	0.07
2007	0.24	0.13	0.05	0.03	0.29	0.16	0.02	0.00	0.00	0.04	0.03
2008	0.37	0.09	0.04	0.11	0.13	0.17	0.05	0.00	0.00	0.01	0.02
2009	0.48	0.11	0.01	0.13	0.06	0.12	0.09	0.00	0.00	0.00	0.00
2010	0.18	0.13	0.10	0.01	0.18	0.18	0.09	0.00	0.00	0.02	0.11
2011	0.15	0.05	0.00	0.00	0.47	0.21	0.03	0.00	0.00	0.10	0.00
2012	0.17	0.00	0.02	0.03	0.28	0.16	0.30	0.00	0.00	0.00	0.03
2013	0.28	0.07	0.01	0.12	0.19	0.10	0.12	0.00	0.00	0.01	0.10
2014	0.11	0.18	0.07	0.17	0.14	0.06	0.22	0.01	0.00	0.04	0.00
2015	0.10	0.11	0.14	0.19	0.08	0.15	0.10	0.05	0.00	0.07	0.00
2016	0.09	0.04	0.08	0.22	0.04	0.20	0.15	0.01	0.01	0.16	0.00

Source: ASCRI, Spain

4.4.2 Cointegration analysis

To enable us use the appropriate estimation for our data, a Johansen test of cointegration is conducted. Table 4-4 reports the Johansen test results. First, I use the maximum rank to test the hypothesis that there is no cointegration. At maximum rank zero (0), the trace statistic of 45.45 exceeds the critical value of 29.68, therefore, I reject the null hypothesis and accept the alternate that VC fundraising, stock market return and market capitalization are cointegrated. For maximum rank 1, the null hypothesis indicates that there is cointegration of equation (1). A trace statistic of 15.36 which is smaller than the critical value of 15.41 implies there is cointegration of equation (1).

For maximum rank 2, I test the null hypothesis that there is cointegration in equation 2. A trace statistics of 2.07 which is smaller than the critical value of 3.76 implies that I accept the null hypothesis. Per maximum rank 2, VC fundraising, stock market return and market capitalization are cointegrated of two equations. Having satisfied this major requirement, I proceed to perform the appropriate estimation using the vector error correction model (VECM) since all the three variables are cointegrated.

Table 4-4: Johansen test of co-integration results

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistics	5% Critical Value
0	12	-192.7376		45.4480	29.68
1	17	-177.69202	0.82968	15.3568*	15.41
2	20	-171.05052	0.54221	2.0738	3.76
3	21	-170.0136	0.11484		

Table 4-5 reports the results of the Vector Error Correction Model (VECM). The first panel result window provides information for all the three variables used. It must be noted that Vector-Error Correction Model takes difference of these variables such that they are represented as D_VCFund/GDP, D_StockMktReturns, and D_MktCap/GDP. I also observed that apart from D_MktCap/GDP with R-square 40.4% (not significant), the other

two variables had a very high R-square with p-values close to zero indicating high significance levels. This is a justification for causality.

Table 4-5: Vector error correction model (VECM)

Equations	Parms	RMSE	R-sq	Chi2	P>chi2
D_VCFund/GPD	6	.528705	0.7111	27.07123	0.0001
D_StockMktReturns	6	11.5819	0.7594	34.72611	0.0000
D_MktCap/GDP	6	183.926	0.4036	7.444208	0.2817

Table 4-5 shows the VECM for the three variables under consideration. I use capital flows injected into the VC and stock markets. I measure these by total VC fundraising and market capitalization respectively. I use the natural logs of these figures and further adjust by GDP. For stock market returns for the period under review, I rely on figures as provided by the Spanish Stock market.

In the second panel, I report results of the regression with D_VCFund/GDP as the dependent variable in Table 4-6. To determine the long-run causality I resort to _ce1 and _ce2, representing the two equations. A negative coefficient and significant p-value of ce1 shows that there is a long-run causality between D_VCFund/GDP and the two other variables being, D_StockMktReturns, and D_MktCap/GDP. To examine the short-run causality I resort to the individual lag coefficients and their p-values of the independent variables. The results show that only the lag of MktCap/GDP has a short-run causality with D_VCFund/GDP. Similarly, in panel 3 I report the results of the regression using D_StockMktReturns as the dependent variable while D_VCFund/GDP and D_MktCap/GDP are our independent variables. The results show a negative and significant ce2 implying a long-run causality between D_StockMktReturns and the independent variables being D_VCFund/GDP and D_MktCap/GDP. I also observed a short-run causality between D_StockMktReturns and D_VCFund/GDP as indicated by the significant p-value while such short-run causality does not exist for D_MktCap/GDP. In panel 4, I observed no long-run and short-run relationships between D_MktCap/GDP as dependent variable and the independent variables being D_VCFund/GDP and D_StockMktReturns.

Table 4-6: Regression results

Equation	Coef	Std. Err.	Z	p>|z|	[95% conf.	Interval]
D_VCFund/GPD						
_cel Li.	-.4781255	.1625084	-2.94	0.003	-.7966361	-.1596149
_ce2 Li.	.035372	.0193261	1.83	0.067	-.0025064	.0732505
VC Fund/GDP LD.	-.0520864	.1777908	-0.29	0.770	-.40055	.2963772
StockMktReturns LD.	-.0006214	0.0128391	-0.05	0.961	-.0257856	.0245428
MktCap/GDP LD.	.002867	.0011104	2.58	0.010	0.006906	.0050433
_cons	.1346742	-.1384252	-0.97	0.331	-.4059826	.1366341
D_StockMktReturns						
_cel Li.	2.307307	3.559936	0.65	0.517	-4.670038	9.284653
_ce2 Li.	-1.182975	.4233604	-2.79	0.005	-2.012746	-.3532034
VCFund/GDP LD.	8.195656	3.894715	2.10	0.035	.5621551	15.82916
StockMktReturns LD.	.2293894	.2812561	0.82	0.415	-.3218625	.7806413
MktCap/GDP LD.	.0449903	.024325	1.85	0.064	-.0026859	.0926665
_cons	-.0023247	3.032365	-0.00	0.999	-5.94565	5.941001
D_MktCap/GPD						
_cel Li.	-56.5075	56.53345	-1.00	0.318	-167.311	54.29604
_ce2 Li.	1.927705	6.723162	0.29	0.774	-11.24945	15.10486
VCFund/GDP LD.	61.2063	61.8499	0.99	0.322	-60.01728	182.4299
StockMktReturns LD.	-1597344	4.46648	-0.36	0.721	-10.35148	7.156795
Market Cap/GDP LD.	-.0709213	.3862931	-0.18	0.854	-.8280419	.6861994
_cons	.0010446	48.15538	0.00	1.000	-94.38176	94.38385

Table 4-7 reports the LM test for residual autocorrelation and diagnosing the Vector-Error-Correction model. The hypothesis is that there is no autocorrelation. An insignificant prob >chi2 for both lag 1 and 2 indicate that we accept the null hypothesis that there is no autocorrelation.

I also test for normality using the Jarque-Bera test. The null hypothesis is that residuals of variables are normally distributed. I observed an insignificant prob > chi2 in all the three panels, signifying that all the residuals of the variables are normally distributed. This is an indication that the tests of hypotheses are valid.

Table 4-7: Autocorrelation, model diagnosis and normality tests

Tests	**Equation**	**Skewness/ Kurtosis**	**Chi-2**	**df**	**Prob>Chi2**
Autocorrelation/ VECM Diagnosis					
Lagrange-Multiplier test	LAG 1		10.5205	9	0.31001
	LAG 2		5.1268	9	0.82312
Jarque-Bera test	D_VCFund/GDP		1.088	2	0.58032
	D_StockMktReturns		0.503	2	0.77755
	D_MktCap/GDP		0.797	2	0.67118
	All		2.389	6	0.88068
Normality tests		*Skewness*			
Skewness	D_VCFund/GDP	.08764	0.022	1	0.88272
	D_StockMktReturns	-.03467	0.003	1	0.95347
	D_ MktCap/GDP	-.0546	0.008	1	0.92677
	All		0.034	3	0.99838
		Kurtosis			
Kurtosis	D_VCFund/GDP	1.7729	1.067	1	0.30172
	D_StockMktReturns	2.16	0.500	1	0.47958
	D_ MktCap/GDP	1.9446	0.789	1	0.37441
	All		2.355	3	0.50200

4.4.3 Discussion

The results support all the three hypotheses which centre around reliance on internal sources of VC fundraising, diversified sources and long-run relation between private and public

equity finance variables. The empirical results on the sources of VC fundraising shows that most funds required for financing equity risk capital come from within Spain (internal). The VC market provide support to the stock market by supplying alternative equity capital to cover up the gap created by the financial crisis. These funds came from diversified sources such as institutions, governments, internal (Spain), Europe, the United States and other parts of the world. The institutional sources of VC funds include financial and non-financial institutions, pension funds, fund of funds, individual and public investors. There is some reliance of VC funds from fund of funds (increasingly growing up to 22%) in Spain. This source of VC funding create a second level of intermediation and the performance of fund of funds is almost at par with portfolios of VC direct investments (Harris et al., 2018). The results show that, Spain is able to attract funds for VC activities.

The ability of the Spanish VC industry to attract significant funding tend to suggest that issue-relevant information is reliable and credible as explained by the persuasive theories. Investors from within Spain, Europe, the US and others feel convinced after perusing credible information regarding VC investments. Perhaps, the VCs uniqueness such as higher human resource acumen and value addition which they bring on-board the firms they collaborate explain the industry's attractiveness. It is important to laud the value-adding opportunities the VC brings to investee firms. However, there is also the tendency for over-indulgence of the VC in the activities of the firm, which might result in frictions. Such misunderstandings impair the value created thereby increasing the agency cost (Luukkonen et al., 2013). The enactment of new Spanish venture capital and private equity entities regulation (Law 22/2014) coupled with the Alternative Investment Fund Managers (AFIM) directive by the European Union in 2011 have promoted fundraising activities thus increasing the liquidity of the VC market after the crisis. The law introduced by the government has provided industry players with solid legal framework needed to grow and develop the VC industry. The tax reforms have stimulated the growth and development of the VC industry in Spain. The government approval of a waiver for Spanish private equity funds from the hitherto obligation to make payments of corporate income tax even if they were exempted from payment has also been helpful. It was a requirement for the firms to

make advance tax payment and recover later, even if they had exemptions. This waver creates opportunity for firms to channel such monies into investments. Again, the exemption on the sale of shares in subsidiaries has also had impact on the industry.

The cointegration results show short and long run relations between equity risk capital variables thus confirming prior research that vibrant stock markets serve as impetus for the VC industry since most venture capitalists prefer exiting through the IPO (Black & Gilson, 1998). From the empirical results, there is a short-run causality between VC fundraising and market capitalization when the equation uses VC fundraising as dependent variable. This implies that, it is difficult for VCs fundraising (private equity) and stock market funds (public equity) to adjust in the short-run. When stock market return is used as outcome variable, the results show a short-run relation with VC fundraising. However, the study reports no short-run causality when the model uses market capitalization as dependent variable.

The study reports significant long-run causal relationship between VC fundraising (outcome variable) and stock market variables (market capitalization and stock market returns). This suggests that private and public equity variables converge with time. This finding confirms earlier research which shows that, in economies where capital markets (especially IPOs) tend to be inefficient, returns to VC investors tend to be low (Bygrave & Timmons, 1992). The long-run relationship between the stock market and the VC market corroborates Black & Gilson (1998) whose study on VC and the structure of the capital market indicated that the relationship could be better understood on contracting arrangements between the entrepreneurs and the VC providers. Most VC firms prefer exiting through IPOs from the stock market thus fostering a strong relationship. It is however contrary to Mayer et al. (2005) who found no such relation. The results show that, during the period of the crisis, funds from the stock markets was unstable but the VC fundraising especially from Spain was relatively stable and even the more in the post-crisis period. This suggests an alternative financing option for equity risk capital. This is in line with previous study by Schmid (2001) that entrepreneurial firms with low initial wealth prefer venture capital financing to IPO financing.

The empirical results do not show short and long run relations between the variables when the model uses market capitalization as dependent variable. Even though market capitalization and stock market returns are both public equity variables, the results show that investors are interested in the returns and not necessarily how much capital the stock market raises. Perhaps, it will be exciting to investigate the determinants of stock market returns in future research.

VC fundraising activities have significant implications on the functioning of the economy. Increasing VC fundraising increases start-ups, jobs and incomes (Samila & Sorenson, 2010). VCs add value to the investee firms, which translate into higher performance, create employment and improve other macroeconomic indicators (Cumming et al., 2005). The findings support the financial intermediation function of VCs as suppliers of funds thereby improving the allocation function for the benefit of economic units. VCs provide alternative equity financing option to the stock market.

4.5 Conclusion

The study sought to examine VC as alternative source of financing equity capital in a period where traditional sources had funding gaps. The paper explores the sources of VC fundraising and the relationship between VC and stock markets as providers of equity capital. Using time series data from 2000-2016, the paper employs cointegration and VECM to establish causal relationship between VC fundraising and stock market.

The two main sources of the VC fundraising in Spain are institutional and geographical sources. The main institutional sources of VC fundraising are financial institutions, pension funds, insurance and non-financial institutions. Geographically, VC funds come from within Spain, Europe, the US and other parts of the world. External sources of VC funds have been increasing after the financial crisis, which indicates expression of confidence in the Spanish VC industry by international investors. VC firms use persuasive and diversification models in raising funds to finance equity risk capital. The study concludes that the Spanish VC market use diversified sources of funds to support the stock market in financing equity risk

capital. The study confirms long run causal relation between VC fundraising and stock market returns. A vibrant VC market with diversified source of funds provide vitality for entrepreneurial development, which translate into economic growth. The debilitating effect of the financial crisis on the stock market has been absorbed (even though not substantially) by the VC market to some extent.

The Spanish government can rely on the VC market as alternative suppliers of funds to finance equity risk capital. The study addressed the issue of ascertaining the source of VC fundraising. This is necessary to inform policy that would encourage unlimited flow of funds into the VC pool for sustained growth. The study has revealed that VCs mobilize most of their funds from internal sources but there is also an increasing interest from investors from Europe, USA, Asia and other parts of the world. The study inform policies targeted at harmonizing the equity markets for better decision making. A better understanding of the VC fundraising sources can assist in the development of policy and regulation that promote increased fundraising. VC firms can rely on information in this study to explore other sustainable sources to meet the capital requirements of firms in the country. Again the study deepens understanding of equity investment climate to enable VC firms to employ reliable capital-acquisition strategies in the fundraising activities. Information in this study would be helpful to companies that are looking to scale up their business to consider VC as alternative business finance.

I recommend that, policy makers consider enacting and implementing policies on external finance bearing in mind the role of currency price developments of partners. Policy makers and industry players should be wary of institutional factors that affect cost of equity capital since most internal funds are mobilized from institutions.

There are four stock markets in Spain (Madrid, Barcelona, Valencia and Bilbao) but the study considered the largest and most international stock exchange which is Bolsa de Madrid. Single country study like this, may suffer limitations in scope so I suggest that future research may consider several countries.

CHAPTER FIVE

"THE EFFECT OF THE FINANCIAL CRISIS ON GEOGRAHICAL SOURCES OF VC FUNDRAISING AND INVESTMENT ACTIVITIES IN EUROPE".

Abstract

The study examined the effect of the financial crisis on geographical sources of VC fundraising and investment activities with macro sample data from Invest Europe, World Bank and Eurostat databases covering 22 EU/EEA countries from 2007-2017. Using a panel quantile regression model, the study find evidence that the financial crisis affected the contributory share of the geographical sources of VC fundraising and investment activities, with the strongest effect occurring in unknown and outside Europe sources of VC fundraising as well as seed investments in all the countries. Inflation and interest rate positively affected geographical sources of VC fundraising and investment activities in countries with high levels of VC activity and partial positive effect in countries with moderate levels of VC activity. The results of the study validate the hypothesis of significant effect of financial crisis on the contributory share of VC fundraising and reduction in investments activities. In addition, the age of VC industry positively affects all sources of VC fundraising and investment activities, whereas GDP has positive effect on geographical sources of VC fundraising and investment activities in Europe. Finally, the results suggest the effect of the financial crisis on geographical sources of VC fundraising and investment activities differ among countries in Europe. The study provides policymakers with useful policy recommendations.

5.1 Introduction

The role of the venture capital industry in promoting innovation has been extensively debated over a long period. The supply of equity capital and, in particular venture capital (VC) finance is viewed as critical to this, however the financial crisis (hereafter crisis) impacted sources of VC fundraising and investment activities thus creating funding gaps for innovative firms and individuals (Lee, Sameen, & Cowling, 2015). This paper contributes to the literature on the current state of VC industry after the crisis by examining the effect of the financial crisis on geographical sources of VC fundraising and investment activities in Europe.

The primary objective of this study was to rigorously examine the effect of the financial crisis on sources of VC fundraising and investment activities in Europe. Understanding the true effect of the crisis on VC fundraising and investment activities will provide valuable insights into the types of policies and strategies that countries in Europe, and perhaps other regions, should put in place to ensure sustained VC fundraising and investment activities. Again, a better understanding of the effect of the crisis on VC fundraising sources and investment activities on a macro level can lend additional insight to policymakers as they design policies that can encourage fundraising and investment actvtities and, possibly, in turn, promote economic growth

VC fundraising and investment activities in Europe has displayed a roller coaster pattern. The industry has experienced high and low periods of fundraising and investment activities even after the crisis (Invest Europe 2017). An impressive fundraising and investment levels in 2006, that were more than four times that of 2002 fundraising and investment levels ended with the crisis in 2007/2008. The situation of so much money chasing investments makes the period of particular interest. The question that requires answer is what is the real effect of the crisis on geographical sources of VC fundraising and investment activities in countries with low, moderate and high levels of VC activity. Although there are existing studies that have attempted to address the impact of the crisis on venture capital funding, majority of these studies limit their analysis on funding activities before and during the crisis with little or no empirical studies on the effect of the geographical sources of VC fundraising and

investment activities (Block & Sandner, 2009; Cummings & Johan, 2012; Block, De Vries & Sandner, 2012). Thus, this study attempts to examine the effect of the crisis on geographical sources of VC fundraising and investment activities from a macro perspective in the European context, thus identifying countrie(s), source(s) and investment stage(s) mostly and adversely hit by the crisis.

The motivation for this study comes from the work of Block & Sandner, (2009) who assessed the effect of the financial crisis on venture capital financing with emphasis on US internet industry and reported decrease in fundraising and investment during that period. Their study focused on assessing the effect of the crisis on VC funding rounds but this current study focuses on the effect of the crisis on geographical sources of VC fundraising and investment activities with emphasis on countries with low, moderate and high levels of VC activity in Europe as well as sources of fundraising and investment activities. This is necessary to understand in more detail measures needed to be put in place to encourage and stimulate VC fundraising and investment activities in countries strongly hit by the crisis. Another motivation for the study stems from the research work of Cummings & Johan (2012). The authors studied whether venture capital was in crisis and concluded that the crisis could not be totally blamed for the marked drops in VC fundraising and investment but may have made it worse. They rather assert that poor returns on investments made over the period to a large extent accounted for the marked drops in fundraising, investing and exiting even before the advent of the crisis. These contrasting findings stimulate further research to settle the matter hence this paper.

The US continue to dominate crisis-related research with limited research on the European context. Though the crisis began in the USA and spread through other parts of the world, with some European countries adversely hit and are now recovering from the negative effect of the crisis (Martinez, Terceño, & Teruel, 2013). The crisis is described as the worst financial crisis in decades experienced by the world since the great depression in the 1930s. The crisis had debilitating effect on VC funding activities causing supply of funds to VC market to withered (Block & Sandner, 2009; Block, De Vries & Sandner, 2012). In particular, the crisis had demonstrable negative impact on insurance companies, banks etc.

that are major sources of VC fundraising activities (Baluch, Mutenga, & Parsons, 2011; Tomczak, 2017). The purpose of this study is therefore, to provide an empirical examination of the effect of the crisis on geographical sources of VC fundraising and investments activities in countries with low, moderate and high levels of VC activity from a macro perspective. Which of the countries, geographical sources and investment activities were strongly hit by the crisis. The study is meant to complement Block & Sandner (2009) studies on the effect of the financial crisis on VC financing with data from US Internet industry. Using country-level data from EVCA now Invest Europe to analyze the following research questions

1. Which of the geographical source of VC fundraising was strongly hit by the crisis?
2. Which type of investment type was strongly hit by the crisis or received the most investment during the period under study?
3. Which country or group of countries were strongly hit by the crisis?

The primary contribution of this paper is to build on literature, which has broadly assessed the effect of the crisis on geographical sources of VC fundraising and investment activities, and produce empirical evidence of the true and real state of VC industry from the European perspective. The second distinctive contribution examined the real effect of the crisis on geographical sources of VC fundraising and investment activities using a country-level data in Europe relative to the level of VC activity so as to guide policy formulation. This is useful and necessary as it helps in addressing effectively the aggregate or net impact of the economic conditions which usually have less to say in terms of aggregate impact with firm-level data. Again the study would help inform regulations that support the VC industry going forward.

The study used panel data on sources of VC fundraising and investment activities from EVCA now Invest Europe and macroeconomic variables data from World Development indicator of World Bank. The findings revealed negative effect of the crisis on geographical sources of VC fundraising with the strongest effect occurring in unknown and within Europe sources of VC fundraising as well as seed stage investments. Again the effect of the crisis was stronger in countries with high levels of VC activity, partial effect in countries with moderate levels of VC activity and close to no effect in countries with low levels of VC

activity. The study thus adds to entrepreneurship finance research, detailing the real effect of the crisis on geographical sources of VC fundraising and investment activities in Europe. The rest of the paper is organized as follow: The next section reviews literature and develop hypothesis for the study. Section 3 presents description of data and methodology for the study. Section 4 presents the results and empirical analysis and section 5 presents the discussion of the study while section 6 concludes and with some implications for the study.

5.2 Review of literature and hypothesis development

5.2.1 Venture capital and the financial crisis

The literature related to the crisis and VC financing in Europe is of considerable importance. VC finance supports innovation, investments, increases the productive capacity of an economy, and constitutes a key ingredient for medium to long-term economic prosperity (Levine, 2005; Bogliacino & Lucchese, 2011). It is also an important driving force for technological innovations and sustained growth. Therefore, a negative effect on the VC industry would have demonstrable effect on fundraising and investment activities of the sector. The crisis made it difficult for VC firms to find investors willing to supply the necessary funding for purposes of investment (Lee et al, 2015). Investors as reported in earlier studies by Gompers & Lerner (1998) usually comprise of pension funds, banks, insurance companies, corporations etc. were affected by the crisis (Block, De Vries, & Sandner, 2012). The crisis forced some of these institutions especially banks and insurance companies to reduce their share of investments in risky instruments such as venture capital (Block, De Vries, & Sandner, 2012). The reduction in turn affected the flow of funds to entrepreneurial firms needed to grow and develop their businesses. VC firms also became risk averse and preferred to focus their investment on later stage investments (Block & Sandner 2009). The crisis led to drops in VC funds raised with real repercussions for the economy (Ning, Wang & Yu, 2014; De Vries & Block 2011; McCahery & Vermeulen 2010), thus making it necessary for appropriate interventions required to close the financing gap created as a result of the crisis. There is limited empirical research of the impact of the crisis on VC financing. Mason, (2009) in his editorial study on VC underscored that the VC industry is widely thought to be in crisis. He indicated that the huge amount of money that

flowed into the industry in recent years during that period drove down returns and may have had a knock-on effect on fundraising and investment activities. He further claimed that many commentators believe that the industry needed to downsize and that there were signs of the downsizing occurring already. Interestingly, Cumming & Johan, (2012) in line Mason, (2009) reported that the crisis cannot be totally blamed for the drops in VC fundraising, reduced VC investment and unsuccessful exits. They however admit that though the crisis may have aggravated the drops, poor returns on investments made over the period could largely account for the drops in fundraising, investments and successful exits. Block & Sandner (2009) in their study of the effect of the crisis in VC financing using crunch base dataset of US internet startups indicated that the crisis is associated with about 20% decrease in the average amount of funds raised per funding round. They further indicated that the decrease could only be found in later funding rounds and not with initial funding rounds. The conclusions by Cumming & Johan, (2012) appear to run contrary to Block & Sandner (2009). In another study, Block, De Vries & Sandner (2012) found crisis to be associated with drops in the number of initial funding rounds and later funding rounds. With regards to industry differences, they found that, the crisis caused the number of initial funding rounds to decrease drastically in healthcare and biotechnology as well as Internet industries than in other industries. They again reported a significant decrease in the amount raised in initial funding for Biotechnology industry, Internet, Medical/Health Care, and Computer Software and Service. Li & Zahra, (2012) studies on Formal institutions, culture, and venture capital activity with a sample of 68 countries found that the level of venture capital activity vary across countries. They claimed that the variation can be attributed to the different levels of formal institutional development. Their study suggest that formal institutions have positive effect on the level of venture capital activity but the effect is weaker in uncertain societies. Studies indicate the crisis originated from the USA and spread to other parts of the world including Europe. There is also evidence that the impact of the crisis on VC funding was more severe in the US than in Europe as reported by De Vries & Block, (2011) thus suggesting same effect of the crisis among countries in Europe.

Apart from the crisis that affected sources of VC fundraising and investment activities, interest rate and inflation are also reported to affect VC fundraising and investment activities

(Cumming & Macintosh, 2006; Van Pottelsberghe & Romain, 2004; Jeng & Wells, 2000; Gompers & Lerner, 1999; Lerner, 2002). Félix, Pires & Gulamhussen, (2013) examined the determinants of venture capital with aggregate data of 23 European countries and found that lower interest rates fuel VC fundraising by making VC funds more attractive to limited partners (LPs) such as pension funds compared to bonds. He again found evidence that in instances of higher interest rates venture capital appears cheaper compared to bank loans, thus making it more attractive to entrepreneurs. Bliss, (1999) analysed venture capital model in transitional economies and found the potential impact of inflation on project returns of the venture capitalists. I expect interest rate and inflation also to negatively affect fundraising and investment activities and therefore hypothesize as follows:

H_1: The crisis decreased contributory share to total VC fundraising.

H_2: The higher levels of inflation (INF) rate negatively affect sources of VC fundraising and investments activities.

H_3: The higher levels of interest rate (INT) negatively affect sources of VC fundraising and investments activities.

5.2.2 Geographical Sources of VC fundraising

Some research highlight sources of VC funding flow and the reasons that motivate the flow of the funds (Black & Gilson, 1998; Levine, 2002; Mayer, Schoors & Yafeh, 2005; Hellmann, Lindsey & Puri, 2008; Colombo, Cumming & Vismara, 2016). Venture capital fund operators comprise of professional investors who understand the intricacies of financing and building newly formed companies. The funds that VC firms invest comes from a variety of sources, including private and public pension funds, financial institutions, endowment funds, foundations, corporations and wealthy individuals, both domestic and foreign. Foreign venture capital Investors are investors incorporated or established outside their country of origin whereas domestic venture capital investors are investors incorporated and established within their country of origin.

Karsai (2003) in his study indicated that many countries especially in Europe play central role in implementing programmes and policies intended to promote VC financing so as to make funding available to develop young firms. The reasons for government involvement in

promoting VC funding in the respective countries include but not limited to the desire to boost economic growth, reduce unemployment, and enhance competitiveness. Acevedo et al, (2016) in their report on the state of venture capital in 5 major economies in Europe (France, Germany, Italy, Spain and the United Kingdom) reported that with €40 billion of funds raised since 2007 by the European VC market, government agencies contributed the most funds. This indicates that government agencies still continue to be one of the main sources of VC funding in Europe after the crisis. However, despite the laudable support of European government in the promotion of VC funding, there is evidence that the intervention of the government is crowding out private sector involvement (Karsai, 2003). The involvement of government in the fundraising activities especially in Europe support domestic fundraising of VC funding. Colombo, Cumming & Vismara, (2016) studied Governmental venture capital for innovative young firms and concluded that the creation of GVC funds is primarily meant to correct for supply-side failures in domestic VC markets.

The corporate sector appears to be an important source of finance for the VC industry as well. It was seen to have been under-utilized by the VC industry in UK and not in USA as reported by (Mcnally 1994). Aizenman & Kendall, (2012) also show that the flow of international VC funding is motivated by the presence of high-end human capital, a better business environment, military expenditure, and deeper financial markets perceived to be important local factors that appear to attract international or foreign VC. In addition to the motivating factors that drive foreign VC, Zhang, (2011) studied spatial dynamics of globalizing venture capital in China and found that the juxtaposition of spatial proximity effects, investment syndication, and interregional office networks within China's unique institutional environment are driving the global flow of funds within the VC industry. Again studies indicate that availability of home country networks help attract foreign VC, in other words the absence of home country partners has the potential to reduce foreign VC entry (Guler & Guillén, 2017).

Hellmann, Lindsey & Puri, (2008) studies examined the relation between banks provision of VC and loans. They reported that banks were reluctant to participate in early-stage deals than in later-stage deals. Mayer, Schoors & Yafeh, (2005) studies report that VC firms whose primary sources of funding are pension funds and insurance companies favour

investments in early- stage portfolio firms whereas VC firms whose primary sources of funding are banking institutions favour later-stage portfolio firms. Black & Gilson, (1998) on their part also report that the capital market is one of the main sources of venture capital funding. The deployment of appropriate intervention requires clear understanding of the nature and scope of the effect of the crisis on fundraising sources. Hence, the need for a study to ascertain the real effect of the crisis on fundraising sources.

From the deliberations above, I anticipate that the effect of the crisis on domestic source would be severe and consistent in all the countries thus greatly impacting domestic source as a contributor to total VC fundraising activities than the other sources. I therefore formulate the hypotheses that:

H_4: Are there variations in the effect of the crisis on geographical sources of VC fundraising in Europe during the period?

H_5: Domestic source of VC fundraising was strongly hit by the crisis

5.2.3 Type of VC investment activity: Stage of investment

The theoretical explanation for a VC firm to choose investment in seed, early, and later stage investments is based on some widely accepted truism that has remained virtually accepted by stakeholders in the industry. The explanation may include but not limited to the following: 1. VC investor may reject seed or early or later stage investment because it may not be operating within the segment that the VC investor may be interested in, 2. the firm may not be operating at the stage that the potential VC investor may be interested in, 3. the firm desiring seed or early or later stage investment may be operating far away from the geographical area where the potential VC investor may be and 4. the potential VC investor may have already invested in similar business (Murray, 1994). In addition to Murray (1994) conclusions, Gompers *et al.*, (2020) in their study reported that most VC firms decision to invest in a firm revolves around the management team, product of the firm, market size or share of the firm and stage the company may be operating at.

Research indicate that there are several interrelated factors or reasons that VC firms consider when investing in a company (Ajaybe & Ismail 2014). In general, these factors represent trade-offs of market opportunity as against operational risk. At earlier stages, investors may

initially get intrigued by a firm's market opportunity and management team but ultimately will focus on mitigating operational risk prior to investing. At later stages, VC firms focus more on capturing market opportunity as many of the operational risks common to early stage ventures would already have been addressed (Ajaybe & Ismail 2014). Fleming, (2015) on his part indicated that VC firms' investment strategies are influenced by the type of industry and the company's stage of development, whether a biopharmaceutical company is focusing on early-stage discovery or whether it already has one or more products in later-stage clinical trials.

VC investors are attracted to seed stage investment as a result of a number of reasons not limited to the following: VC desire to be relevant to the best entrepreneurs in all stages, VC doing seed investment as a way of purchasing information about a company's progress so as to be able to make real investment if the company takes off well, and VC's desire to increase their odds of being in on the big winners, that is the possibility of making better return by having invested at lower entry valuation (Dimov & Murray, 2008). Rea (1989) studies point to factors affecting the success and failure of seed capital/start up negotiations and identified market, product, team, risk, time and deal as important factors that guide VC/entrepreneur pre-investment negotiations. He again found business factors as more important than product characteristic for successful investment negotiation. The author claims that among the business factors, market that offer unconstrained opportunities for rapid growth are significantly more important than the completeness of the team, a credible business plan, a rapid return on investment or favourable terms. He however, reports that the most important factor that can cause VC/entrepreneur pre-investment negotiation to fail is the business plan. Sohl, (2003) studies report that angel investors are reasserting their fundamental role as the major source of seed capital for high growth entrepreneurial ventures. Though Block & Sandner (2009) reported in their study that the crisis increased the difficulty for entrepreneurs to raise seed and early-stage finance because VCs firms became more risk adverse and focused their investment on later-stage projects, there is evidence contrary to this report suggesting positive growth of seed stage investments especially in the US as reported by CB Insights report (2014). The report claimed that there was

11% increase in 2013 seed stage investments compared to the 2012 seed stage investments in the US.

Mayer, Schoors & Yafeh, (2005) in their study prior to the crisis reported that VC firms in Israel provided finance primarily to companies in early stages of development, in other words their investment in early-stage was significant. They further indicated that VC firms in Germany and the United Kingdom provided funding to companies in all stages with a slight bias towards later stages of development, however the bias was more pronounced for the United Kingdom than in Germany. They again claimed that VC firms in Japan directed funds primarily to companies in the middle and later stages of development with very little support to both seed and start-up companies. Jeng & Wells (2000) studies confirmed that investment in early stages relative to GDP has been slightly higher in Germany than in the United Kingdom, though in the past United Kingdom invested relatively more in early-stage companies. BVK (2000) activity report provided consistent report with Jeng & Wells (2000) observations. Lerner & Hardymon (1999) on their part reported that venture capital firms in Japan focused their investment activities in later stage companies than its American counterpart. They further reported that seed and startup investments accounted for only 17% of all VC investments in Japan in 1996, whereas expansion and "mezzanine" investment accounted for over 80%. The Ministry of Economy, Trade and Industries (METI) report (2000) indicated that only a small fraction of the Japanese VC funds focus exclusively on early-stage investments.

Brouwer & Hendrix (1998) in their comparative study of US and Dutch early stage investment claimed that European venture capital has not been as supportive of start-ups as compared to their counterparts in the U.S. The supply of capital from both public and private sources to finance early-stage high potential but unproven applications of emerging technologies appears positive in the USA than in other countries as reported by (Florida & Kenney, 1988) but same cannot be said in Europe despite the relevance of venture capital toward the growth agenda of the region (Manigart et al., 2000). It is probable that the effect of crisis may skewed investments to later stage to the neglect of startups and seed investments and therefore hypothesize as follows:

H_6: Are there variations in VC stages of investment in Europe during the period under study? *Or*

H_6: Early stage investments were strongly hit by the crisis tan other stages of investments

5.3. METHODOLOGY AND DATA

5.3.1. Data and Materials

The study employs an unbalanced panel of 22[1] EU/EEA member countries for the period 2007–2017. The choice of sample countries is purely governed by the fact that they are members of EU/EEA countries and also data for variables used for the study was available and could be accessed for such countries. The reason for choosing this period is to ascertain the real effect of the crisis on geographical sources of VC fundraising and investments activities with annual country-level data from a macro perspective. Our data are collected from EVCA now Invest Europe and World Development Indicators of World Bank. Except for 10-year government bond yield (the main proxy measuring the financial crisis), interest rate, inflation and age of VC industry, all variables are transformed into natural logarithms prior to empirical analysis. I took log of the variables to make the data concise.

The geographical sources of VC funds raised are used as dependent variable(s) and measured in terms of annual contribution to funds raised. They include domestic, within Europe, outside Europe and unknown sources of VC fundraising, the investment activities include seed, start-ups and later stage. The VC funding in Europe suffered a great deal as a result of the crisis and now appears to be recovering from the impact occasioned by the crisis. The study employs 10-year government bond yield as main proxy measuring the financial crisis (Martinez, Terceño & Teruel, 2013; Beirne & Fratzscher 2013; Fender, Hayo & Neuenkirch, 2012). The bond market performance is generally viewed as an indicator of economic conditions. In reality, it is more accurate to say that the performance of bond market reflects investor expectation of *future* economic conditions 6 to 12 months out, thus making 10-year government bond yield an appropriate indicator to measure the financial crisis. Again I chose

[1] The lists of countries include Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and United Kingdom

this proxy because in turbulent markets the 10-year government bond yield jumped higher while they are usually lower.

Apart from the main variable measuring the crisis. The study employ other explanatory variables such as interest rate and inflation that can affect VC fundraising and investment activities. I also incorporate in the model estimation two control variables i.e GDP and age of VC industry of the countries under study since the relationships among financial crisis, geographical sources of VC fundraising and investment activities can be affected by others factors so as to avoid omitted-variable bias.

The study uses the total amount of VC investments per capita, based on active working population (Li & Zahra, 2011; Armour & Cumming, 2006; Cumming & MacIntosh, 2006) to capture the level of VC activity in a country. The categorizations include: High level of VC activity- (UK, Luxembourg, Sweden, Denmark, France, Finland, Netherlands, Norway and Switzerland), Moderate level of VC activity- (Belgium, Germany, Italy, Spain, Ireland and Austria), Low level of VC activity- (Bulgaria, Czech Republic, Greece, Hungary, Poland, Romania and Portugal). The analyses exclude countries with less than ten years of data on the variables of interest. This makes the panel data unbalanced. Even though the data shows an initial 243 observations in the descriptive statistics, the regressions use 234 observations for the analyses.

5.3.2 Model Specification

The study employs panel quantile regression model by Koenker (2017) to examine the effect of the crisis on geographical sources of VC fundraising and investment activities from a macro perspective. By using a panel quantile regression methodology, the real effect of the crisis on sources of VC fundraising and investment activities throughout the conditional distribution, especially in the countries with the high, moderate and low levels of VC activity can be accessed. Though traditional regression techniques focus on the mean effects, which may lead to under- or over-estimating the relevant coefficient or even failing to detect important relationships (Binder & Coad, 2011). The quantile regression technique was introduced in the seminal paper by Koenker & Bassett (1978). This method is a

generalization of median regression analysis to other quantiles. The conditional quantile of y_i given x_i is as follows:

$$Q_{yi}\,(T/x_i) = x^{T}_{i}\,\beta_T$$

Quantile regression is robust to outliers and heavy distributions. However, these methods do not take into account the unobserved heterogeneity of a country. In this study, a panel quantile method is employed which makes it possible to estimate the conditional heterogeneous covariance effects of venture capital, thus controlling for unobserved individual heterogeneity. Some works, such as those by Koenker (2004); Lamarche (2010); & Galvao (2011) are focused on the econometric theory of applying quantile regressions to panel data. Consider the following panel quantile regression model:

$$Q_{yit}\,(T_k/\,\alpha_i, x_{it}) = \alpha_i + x^{,}_{it}\,\beta(T_k)$$

The major problem with panel quantile regression is that the inclusion of a considerable amount of fixed effects(α_i) is subject to the incidental parameters problem (Lancaster, 2000). The estimator will be inconsistent when the number of individuals goes to infinity but the number of observations for each cross-sectional unit is fixed. The main reason why the literature on panel quantile regression is relatively scarce is that the inferior approaches to eliminating unobserved fixed effects are unfeasible in the quantile regression model. These methods rely on the fact that expectations are linear operators, which is not the case for conditional quantiles (Canay, 2011). Koenker (2004) proposes an appropriate method for addressing such problems. The author treats unobservable fixed effect as parameters to be jointly estimated with the covariate effects for different quantiles. The unique characteristic of this method is the introduction of a penalty term in the minimization to address the computational problem of estimating a mass of parameters specifically; the parameter estimate is calculated as follows:

$$w_k\,\rho_{\tau k}\,(y_{it} - \alpha_i - x^{T}_{it}\beta(\tau_k) + \lambda\quad \alpha_i$$

where i is the index for countries (N), Tis the index for the number of observations per countries, K is the index for quantiles, x is the matrix of explanatory variables, $\rho_{\tau k}$ is the quantile loss function. In addition, w_k is the relative weight given to the k-th quantile, which controls for the contribution of the k-th quantile on the estimation of the fixed effect. In this paper, I employ equally weighted quantiles $w_k=1/K$ (Alexander et al., 2011; Lamarche, 2011). λ is the tuning parameter that reduces the individual effects to zero to improve the performance of the estimate of β. If the λ term goes to zero, then the penalty term disappears, and I obtain the usual fixed effects estimator. However, if the λ term goes to infinity, then I obtain an estimate of the model without individual effects. In this paper, I set $\lambda=1$ (Damette and Delacote, 2012). Furthermore, the study examines the effect of the crisis on geographical sources of VC fundraising and investment activities by ascertaining the real effect of the crisis on geographical sources of VC fundraising and investment activities in high, moderate and low levels of VC activity in Europe. I specify the conditional quantiles function for quantile τ as follows

$$Q_{yit}(\tau/\alpha_i, \xi t, x_{it}) = \alpha_i + \xi_t \beta_{1\tau} GOV_{it} + \beta_{2\tau} INT_{it} + \beta_{3\tau} INFL_{it} + \beta_{4\tau} GDP_{it} + \beta_{5\tau} AVF_{it}$$

where the countries are indexed by i and time by time t. y_{it} is the source of VC fundraising and investment stage of VC. The descriptions of other variables have been provided below.

Table 5-1: Variable definitions, and expected relations with dependent variable(s) and data source

Variables	Definition/Measurement	Notation	Expected effect	Data Source
Dependent Variable(s)				
Source Type:				
Domestic	Funds raised only from the study country.	**DOMES**		**EVCA now Invest Europe**
Within Europe	Funds raised from other EU countries	**IN-EU**		**EVCA now Invest Europe**
Outside Europe	Funds raised outside the continent of EU	**OUT-EU**		**EVCA now Invest Europe**
Unknown	Funds from the combined sources	**UNKN**		**EVCA now Invest Europe**
Investment Type:				
Seed	Small investment to test viability	**SEED**		
Startup	Investment to operationalize a firm.	**START**		**EVCA now Invest Europe**
Later stage	Investment to help the firm become a market leader	**LATER**		**EVCA now Invest Europe** **EVCA now Invest Europe**
Independent Variable(s)				
10-year government bond yield	It is an instrument of indebtedness, issued by a national government.	**GOV**	-	**World Bank, OECD and Eurostat**

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Control Variable(s)				**World Bank, OECD and Eurostat**
Interest rate	Annual interest rate	**INT**	-	
Inflation	Annual percentage of inflation	**INF**	-	**World Bank, OECD and Eurostat**
logGDP	GDP is the value of goods and services of a country in a year in Euros.	**GDP**	+/-	**World Bank, OECD and Eurostat**
Age of VC industry	The number of years VC has been in operation in the country.	**AVC**	+	**EVCA now Invest Europe**

Notes: All of the data are annual over the period 2000–2017

5.3.3 Motivation for quantile regression

The motivation behind using a panel quantile regression model on the effect of the crisis on VC fundraising sources and investment activities is threefold: First, I employ the panel data framework to research the effect of the crisis on geographical sources of VC fundraising and investment activities in Europe because it has the advantage over focusing on a single country of providing more informative data, more variability, more degrees of freedom and thus greater efficiency in estimation. Moreover, panel data model accommodates the special heterogeneity indicated by region-specific, non-observable and time-invariant intercepts. In addition, many of the challenges (i.e lack of sufficient scale of individual VC funds, lack of diversity of different types of investors etc) regarding fundraising sources and investing activities cut across EU/EEA member countries and thus require a collective approach to addressing same. Therefore, it makes sense to assess the effect of the crisis on VC fundraising sources and investment activities for EU/EEA countries within the panel data framework. Second, this method can describe the entire conditional distribution of the dependent variables; thus helping us obtain a more complete picture of the effect of the crisis on geographical sources of VC fundraising and investments activities. Specifically, quantile regression estimators provide one solution to each quantile. Using this methodology, an assessment of the effect of the crisis on geographical sources of VC fundraising sources and investment activities throughout the conditional distribution, especially in countries with the high, moderate and low levels of VC activity can be done. From a policy perspective, it is more interesting to know how impactful was the crisis at the extremes of a distribution. By contrast, OLS regression techniques are not suitable for making informed decision regarding

the sample countries in panel data model. Third, the panel quantile regression estimation results are robust to outlying observations of the explained variable and are more effective than OLS regression, especially when the error term is non-normal, which will help policymakers formulate more accurate and reliable policies to support fundraising and investment activities in those countries. Again, few papers have applied panel quantile regression model to investigate the relationship among variables (Block & Sandner, 2011).

This paper makes three contributions: First, this study provides a more detailed description of the effect of the crisis on geographical sources of VC fundraising and investment activities throughout the conditional distribution. This approach provides a perspective to understanding how the crisis affected the various geographical sources of VC fundraising and investment activities in countries with low, moderate and high levels of VC activity. Specifically, this study allows us to formulate policies that can improve fundraising activities. Second, I included certain related control variables in the model, which may help resolve the omitted-variable bias problems that may come up. This issue is very important especially in studies of this nature. Third, because of the method used, I find that geographical sources of VC fundraising and investments activities in countries with high levels of VC activity were the hardest hit, with partial effect occurring in countries with moderate VC activity and mote effect occurring in countries with low levels of VC activity. Therefore, the results of this study are also expected to provide useful information to policymakers in drafting effective policies to support the growth of VC market in the respective countries.

5.4.0 Analysis and Results

The results comprise descriptive statistics, correlation matrix, unit root testing and quantile regression model.

5.4.1 Descriptive Statistics

Table 5-2 provides the relevant descriptive statistics for the variables. Most of the variables used in the study are transformed into natural logarithms in order to reduce skewness (Mukherjee, White & Wuyts, 1998). Data are normally distributed if the value of skewness is zero and kurtosis is lower than 3. If skewness is zero, the distribution of the data is

symmetric. If kurtosis is lower than 3, the tails of the data are thin (Mukherjee, White & Wuyts, 1998). It can be observed that the skewness value for all variables is not close to zero with the exception of outside Europe source, indicating that the variables are not symmetrically distributed. Additionally, the kurtosis value is above 3 for eight variables – i.e. (Domestic, seed, startup, later stage, government 10-year bond yield, interest rate, inflation, and age of VC industry). This signals observations with extreme values. Moreover, the mean is different from the median for almost all variables with the exception of GDP, and inflation whose mean and median appear close. This implies that the distribution of the data is not bell-shaped.

It is worth noticing that the coefficients of variation (CV) are also relatively small for investment distribution stages. The ratio of outside Europe source has the smallest coefficient of variation, and a sample mean equal to 6.55, implying this source contributed less to total VC fundraising activities during the period under study. Also, domestic source has a sample mean equal to 10.35 approximately, suggesting a large dependence of fundraising activities on this source for the EU/EEA countries. The source within Europe followed closely after the domestic source with a mean value equal to 9.12 whereas the unknown source followed after the within Europe source with a mean value of 8.97.

Table 5-2: Summary statistics

	Mean	St. Dev	skewness	kurtosis	cv	p25	Median	p75
logndomestic	10.347	4.715	-1.342	3.602	.456	9	12	13
lognwithineuro	9.12	5.466	-.875	2.159	.599	6	11	13
lognoutsideeuro	6.55	6.092	.021	1.311	.93	0	9	12
lognunknown	8.971	5.232	-.879	2.265	.583	8	11	13
lognseedinvst	7.211	3.597	-1.128	3.041	.499	6	8	10
lognstartup	9.971	2.901	-1.927	7.01	.291	9	11	12
lognlaterstage	9.57	3.07	-1.707	6.075	.321	9	10	11
govtbond10yearyield	3.517	2.64	2.323	14.74	.751	1.64	3.19	4.49
interestrate	3.449	2.675	2.315	14.43	.776	1.6	3.1	4.5
inflation	1.916	1.911	1.021	6.989	.997	.6	1.8	2.9
logngdp	13.388	1.413	.378	2.983	.106	12	13	14
Avf	22.955	7.985	-.356	3.328	.348	19	24	28

5.4.2 Empirical results

5.4.2.1 Panel unit root test results

Before estimating the panel quantile regression models, it is imperative to test whether the variables used are stationary. I conduct two panel unit root tests: the LLC test and the Hadri LM test. **Table 5-3** presents the results of the panel unit root tests. These results indicate that the null hypothesis of the existence of a unit root could be rejected for almost all of the variables at the selected level. LLC represent the panel unit root test of Levin et al. (2002) whiles Hadri LM represent the panel unit root test of *Hadri* (2000).

Table 5-3: Unit root testing of LLC & Hadri LM

Variables	Levin-Lin-Chu (LLC)	Hadri LM
logndomestic	-8.3450***	3.3624***
lognwithineuro	-6.4018***	1.0067
lognoutsideeuro	-5.0539***	0.0849
lognunknown	-4.66.26***	3.0001***
lognseedinvst	-9.4042***	5.0571***
lognstartup	-1.5093*	2.0505**
lognlaterstage	-5.4637***	8.6018***
govtbond10yearyield	-4.5720***	13.1925***
interestrate	-4.1434***	13.6592***
inflation	-6.79933***	12.6981***
logngdp	18.8968	3.7291***
avf		26.4803***

5.4.2.2 Pooled OLS regression model

The study first run the pooled OLS regression model (see Table 5-4). As the considered model denies heterogeneity and individuality of data, A panel quantile regression model that allows heterogeneity or individuality among countries was also performed.

Table 5-4: OLS regression results

	logdomestic	logwithineuro	logoutsideeuro	logunknown	lognseedinvst	lognstartup	lognlaterstage
govtbond10yearyield	-1.532* (0.644)	-1.046 (0.793)	-1.414 (0.937)	-2.330** (0.708)	-1.761*** (0.475)	-1.434*** (0.392)	-0.876* (0.412)
interestrate	1.083	0.313	0.845	1.736*	1.414**	1.074**	0.549

	(0.638)	(0.786)	(0.929)	(0.702)	(0.471)	(0.388)	(0.408)
inflation	0.431**	0.519**	0.488*	0.639***	0.125	0.169	0.466***
	(0.146)	(0.180)	(0.212)	(0.161)	(0.108)	(0.0888)	(0.0933)
logngdp	0.215	0.187	0.233	0.0664	0.176	0.209	0.513***
	(0.186)	(0.229)	(0.271)	(0.205)	(0.137)	(0.113)	(0.119)
avf	0.322***	0.267***	0.264***	0.342***	0.228***	0.162***	0.171***
	(0.0384)	(0.0473)	(0.0559)	(0.0423)	(0.0283)	(0.0234)	(0.0246)
_cons	0.858	1.997	-1.625	1.193	0.736	4.445**	-0.941
	(2.419)	(2.979)	(3.521)	(2.663)	(1.738)	(1.471)	(1.547)
N	234	234	234	233	234	234	234
R^2	0.397	0.314	0.213	0.399	0.420	0.409	0.416

Table 5-5: Quantile regression results

Table 5-5A: Quantile (75th)

	logdomestic	logwithineuro	logoutsideeuro	logunknown	lognseedinvst	lognstartup	lognlaterstage
govtbond10yearyield	-1.242***	-0.905**	-3.389***	-3.556***	-1.391***	-0.567***	-0.972***
	(0.177)	(0.278)	(0.563)	(0.386)	(0.196)	(0.152)	(0.139)
interestrate	1.075***	0.304	2.714***	3.120***	1.161***	0.424**	0.782***
	(0.177)	(0.277)	(0.551)	(0.378)	(0.193)	(0.150)	(0.137)
inflation	0.277***	0.392***	0.548**	0.325**	0.146*	0.146**	0.341***
	(0.0630)	(0.0862)	(0.175)	(0.117)	(0.0601)	(0.0543)	(0.0484)
logngdp	0.342***	0.546***	0.542**	0.474***	0.621***	0.463***	0.494***
	(0.0701)	(0.0943)	(0.204)	(0.140)	(0.0758)	(0.0616)	(0.0510)
avf	0.187***	0.0568*	0.183***	0.165***	0.0477**	0.106***	0.112***
	(0.0157)	(0.0253)	(0.0537)	(0.0342)	(0.0152)	(0.0122)	(0.0107)
_cons	4.077***	5.207***	0.919	2.800	0.473	3.123***	1.939**
	(1.007)	(1.508)	(3.144)	(2.081)	(1.021)	(0.767)	(0.675)
N	234	234	234	233	234	234	234
R^2							

Table 5-5B: Quantile (50th)

	logdomestic	logwithineuro	logoutsideeuro	logunknown	lognseedinvst	lognstartup	lognlaterstage
govtbond10yearyield	-0.979*	-1.234*	-2.408	-2.769***	-2.378***	-0.726*	-0.891*
	(0.468)	(0.570)	(1.507)	(0.555)	(0.291)	(0.360)	(0.376)
interestrate	0.639	0.395	1.581	2.321***	2.057***	0.505	0.588
	(0.461)	(0.566)	(1.493)	(0.548)	(0.287)	(0.357)	(0.373)
inflation	0.349**	0.641***	0.629	0.742***	0.217**	0.138	0.379***
	(0.126)	(0.128)	(0.361)	(0.150)	(0.0771)	(0.0818)	(0.0877)
logngdp	0.296	0.377*	0.181	0.536**	0.267**	0.0995	0.326**
	(0.158)	(0.164)	(0.458)	(0.191)	(0.0966)	(0.108)	(0.112)
avf	0.218***	0.174***	0.403***	0.287***	0.157***	0.154***	0.159***
	(0.0331)	(0.0337)	(0.0953)	(0.0395)	(0.0204)	(0.0226)	(0.0234)
_cons	3.122	3.115	-2.571	-3.563	1.546	6.087***	2.453
	(2.075)	(2.133)	(5.949)	(2.488)	(1.278)		(1.476)
N	234	234	234	233	234	234	234
R^2							

Table 5-5C: Quantile (25th)

	logdomestic	logwithineuro	logoutsideeuro	logunknown	lognseedinvst	lognstartup	Lognlaterstage
govtbond10yearyield	-2.757	-2.149	0	-2.107*	-2.170*	-1.039**	-0.157
	(1.636)	(1.380)	3.18e-08	(0.914)	(0.967)	(0.344)	(0.517)

interestrate	2.200 (1.628)	1.157 (1.368)	0 3.17e-08	1.375 (0903)	1.521 (0.963)	0.726* (0.339)	-0.209 (0.515)
inflation	0.498 0.377)	0.616 (0.316)	0 1.43e-08	0.692* (0.301)	0.154 (0.217)	0.139 (0.0809)	0.553*** (0.117)
logngdp	0.755 (0.467)	0.174 (0.407)	0 1.66e-08	-0.299 (0.353)	0.119 (0.251)	0.146 (0.103)	0.402** (0.147)
avf	0.341*** (0.0977)	0.404*** (0.0799)	0 4.42e-08	0.451*** (0.0769)	0.271*** (0.0635)	0.130*** (0.0245)	0.171*** (0.0318)
_cons	-8.635 (5.983)	-2.984 (4.825)	0 0.000000250	0.354 (4.375)	-0262 (3.346)	5.380*** (1.339)	-0442 (1.939)
N R^2	234	234	234	233	234	234	234

5.4.2.3 Panel quantile regression analysis

For proper and effective examination, the model is first estimated by pooled OLS regression. Table 5-4 presents the pooled OLS regression estimates. To be able to control for the distributional heterogeneity that may occur, panel quantile regression by Koenker (2017) is employed. The results are reported for the 75th, 50th and 25th percentiles for the effect of the crisis on geographical sources of VC fundraising and investment activities. Overall, the empirical results indicate that the effect of the crisis on geographical sources of VC fundraising and investments activities are clearly heterogeneous. Generally, the results in Tables 5-5A, B, and C consistently show that the main proxy measuring the crisis that is 10-year government bond yield is negatively related to VC fundraising source and investment activity regardless of the choice of dependent variable and quantile specification. Hence, this is sufficient to support the expected decrease in average contribution of funds from the various geographical sources to total VC fundraising as well as reduction in investments activities during the study period.

At the 75th quantile (P75), the coefficients for all the geographical sources of VC fundraising are negative and significant at 1% with the exception of the within Europe source of VC fundraising which is negative and significant at 5%. The negative coefficients are sufficient to support decrease in the sources contribution to total VC fundraising with the strongest effect occurring in domestic, outside Europe and unknown geographical sources of VC fundraising in countries with high levels of VC activity. With respect to the investment activities, the coefficients are negative and significant at 1% for all types of investments. This suggests decrease in the required investments directed to businesses or firms with the

strongest effect occurring in seed and later stage investments in countries with high levels of VC activity during the period under study.

However, at the 50th quantile (P50), the coefficients are negative and significant for all the geographical sources of VC fundraising with the exception of outside Europe source of VC fundraising in the countries with moderate levels of VC activity. The evidence adduced is sufficient to support decrease in the sources contribution to total VC fundraising with the strongest effect occurring in unknown and within Europe geographical sources of VC fundraising. Regarding investment activities, the coefficients for the proxy measuring the crisis are negative and significant for all the investment activities. This suggest reduction in investments directed to businesses and firms with the strongest impact occurring in seed and later stage investments accordingly in countries with moderate levels of VC activity during the study period.

At the 25th quantile (P25), the coefficients of the proxy measuring the crisis for all geographical sources of VC fundraising with the exception of unknown source are negative and insignificant for countries with low levels of VC activity, but the coefficient for unknown source of VC fundraising is negative and significant at 5%. This suggest decease in the contributory share of unknown source to total VC fundraising for the countries with low levels of VC activity. The negative coefficients for the other geographical sources are insufficient to support decease in their contributory share to total VC fundraising as a result of the crisis in countries with low levels of VC activity. The result points to the fact that the effect of the crisis was more severe in unknown source of VC fundraising than the other geographical sources of VC fundraising in countries with low levels of VC activity. In the case of investment activities, the coefficients are negative and significant for seed and startup investments whereas it was negative and insignificant for the later stage investments. This suggest reduction in investments directed to businesses with the strongest effect occurring in seed and startup investments in countries with low levels of VC activity, however the evidence does not support reduction in later stage investments in countries with low levels of VC activity.

Similarly, at the higher quantile 75th, the coefficients of interest rate and inflation are positive and significant at 5% for all geographical sources of VC fundraising and investment

activities in countries with high levels of VC activity, indicating that, investors were encouraged by the prevailing interest rate margins and inflation rate to increase their contributory share to total VC fundraising. Hypothesis 2 & 3 cannot be corroborated given the positive coefficients on geographical sources of VC fundraising and investment activities in countries with high levels of VC activity. The results however reflect the average prevailing interest and inflation rates of 2.4 and 1.3 respectively existing in countries with high levels of VC activity.

At the 50^{th} quantile (P50), the coefficients of interest rate are positive and insignificant at 5% for all geographical sources of VC fundraising and investment activities in countries with moderate levels of VC activity with the exception of unknown source of VC fundraising and seed stage investment that are positive and significant. This means that available evidence was insufficient to support the effect of interest rate on the geographical sources of VC fundraising in countries with moderate levels of VC activity during the period with the exception of unknown source of VC fundraising. The above results suggest that the prevailing interest rate persuaded unknown source of VC fundraising to increase its contributory share to total VC fundraising. The coefficient for seed investment is positive and significant at 5% suggesting preference for seed stage investments in countries with moderate levels of VC activity during the period under study. With respect to inflation, the coefficients are positive and significant for all geographical sources and investment activities with the exception of outside Europe source of VC fundraising and startup stage investments in countries with moderate levels of VC activity. This indicate that investors were encouraged by the prevailing inflation rate margins to increase their contributory share to total VC fundraising thus encouraging investments to seed and later stage in countries with moderate levels of VC activity. Thus, hypothesis 2 & 3 cannot be corroborated given the positive coefficient on geographical sources of VC fundraising and investment activities in countries with moderate levels of VC activity. The results however reflect the average prevailing interest rate and inflation rate of 2.8 and 1.8 respectively that exist in countries with moderate levels of VC activity.

At the 25^{th} quantile, the coefficients for interest rate and inflation are positive and insignificant for all geographical sources and investment activities with the exception of later

stage investments in countries with low levels of VC activity, indicating that, evidence were insufficient to support increase in contributory share to total VC fundraising and investment activities as a result of prevailing interest rate and inflation rate margins. On the other hand, the coefficients for later stage investment is positive and significant at 5% suggesting preference for later stage investments in countries with low levels of VC activity during the period under study. Hypothesis 2 & 3 cannot be corroborated given the positive coefficient on geographical sources VC fundraising and investment activities in countries with low levels of VC activity. The result points to average prevailing interest rate and inflation rate of 5.8 and 2.5 respectively that exist in countries with low levels of VC activity.

With the other control variables included in the model. First, it can be observed that the effect of ΔGDP on geographical sources of VC fundraising and investment activities. At the 75^{th} quantile, the coefficients of ΔGDP is clearly positive and significant for the all the geographical sources with the strongest effect occurring in within Europe and outside Europe sources of VC fundraising respectively in countries with high levels of VC activity. This clearly suggests that ΔGDP increased the contributory share of all the geographical sources with the strongest effect occurring in within Europe and outside Europe sources of VC fundraising during the period under study in the countries. Whereas the coefficients are positive and significant for all the investment activities in countries with high levels of VC activity. This suggests that GDP growth rate was enough to encourage investments directed to businesses with the strongest effect in seed stage investments in countries with high levels of VC activity; at the 50^{th} quantile (P50), the coefficients are positive and significant for outside Europe and unknown sources of VC fundraising whereas they are positive and insignificant for domestic and within Europe sources of VC fundraising in countries with moderate levels of VC activity. This indicate that GDP growth rate influenced the contributory share of outside Europe and unknown sources of total VC fundraising during the period. The same increase can be reported for seed and later stage investments during the period under study in countries with moderate levels of VC activity.

At the 25^{th} quantile, the coefficients though positive but insignificant for all the sources of VC fundraising with the exception of unknown source of VC fundraising which is negative and insignificant. This means that the evidence is insufficient to support increase in

contributory share as a result of change in GDP in countries with low levels of VC activity. With respect to investment activities, the coefficient is positive and insignificant for seed and startup stage investments, whereas it is positive and significant for later stage investments in countries with low levels of VC activity. The results are consistent with previous studies confirming the relationship between GDP and VC fundraising activities and improved investments activities (Gompers & Lerner, 1999).

With the other control variable, the coefficients of VC industry age (AVF) is clearly positive and significant at 5% regardless of the choice of dependent variable and quantile specification, implying the benefits of long existing VC industry on VC fundraising and investment activities.

Additionally, the results provide evidence to the fact that the pooled OLS mean regression may not provide adequate picture as regards the effect of the crisis on geographical sources of VC fundraising and investment activities with respect to countries with have high levels, moderate levels and low levels of VC activities.

In summary, by comparing the results of two methods, It can can be observed that panel quantile regression model provides a more complete picture of the effect of the crisis on geographical sources of VC fundraising and investment activities in the countries under study. In addition, based on the results, it can be observed that the effect of the crisis on geographical sources of VC fundraising and investments activities are evidently heterogeneous. In particular, the effect of crisis supports decrease in the geographical sources contribution to total VC fundraising as well as reduction in investment activities especially in countries with high levels of VC activity, thus supporting the hypothesis that the effect of the crisis on VC funding differ among countries in Europe. The effect of ΔGDP on geographical sources of VC fundraising and investment activities is also heterogeneous. The results indicate that a growth in GDP (economic growth activities) can mitigate the effect of the crisis on VC fundraising sources and investment activities thus supporting Félix, Pires & Gulamhussen, (2013) studies reporting positive impact of GDP on venture capital. The age of the VC industry increases the fortunes of fundraising and investment activities, with the strongest effects occurring in countries with high and moderate levels of VC funding activity.

5.5.0 Discussion

In this study, I attempt to examine the effect of the financial crisis on geographical sources of VC fundraising and investment activities from a macro perspective. Some studies have examined the effect of the financial crisis on VC funding activity. These studies have provided the base for developing the hypotheses in this study. Generally, at the high quantile, empirical findings highlight that at 5% significance level, all the geographical sources of VC fundraising were negatively affected by the crisis with the strongest effect occurring in unknown and outside sources of VC fundraising in countries with high levels of VC activity. This runs contrary to studies suggesting that overseas sources of VC fundraising play an important role in stimulating VC investments in start-ups (Zhang, 2011). Whereas all the investment activities were negatively affected by the crisis at 5% significance level with the strongest effect occurring in seed stage investments in countries with high levels of VC activity. The finding is in line with Ning, Wang, & Yu, (2015) study that reported impact of the 2000 dot-com and financial crisis on aggregate venture investments including seed stage investments. But it however runs contrary to Block & Sandner (2009) conclusión that firms in later stage were more likely affected negatively than firms seeking initial financing or early stage investments.

I find that interest rate and inflation have positive effect on almost all geographical sources of VC fundraising and investment activities with the exception of within Europe source of VC fundraising as prevailing rates encouraged investments directed to businesses. The results corroborate Félix et al., (2013) studies confirming positive effect of interest rate on venture capital activity. However, with respect to inflation, the results run contrary to Mason & Harrison, (2012) studies reporting that investors consider high inflation had major effect on discouraging venture capital investment activity.

GDP also has positive effect on all the geographical sources of VC fundraising and investment activities in countries with high levels of VC activity. The results corroborate Ning, Wang, & Yu, (2015) and Félix et al., (2013) studies that confirm positive relationship of GDP on venture capital activity. The age of VC industry has significant positive effect on almost all geographical sources of VC fundraising and investment activities in countries with

high levels of VC activity. This appears consistent with the results of Lee & Wahal, (2004) studies that found VC age to be positively and statistically significant with venture capital. However, in countries with moderate levels of VC activity, the coefficients for the crisis at the (P50) 50^{th} quantile are negative and significant for domestic, within Europe and unknown sources of VC fundraising with the strongest effect occurring in unknown source of VC fundraising. The outside Europe source of VC fundraising is rather negative and insignificant. The coefficients for all investment activities are negative and significant with the strongest effect occurring in seed stage investments. The results appear consistent with Ning, Wang, & Yu, (2015) study confirming the impact of 2000 dot-com and financial crisis on aggregate venture investments including seed stage investments. Interest rate though positive is insignificant for all the geographical sources of VC fundraising with the exception of unknown source of VC fundraising which appears positive and significant at 5%. This indicate that available evidence is insufficient to support positive effect of interest rate on domestic, within Europe and outside Europe sources of VC fundraising in the countries with moderate levels of VC activity. Whereas that of unknown source of VC fundraising is positive and significant which appears consistent with Félix et al., (2013) studies confirming positive effect of interest rate on venture capital activity in countries with moderate levels of VC activity. Inflation has positive and significant effect on all the geographical sources of VC fundraising and investment activities with the exception of outside Europe source of VC fundraising and startup stage investment. The results appear inconsistent with Mason & Harrison, (2012) studies reporting that investors consider high inflation having major discouraging effect on venture capital investment activity. GDP also has positive and significant effect on within Europe and unknown sources of VC fundraising as well as seed and later stage investment activities whereas it has though positive but insignificant effect on domestic and outside Europe sources of VC fundraising as well as startup stage investments. VC age has significant positive effect on almost all geographical sources of VC fundraising and investment activities in countries with moderate levels of VC activity. This is consistent with the expected theoretical impact of the results obtained by Lee & Wahal, (2004).

In the countries with low levels of VC activity, the proxy measuring the crisis is negative but insignificant for domestic and within Europe sources of VC fundraising but negative and significant for unknown source of VC fundraising. The evidence is insufficient to support effect of the crisis on domestic and within Europe sources of VC fundraising. With respect to investment activities, the coefficients are negative and significant for seed and startup investments activities whereas it is negative and insignificant for later stage investments. Interest rate though positive is insignificant for domestic, within Europe and unknown sources of VC fundraising as well as seed stage investments. It is negative and insignificant for later stage investment but positive and significant for startup investments. The available evidence is insufficient to support positive effect of interest rate on sources of VC fundraising and investment activities with the exception of startup investment which is being affected positively by prevailing interest rate. This is inconsistent with Campbell and Kraeussl, (2006) study suggesting an appreciable contribution of European institutions to fundraising activities for central and eastern European countries. Again the investment result is inconsistent with European Commission, (2015b) studies that during the crisis period, firms in later financing rounds received about 20% less funds than they would have received during the period before the crisis. Inflation rate has positive but insignificant effect on all sources of VC fundraising and investment activities with the exception of unknown source of VC fundraising and later stage investment that appear positive and significant at 5%. The positive but insignificant effect of inflation on geographical sources of VC fundraising and investment activities suggest that the prevailing inflation rate in countries with low levels of VC activity is insufficient to encourage fundraising and investment activities whereas it is sufficient to encourage unknown source of VC fundraising and later stage investments.

The level of GDP is an important factor in affecting VC fundraising and investment activities. At 5% significance level in countries with low levels of VC activity, GDP was found to have insignificant positive effect on domestic and within Europe sources of VC fundraising and insignificant negative effect on unknown source of VC fundraising. With respect to investment activities, at 5% significance level, later stage was found to be positive and significant whereas it is positive and insignificant effect for seed and startup stage investments in countries with low levels VC of activity. There are a number of studies in

relation to GDP and VC activities. Among these studies Gompers & Lerner (1998), Jeng & Wells (2000), Schertler & Tykyova, (2012) emphasized that GDP has impact on VC fundraising sources and investment activities.

At 5% significance level, the age of VC industry was found to have significant positive effect on almost all geographical sources of VC fundraising and investment activities in countries with low levels of VC activity thus suggesting significant influence of the industry on fundraising and investment activities. This is supported by Kaplan & Schoar (2005) and Gompers & Lerner (1999) studies that a long existing VC firm or industry positively affect fundraising and investment activities.

Overall, the results show that the effect of the crisis on geographical sources of VC fundraising was stronger in countries with high levels of VC activity, partial effect of the crisis on geographical sources of VC fundraising in countries with moderate levels of VC activity and close to no effect of the crisis on geographical sources of VC fundraising in countries with low levels of VC activity.

However, all investment activities were affected by the crisis with the strongest effect occurring in seed stage investments in countries with high and moderate levels of VC activity. The studies reveal that the effect of the crisis on geographical sources of VC fundraising and investment activities differ among the countries in Europe.

5.6 Conclusions and policy recommendations

While most policy makers and analysts believe that the global financial crisis had damming impact on VC industry as well as the economy as a whole, relatively little empirical work has been done to ascertain the true effect of the crisis on VC activity in Europe.

The main aim of this study is to examine the effect of the financial crisis on geographical sources of VC fundraising and investment activities in countries with low, moderate and high levels of VC activities in Europe. The study employs panel quantile regression method to achieve the objectives. This method takes the unobserved individual heterogeneity and distributional heterogeneity into consideration. In addition, to avoid an omitted-variable bias, certain related control variables are included in the model. Compared with OLS mean

regression, the panel quantile regression model can help provide a more complete and accurate picture of the effect of the crisis on geographical sources of VC fundraising and investment activities in countries with low, moderate and high levels of VC activities in Europe. This study covers annual sample period from 2007 to 2017 in twenty-two (22) EU/EEA countries.

The empirical evidence suggests that the effect of the crisis on geographical sources of VC fundraising and investment activities are evidently heterogeneous. In particular, the effect of the crisis on the sources of VC fundraising (domestic, within Europe, outside Europe and unknown sources of VC fundraising) are negative and statistically significant in countries with high levels of VC activity, which does lend sufficient support to the fact that the contributory share of the geographical sources to total VC fundraising decreased significantly with the strongest effect occurring in unknown and outside sources of VC fundraising during the study period. This impacted the overall investments directed to businesses with the strongest effect occurring in seed stage investments in countries with high levels of VC activity. Again the study reports partial negative effect of the crisis on domestic, within Europe and unknown sources of VC fundraising with the strongest effect occurring in unknown source of VC fundraising in countries with moderate levels of VC activity whereas evidence suggest partial reduction in the investment directed to businesses with the strongest effect occurring in seed stage investments. The findings again reveal that apart from unknown source of VC fundraising, the crisis did not affect domestic, within Europe and outside Europe sources of VC fundraising in countries with low levels of VC activity. The evidence does not support the idea that the crisis equally affected all geographical sources of VC fundraising and investment activities irrespectively of the level of VC activity. This is an interesting result as it suggests that the crisis had significant negative effect on sources of VC fundraising in countries with high levels of VC activity, partial negative effect on countries with moderate levels of VC activity and close to no effect on countries with low levels of VC activity. Furthermore, there is evidence of reduction in investments directed to businesses with the strongest effect occurring in seed stage investments irrespectively of the levels of VC activity.

Moreover, interest rate and inflation had significant positive effect on VC fundraising sources and investment activities in countries with high levels of VC activity, partial effect in countries with moderate levels of VC activity and close to no effect in countries with low levels of VC activity. This suggest that the prevailing interest rate and inflation encouraged fundraising and investment activities in the countries under study.

Furthermore, the results confirm the expected theoretical effect of age of VC industry on fundraising sources and investment activities in countries with low, moderate and high levels of VC activity consistent with Gompers, (1996) and Sorensen, (2007). In addition, the study finds evidence that GDP has a positive effect on VC fundraising sources and investment activities in countries with low, moderate and high levels of VC activities. In particular, the effect of GDP on seed stage investments are stronger in countries with high and moderate levels of VC activity. The study do not find any significant effect of GDP on seed and startup investments in countries with low levels of VC activity. Finally, another important finding is that the effect of the crisis on the geographical sources of VC fundraising and investments differ among countries in Europe.

Based on the results of the study, the following policy implications must to be vigorously pursued to improve fundraising and investment activities even in the midst of turbulent times especially in countries with high and moderate levels of VC activities in Europe. First, because of possible reduction in fundraising activities occasioned by the crisis, bold and decisive steps ought to be taken to align National and European tax incentives meant for the VC industry to boost and encourage funding supplies. A single tax policy framework could be adopted by EU/EEA member countries to ensure transparency and encourage cross-border investments. These tax incentives usually contribute to lowering the risk of investments in SMEs and startups. Secondly, in terms of VC funding, fundraising is very important and at the core of VC activities, therefore each EU/EEA member country should consider easing regulatory restrictions currently in place for pension funds, insurers and other private equity investors as has been done in the USA. The call for the setting up of fund-of-funds pool made up of both public and private money as a medium-term solution by market players should be vigorously pursued. This approach has been successfully

implemented in Canada and could be useful for the European VC market to provide finance for businesses.

The study recommends continued use of government funds as catalysts in new fund vehicles and also encourage transatlantic expertise and networking among VC fund managers to support the growth of ventures in the European VC market.

In the light of the above, future research could consider analyzing further how unknown source of VC fundraising could impact the capital structure of venture backed VC firms.

CHAPTER SIX

"VENTURE CAPITAL HEALTHCARE INVESTMENTS AND HEALTHCARE SECTOR GROWTH: A PANEL DATA ANALYSIS OF EUROPE"

Abstract

The study examined the effect of venture capital investments on health sector growth, using a macro sample data from EVCA now Invest Europe, World Bank, OECD and Eurostat databases covering 23 EU/EEA countries between 2000 and 2017. Following the system GMM approach, the study finds evidence that VC healthcare investments affect healthcare sector growth in Europe but in different directions. Even though life expectancy (proxy for health sector growth) shows increasing trends, VC healthcare investment decrease health sector growth. A conjecture can be made that VC investors may enjoy returns on investments, this does not decipher into social returns to health sector outcomes. The study consequently makes justification for private-public partnership to support health sector growth. The study recommends more funding support and inducement policy models tailor-made to reap benefits from overall health sector growth.

6.1 Introduction

Threats posed by some diseases like Alzheimer, Parkinson and Ebola compel nations such as the US to make huge public investments in the health sector to conduct research, the outcome of which serve as therapy to cure the diseases (Fleming, 2015). The recent global pandemic caused by the coronavirus (Covid-19) has exposed most advanced countries in Europe and other parts of the world that the healthcare industry still needs more investments to cater for eventualities. Securing finance for early stage innovation in healthcare is very challenging (Karpa & Grginović, 2019). The private sector through the venture capital (VC forthwith) industry makes significant investments in the health sector to cushion the load on the government in meeting healthcare needs. The call for private sector investment in healthcare stems from arguments that there is excessive waste in public expenditure on health (Berwick & Hackbarth 2012). Perhaps, with private sector involvement such as venture capitalists, it is envisaged that health sector investments could positively influence health outcomes. The question that begs for answer is whether VC investments in healthcare increases health sector growth in Europe. Compared to the US, the VC industry in Europe is still at the development stage but recent trends show increasing investment activities in either amounts or number of VC-backed firms. The European healthcare sector is faced with challenges such as an ageing population, reduction in public spending etc that affect the industry, a situation which requires more investments to meet the health needs of the citizenry (BVCA Report, 2016; Kirigia et al. 2011; Schneider 2009). The devastations of the global pandemic (Covid-19) on severely affected advanced nations (including Europe) was incredible, thus signaling a global wake-up call to channel considerable investments to the health sector. Fleming (2015) bemoan the decline in early stage investments by VCs.

In spite of these challenges, the healthcare sector continues to have global attraction for VC activities probably due to reasons like high returns of the healthcare market, successful exits, ageing population, people living longer with chronic diseases etc (BVCA Report, 2016; Sillicon Valley Report, 2018). Europe is experiencing steady growth in public-private partnership in healthcare infrastructure investment in the form of buildings, large technology systems, and associated health services (Barlow, Roehrich & Wright, 2013). World

Economic Forum Report (2019) reveals that VC has the potential to turn scientific discoveries into products for patients and has driven healthcare innovation especially in low and middle income countries. Despite the increasing presence of VC investment in healthcare, to date empirical evidence on its impact on the sector's growth within the context of Europe is scarce. This study advances knowledge of the private sector involvement in the health sector through VC investments. Specifically, the paper explores VC investments in Europe, analyzes whether VC investments in healthcare and age of the VC industry increase health sector growth.

One paper motivating this study is 'Eliminating wastes in US healthcare' by Berwick & Hackbarth (2012). The authors argue that failures of care delivery, care coordination, overtreatment, fraud and abuse etc contributes to huge wastes in public expenditure on health which in turn negatively affect health outcomes. The study deviates from Berwick & Hackbarth (2012) by focusing on the private sector (VC) using Europe-based data to determine the relationship between healthcare investment and health sector growth. Another motivation emanates from Karpa & Grginović (2019). They investigate long-term investment into early stage life sciences projects for healthcare in Europe. The authors focus on the motivations and strategies for VC investments in early stage and report volatile financing environment in Europe. Karpa & Grginović (2019) conclude that long-term returns outperform other sectors and that skepticism of the VC to invest in the health sector remains a puzzle. I align with Karpa & Grginović (2019) and extend the argument to how VC investments in healthcare affect the growth of the health sector. The authors adopt a micro approach by looking at the returns, strategies and motivations for VC firms but the current paper use a macro approach which considers the relation with broad health sector (country level) and the economy as a whole. The study projects the European VC industry to attract investments leading to a vibrant market that still trails their US counterpart. Another source of motivation comes from the work of Lehoux, Miller & Daudelin (2016) whose theoretical paper from Canada focus on the mandate of VCs on how they operate and policy support for medical innovation. Apart from the paper being theoretical and lacking data from Europe, it does not touch on the relation between healthcare investments and

health sector growth. I employ rigorous quantitative methodological approach to address the gaps identified.

I use panel data on VC investment activities from EVCA now Invest Europe and healthcare data from EUROSTAT, OECD, WHO and World Bank websites. The study contributes to research in the following ways: First, with support from Europe-based data, I provide evidence that VC investments in healthcare does not increase health sector growth. Thus private sector investments in healthcare fails to remove the skepticisms surrounding public expenditure on health outcomes. Second, the study contributes to knowledge by confirming that the age of the VC industry increases health sector growth. The finding craves support for advancing policy to deepen the European VC industry which still trails the US. Third, using Europe-wide cross-sectional data makes room for generalization of the findings. This provides a wider perspective of the subject as compared to single country-based studies. Finally, the study proffers evidence that it is not enough to commit resources into healthcare but monitoring to ensure social return on investment. Therefore, I suggest public-private partnerships in healthcare investments as well as well coordinated and sustained policies and programmes aimed at promoting healthy lifestyles in Europe. Investors may enjoy financial returns on their investment, there should however be alignment with the benefits to society (social return). Thus regional bodies such as the EU and EEA can rely on this findings to design policy interventions to ensure equity in supporting the growth and development of the VC industry.

The rest of this study is organized as follows: Section two is dedicated to theoretical development and review of literature. Section three describes the data and methodology for the study. Section four covers the empirical results and discussions and section five concludes with the implications.

6.2 Theory and Hypothesis development

6.2.1 The Venture Capital Industry in Europe

The Invest Europe (formerly EVCA) defines venture capital" as an investment in unquoted companies by specialized VC firms. It is a subset of private equity, that is, equity investment in companies not listed on a stock market, as opposed to publicly traded companies. The VC industry in Europe started operations in the early 1980s with the establishment of VC firms. This was followed by the setting up of professional associations like the European Private Equity and Venture Capital Association (EVCA) now Invest Europe and the British Venture Capital Association (BVCA) in 1983 (Kaur, 2007). The VC market in Europe according to Manigart (1994) began in the UK and Ireland, followed by continental Europe with active participation by domestic banks. The European VC market is modelled after the US but have differences in their institutional environment as well as tax and securities laws regarding VC investments (Manigart, 1994).

Not until recently, the United States VC market was deemed to be the only active market but Europe, Asia and the rest of the world are experiencing some growth in their operations. The strength of the US VC industry lies in its existence and years of operation among other factors. In the opinion of Fleming (2015), regulatory support and reimbursement policies aimed at driving and funding early stage innovation research could help the VC industry. The US VC market enjoys government support by establishing models to serve as catalysts for innovative investments into healthcare (Perla *et al.*, 2018). In Europe, governments support fundraising activities to enhance liquidity in the VC industry. Despite this effort, Europe still trails the United States in size, age and depth of the VC markets. The participants in the VC market in Europe can be categorized under investors, intermediaries and portfolio companies. Investors in the market include financial institutions like banks, insurance companies, pension funds etc., corporations, endowment funds and wealthy individuals. The VC firms serve as intermediaries or the conduit through which funds get to portfolio firms (Zider, 1998). Portfolio companies here refer to firms with growth potential that receive VC funds.

The European VC market has grown enormously for the past two decades, from a fundraising of around €48 billion and investment level of €35 billion in the year 2000 to a peak of €97.3 billion in fundraising and €80.6 billion in investment in the year 2017 (Invest Europe Activity Report, 2018). Entrepreneurial activity has improved, government policy incentives and tax waivers coupled with strong economies seem to work well for the VC industry in Europe. Yet, there still remains a grey area for the European VC industry because it lacks the critical mass for effective operation to reach maturity (Kelly, 2011). The experience of the venture capitalist may prove decisive in most venture capital deals (Wang et al., 2003). An experienced venture capitalist may have witnessed many venture scenarios which inform reasonable recommendations to spur the growth in portfolio firms. VC firms that have been in the industry for a long time have enviable reputation and therefore their advice and judgements are regarded by entrepreneurs. Empirical studies support the fact that how long a VC firm has been in operation to a large extent impact the growth of its portfolio firms. For instance, Wang et al (2003) studied the effect of VC firms' participation on the portfolio of listed companies and reported that companies that are backed by older VC firms perform better than companies backed by younger VC firms. This is in line with Barry et al (1990) who reported that the presence of experienced venture capitalist on the board of a portfolio firm lowers IPO underpricing. Experienced VC firms have a broader knowledge base to draw from and are therefore better positioned to add value to their investee firms. However, what is unknown is the effect of the age of the VC industry on the growth of the health sector. Seeing that the age and experience of the venture capitalist appear to be a good indicator for impacting healthcare growth, the study hypothesizes that:

H_1: A long existing VC industry increases health sector growth

6.2.2 VC investment in health sector in Europe

The manifold problems confronting the European healthcare sector such as ageing population, reduction in public expenditure calls for capital investments into the sector, hence the involvement of VCs (Rossi, Thrassou & Vrontis 2012). Research indicate that

innovative health firms contribute to the improvement of healthcare delivery (Robinson, 2015). The healthcare sector has witnessed considerable change with respect to venture capital investments in the last two decades (HealthAffairs Report, 2019). The continuous improvement of healthcare is ideal, as overall wellbeing of a citizenry in contributing to economic growth largely depended on the sector (Cervellati & Sunde 2011; Weil 2007). Salter (2009) study globalization and health biotechnology innovation and cautions VCs on the need to manage risks involved in making investment decisions in health and biotechnology sectors (Silicon Valley Report, 2018).

Some healthcare related firms that receive VC funding are not limited to digital health products, innovative wearable devices, mobile health applications, telemedicine, personalized medicinal tool manufacturers and suppliers within the healthcare sector but service providers as well (Pitchbook VC Report 2018). Future VC investment opportunities are tilting towards medical technology, pharmaceutical, service providers and IT health infrastructure firms (BVCA Report, 2016). Despite the reported interest of VCs support to startups especially in healthcare sector, studies confirm that less than one percent of startups in all sectors get funded by venture capitalists and majority get funded by personal loans, credit, and family and friends (Rajan, 2010). VC investors interest in funding healthcare sector firms be it startups or existing firms with the required amount of capital is also driven by the desire to attain high liquidity option and an IPO which appears more possible with health related firms (Ackerly et al 2009). The KPMG Report (2018) indicates signs of renewed increase in investments in recent times. For example, the last two decades (apart from the crisis period) witnessed improved VC investments across all sectors especially in the healthcare sector. For instance, between 2010 and 2017, the value of VC investments in digital health alone increased by 858 percent, with more than $41.5billion investments made in a decade (HealthAffairs Report, 2019).

With the exception of the crisis period where VC investments dropped by more than 50%, the healthcare sector in Europe has witnessed major boost in capital investment compared to other industrial sectors like the IT and products/services sectors that witnessed a reduction in investment (Global VC Insights Report 2006; Invest Europe Report 2017). In the year

2000, healthcare related firms in Europe accounted for 11.8 percent of the companies financed by VCs representing 10.8 percent of total investments (EVCA Report, 2001). The pharmaceuticals, medical technology and healthcare services constitute the main sub-sectors attracting VC investments. The healthcare service subsector is regarded as the strongest area of growth in Europe (Pitchbook Report, 2018). Startups in digital healthcare venture investments alone increased from $1.1billion in 2011 to $11.5 billion in 2017 to an all-time record of $14.6 billion in 2018 more than 14 times the investment recorded in 2010 (StartUp Health Insight Report, 2018). Again between 2010 and 2018 the value of startup digital healthcare venture investments grew more than 917% (HealthAffairs Report, 2019) far exceeding the growth in overall VC investments in all sectors. In comparative terms while the overall Europe VC investments in the ICT sector has reduced significantly from 44.2% in 2000 to 19.3% in 2017 that of the life sciences and health sector has increased from 5.8% in 2000 to 11.5% in 2017 (Invest Europe activity Report 2017). This support Evens & Kaitin, (2015) report that biotechnology has promising impact for the healthcare of people thus justifying the need for improved and sustained VC investments in the sector. Recent report of VC investments in the Pharmaceutical and medical technology sectors in Europe indicate a growth trajectory from $1.9 billion and $1.4 billion in 2017 to $3.5 billion and $3.1 billion in 2019 (Silicon Valley Bank Report, 2020). Moreover, angel investors also offer investments to healthcare related firms especially startups, thus helping them to turn their dreams and ideas into viable commercial ventures.

The renewed interest of healthcare investments as reported by Pisano (2006) in his book on healthcare sector and biotechnology sector has been corroborated by Lazonick & Tulum (2011) in their study on US biopharmaceutical finance and the sustainability of the biotech business model. As such it is indicative that continuous interest in the industry may present opportunities for investors and investees alike.

Recommendations for a mix of private-public investment in the health sector at the global level has seen positive response through foreign direct investments, private equity and VCs. Sometimes, what attracts VC investments into the health sector could be attributed to cost-efficiency and ability to make returns on investments. In the UK, a study on private

investment in delivery of hospital facilities reveal that expected returns are generally in excess of WACC benchmarks (Vecchi, Hellowell & Gatti, 2013). The authors propose regulatory intervention where investors will set 'fair' expected returns to minimize the financial impacts on hospital investments. Empirical evidence suggest that the VC industry rather than non-VC impacts economic growth through financing innovative ventures (Kolmakov & Shalaev, 2015). In a study of the impact of VC investments on economic growth and innovation in the US and Russia, the authors underscore the fact that the VC market's contribution to R&D spending or gross investment is low. Kolmakov & Shalaev (2015) admit the contradiction in the impact of VC investment on modernization between theory and practice, they reiterate the importance and significance of VC investments albeit the delay. What is yet to be known is the impact of VC healthcare investments on health sector growth within Europe. Studies from the Eurozone area shows long run relation between VC investments, financial development and economic growth (Pradhan *et al.*, 2017). The European Union has made significant investments in the health sector between 2014-2020. A report by the European Structural and Investment Fund indicates that, 3.963billion euros have been invested in health infrastructure, followed by 3.711billion in access to health care services and 979million euros in ICT solutions and e-Health (ESIF, 2020).

Trends in overall VC investments year after year in Europe suggest improvement in investment thus impacting the overall economy (Invest Europe Report, 2018). The remarkable results of venture capital investments in the healthcare sector as reported by Global PE Report (2018) and Invest Europe Report (2018) is evident that the sector may be on a growth trajectory. Yet with the positive indicators and the growing interest of the healthcare sector by venture capitalists, very little or no attribution is made of venture capital investments directed towards the growth of the sector. In other words, there is paucity of research pointing to the evidence of the effect of VC investment in explaining healthcare growth in Europe. It is not enough for investors to receive their return on investment but the positive impact of VC investments on health outcomes. Berwick & Hackbarth (2012) bemoan the waste in the US healthcare expenditure which suggest a negative impact on

health outcomes. Thus in a health system where monitoring is weak, investments in health sector may be counter-productive. Therefore, the sector provides an ideal context to examine VC investments directed to healthcare sector and explore the effect of the investment. There is paucity of research to resolve whether investments in health sector produce positive or negative outcomes. I conjecture that VC investments significantly affect healthcare sector growth in Europe and therefore hypothesize that:

H_2: VC investment activities significantly affect health sector growth.

6.3. DATA AND METHODOLOGY

6.3.1. Data and Materials

The study employs an unbalanced panel of 23[2] EU/EEA member countries for the period 2000–2017. The choice of sample countries is purely governed by the fact that they are members of EU/EEA countries and also data for variables used for the study was available and could be accessed for such countries. The healthcare related indicators and macroeconomic data were obtained from the official websites of https://ec.europa.eu/eurostat/data/database, https://datacatalog.worldbank.org/ and https://stats.oecd.org/Index.aspx?DataSetCode=SHA whereas venture capital investment activities data were European Venture Capital Association (EVCA) now Invest Europe (the umbrella body of national private equity and venture capital associations in Europe).

The venture capital is represented by total investments or allocation of VC funds to the health sector of a country expressed in natural logarithmic terms and the number of years VC has been operating in the country in our model. I adjust for VC funds as a percentage of GDP, healthcare cost as a percentage of GDP and per-capita expenditure on health. The choice of control variables is informed by growth and economic theories in which these variables along with measures of human capital are found to impact healthcare growth (Pereira,

[2] The lists of countries are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom.

Pereira & Rodrigues, 2019). The data spans from 2000-2017 providing a maximum of 18 observations per country for each variable. The choice of the long period study is expected to provide robust evidence of the effect of VC investment activities on healthcare sector growth.

Life expectancy at birth is used as a proxy for healthcare sector growth. This proxy variable may come with some challenges because a country may have high life expectancy but majority of its population might be suffering from illness and might not be productive thus not contributing to the growth of the country (Bhargava et al 2001). In spite of this argument and health being a multi-dimensional concept, I follow previous research because life expectancy is a widely used indicator to gauge the growth of the health sector of a country (Cervellati & Sunde 2011; Bloom et al. 2004; Acemoglu & Johnson 2007).

Table 6-1: Variable definitions.

Variables	**Definition/Measurement**	**Data Source**
Dependent Variable		
Health sector growth proxied as life expectancy in years	Life expectancy is defined as the number of years a newborn is expected to live.	**World Bank , OECD and Eurostat**
Independent Variables		
VC investments	VC investments directed to healthcare related firms	**EVCA now Invest Europe**
Age of VC industry	The number of year(s) VC has been in operation in the country	**EVCA now Invest Europe**
Control Variables		
VC fund as percentage of GDP		**EVCA now Invest Europe**
Healthcare cost as percentage of GDP	Level of current health expenditure expressed as a percentage of GDP	**World Bank , OECD and Eurostat**
Per capita expenditure on health	Current expenditures on health per capita in current Euros	**World Bank , OECD and Eurostat**

Notes: All of the data are annual over the period 2000–2017

6.3.2 Econometric Model

In the empirical estimation of the effect of VC investment on healthcare sector growth, I measure healthcare sector growth (dependent variable) by the life expectancy of a country (see table 1 for variables definitions).

The study employs three main estimation techniques in a graduated manner to address biases. I initially use an OLS estimation technique, followed by fixed effect model before addressing the issue of endogeneity using the dynamic system GMM estimation technique. This estimation technique was chosen because the data is unbalanced and handles well the subject specific means whilst also weakening the assumption of no unobserved heterogeneity as well as avoiding dynamic panel bias (Bruderl & Ludwig, 2015; Nickell 1981). I therefore state the basic model of the healthcare sector growth as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \mu_{it} + \xi_{it} \quad (1)$$

where Y_{it} represent the healthcare sector growth, X_{it} represent the vector of the explanatory variables while μ_{it} is the vector of control variables, ξ_i is the error term, the observational units are *i* and *t* indexes time. The study takes into account the individual specific effects α_i and rewrite our model as follows:

$$Y_{it} = \alpha_1 + \beta_1 X_{it} + \mu_{it} + \xi_{it} \quad (2)$$

Fixed effect model account for composite error vit = $\alpha_1 + \xi_{it}$

At this stage I extend the model to take into account the possibility that the intercept may change across individuals and time which results in:

$$Y_{it} = a_i + y_t + \beta_0 X_{it} + \mu_{it} + \xi_{i,t} \quad (3)$$

I assume that, other investments may affect healthcare sector growth and so therefore I adjust for VC fund as a percentage of GDP, healthcare cost as a percentage of GDP and per-capita expenditure on health in our model.

I employ system GMM estimation technique which is preferred over single equation-based GMM to deal with possible endogeneity. System GMM is reliable and asymptotically

normal under appropriate conditions and has the advantage of combining the first differenced with same equation expressed in levels in a system (Kumar, 2013). Since the dependent variable is health sector growth, I employ two-stage system GMM to capture the change in health sector growth. *The equation for the model is:*

$$\Delta lnHSGrowth_{i,t} = lnHSGrowth_{i,t-1} + \sum_{j=1}^{n} \beta_j lnIndp_{i,t-1} + \sum_{j=1}^{n} \gamma_j lnCont_{i,t-1} + \varepsilon_{i,t} \ldots\ldots (4)$$

Where $\Delta lnHSGrowth =$
$change\ in\ log\ of\ health\ sector\ growth\ (dependent\ variable)$

$lnHSGrowth_{i,t-1} = lagged\ dependent\ variable$

$\beta\ and\ \gamma =$
$parameters\ to\ be\ estimated\ for\ the\ set\ independent\ and\ control\ variables$

$i, t = country\ and\ time\ measures\ for\ panel\ data$

$t - 1 = lagged\ variables\ for\ dynamic\ model$

$\varepsilon_{i,t} = individual\ fixed\ effect\ and\ error\ term$

$lnHSGrowth\ (dependent\ variable) is\ measured\ by\ life\ expectancy\ in\ years,$

$Indp\ variables\ are\ represented\ by\ VC\ healthcare\ investments\ and\ age\ of\ the\ VC\ industry$

$lnCont\ which\ is\ the\ set\ of\ control\ variables\ is\ represented\ by\ lnVC\ allocation\ to$

$healthcare, healthcare\ cost\ as\ percentage\ of\ GDP\ and\ VC\ fund\ as\ percentage\ of\ GDP$

6.4. Results and Analysis

6.4.1 Results

This section reports the descriptive statistics, correlation matrix, of venture capital investments in health and health sector growth in Europe. Table 2 shows the summary statistics for the variables.

Table 6-2: Descriptive Statistics

Variables	N	Mean	St.Dev	Min	Max
Life expectancy (Health sector growth)	414	4.368	.038	4.263	4.431
Classification by region	414	2.304	1.082	1	4
Age of VC industry	403	17.268	8.996	0	44
VC allocation to Healthcare	414	9.52	4.216	0	15.11
Healthcare cost as percentage of GDP	414	8.376	1.759	0	12.3
VC fund as of GDP	414	.141	.229	0	2.138
Ln per capita expenditure on health	414	7.549	.937	4.33	9.088

Table 6-2 shows the descriptive statistics for the variables used in the models. Apart from the age of VC industry which has 403 observations, all the other variables had 414 observations. The average age of the European VC industry is 17years with life expectancy (logged value) of 4.368. Apart from the age of the VC industry (SD=9) all the variables indicate consistency and less variability with standard deviations less than 5. The nature of the dataset as can be said to be homogenous and normally distributed.

Table 6-3: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Life expectancy	1.000						
(2) Classification by region	0.131*	1.000					
(3) Age of VC industry	0.460*	0.056	1.000				
(4) VC allocation to Healthcare	0.564*	0.008	0.452*	1.000			
(5) Healthcare cost as % of GDP	0.679*	-0.089	0.496*	0.504*	1.000		
(6) VC fund as of GDP	0.394*	0.004	0.422*	0.321*	0.246*	1.000	
(7) Ln per capita expend on health	0.851*	-0.075	0.444*	0.567*	0.707*	0.346*	1.000

Table 6-3 shows the correlation matrix for the variables. The correlation coefficients show low figures among the explanatory variables. This minimizes the problem of possible multicollinearity.

Figure 6-1: Life expectancy for sampled countries

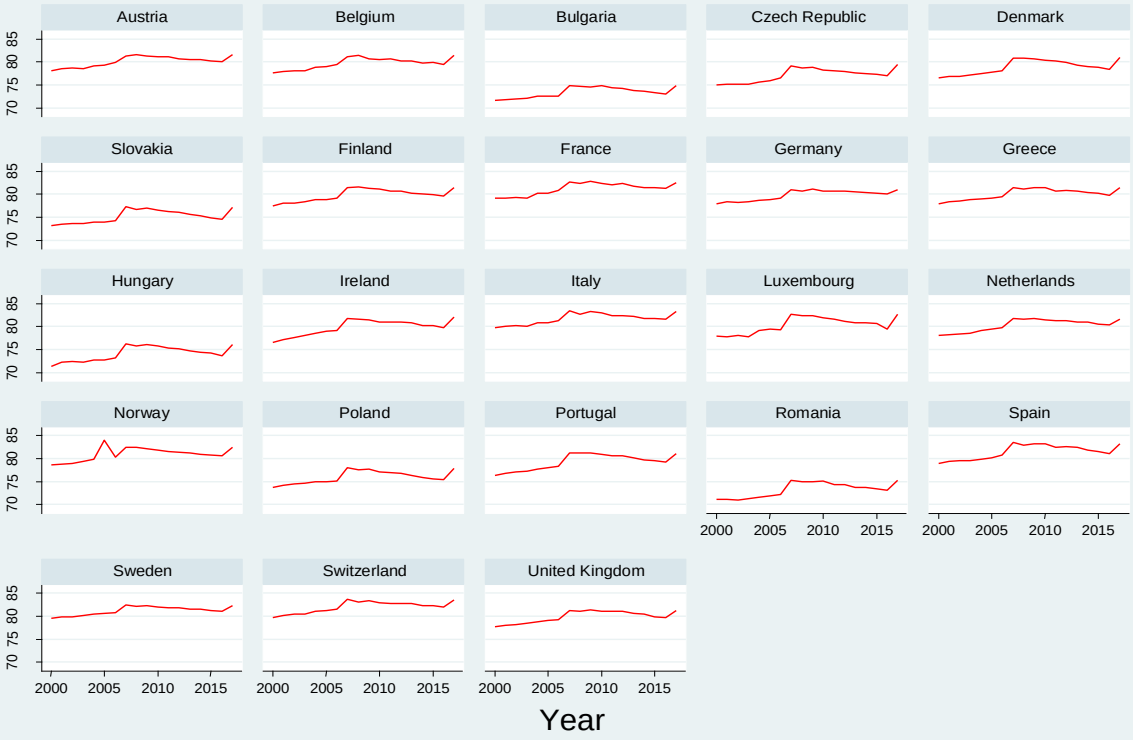

Figure 1: Panel Data Graphs by Countries

Figure 6-1 shows the life expectancy (proxy for health sector growth) for the sampled 23 countries. The trend shows relatively favourable life expectancy which is above 70 years. Almost every country is recording progressive life expectancy throughout the period under study. Among the implications of high life expectancy is the need to support an ageing population who become dependent on the actively working population. The next section analyses the static and dynamic estimations of the model.

6.4.2 Empirical results and analysis

This section reports panel unit root test to check the stationarity or non-stationarity of key variables in the model. OLS, fixed effect and as well as the GMM estimation results are also reported below.

6.4.2.1 Panel unit root test

The study performs Levin-Lin-Chu (LLC) as well as IM, Peseran and Shin (IPS) panel unit root tests to confirm the stationarity or non-stationarity of the main variables in the model. This is necessary to avoid a situation where the regression would give spurious results if found to be non-stationary (Granger and Newbold, 1974).

Table 6-4: Panel Unit Root Test main variables

Variables	LLC		IPS	
	Level	Difference	Level	Difference
VC Health Sector Investments	-4.5776	-12.6863	-2.8704	-12.3263
	(0.0000)*	(0.0000)*	(0.0021)*	(0.0000)*
Life Expectancy	-3.3728	0.4858	-0.0253	-3.7680
	(0.0004)*	(0.6864)	(0.4899)	(0.0001)*

Note: The p-values are reported in parentheses (*) and indicate significance at 1 percent level

Before estimating the models, I test whether the variables used are stationary. This is necessary because, economic and finance theory often suggests the existence of long-run equilibrium relationships among nonstationary time series variables. I conduct two panel unit root tests: the LLC test and the IPS test. **Table 6-4** shows the unit root test result for VC allocation to health and life expectancy (proxy for health sector growth) being the main variables of the study. The respective results for LLC unit root testing show a t-statistic of -4.5776 and -3.3728, and significantly less than zero ($p<0.0000$ and $p<0.0004$) at level. So the null hypothesis is rejected and the alternative that the variables are stationary is accepted. However, when converted to difference, the null hypothesis is rejected for the life expectancy variable but not for VC allocation to health. The IPS unit root test shows that life expectancy (t-statistic = -0.0253 and p-value = 0.4899) the null hypothesis cannot be rejected at level but when converted to difference it reports a t-statistic of -3.7680 and a p-value of 0.0001 and so the null can be rejected. But for VC allocation to health, the IPS test reports a t-statistic of -2.8704 (p-value= 0.00021) at level and a t-statistic of -12.3263 and (p-value of

0.0000) when converted to difference indicating that the null hypothesis can be rejected in favour of the alternative hypothesis that the variable does not contain unit root.

6.4.2.2 Analysis of the static panel data estimations

In order to ascertain whether VC investments affect health sector growth, I estimate the first model using an OLS for the group of twenty-three countries with the control variables and followed it with the robust OLS model. The result from Table 6-5 shows positive but insignificant relation between VC investment allocation to health and health sector growth for both the default and robust standard errors OLS. The age of the VC industry for both the default and the robust standard errors of the OLS estimation technique record a positive and statistically significant coefficient at 5% confidence interval. For the control variables, I report positive and statistically significant relations at 1% and 10% for the default and robust OLS models respectively for VC fund as a percentage of GDP. Per-capita expenditure on health and healthcare cost as a percentage of GDP show positive and statistically significant relation with health sector growth at 1% for both the default and robust standard errors OLS.

Usually, there are problems with using OLS models in panel data regressions because of the assumption that all the observations in the dataset are conditionally independent. This assumption may bring about biases and misleading standard errors. The study addresses country heterogeneity using fixed effect and the robust fixed effect models that encompasses individual and time-specific effects. Based on the assumption that individual country error term correlates with the predictor variables, I consider the use of fixed effects model to cater for time-invariant omitted variables.

Table 6-5: Baseline OLS and Fixed Effect Regressions

	(1) Health sector growth (OLS)	(2) Health sector growth (Robust OLS)	(3) Health sector growth (Fixed Effects)	(4) Health sector growth (Robust FE)
Ln VC allocation to healthcare	0.000367	0.000367	0.000553*	0.000553**
	(0.000312)	(0.000327)	(0.000251)	(0.000163)
Age of VC	0.131**	0.131**	0.220***	0.220***

industry				
	(0.0443)	(0.0459)	(0.0291)	(0.0393)
Healthcare cost as % of GDP	0.00319***	0.00319***	0.00354***	0.00354***
	(0.000851)	(0.000834)	(0.000804)	(0.000852)
Ln VC fund as % of GDP	0.0171***	0.0171*	0.0164***	0.0164
	(0.00495)	(0.00771)	(0.00346)	(0.00930)
Ln Per capita expend. on health	0.0270***	0.0270***	0.00398	0.00398
	(0.00171)	(0.00156)	(0.00329)	(0.00415)
Age*year	-0.0000653**	-0.0000653**	-0.000108***	-0.000108***
	(0.0000220)	(0.0000229)	(0.0000143)	(0.0000194)
Year dummy	0.00102*	0.00102*	0	0
	(0.000429)	(0.000449)	(.)	(.)
_cons	2.088*	2.088*	4.251***	4.251***
	(0.860)	(0.900)	(0.0209)	(0.0258)
N	403	403	403	403
R^2	0.736	0.736	0.567	0.567

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Table 6-5 shows the baseline OLS and fixed effect models for default and robust standard errors using 403 observations. The model introduces an interactive term between the age of the industry and year (Age*year). The iteration drops the year dummy for the fixed effect model because of collinearity. Apart from per capita expenditure on health and healthcare cost as percentage of GDP whose robust standard errors dropped as compared to their default standard errors for only the OLS model, robust standard errors increases for all other variables as compared to their default standard errors.*

The OLS result reports no difference in intercept and slopes across countries and time period. Although this model fits the data well, one may suspect if each country or year has different health sector growth. That is, each country may have its own health sector growth, its Y-intercept, that is significantly different from those of other countries. One could also assume

that error terms vary across countries and/or year. Fixed effect models enable the estimation of the net effect of the predictor variables on the outcome variable.

From the fixed effects model, VC allocation to healthcare significantly affect health sector growth at 10% and 5% confidence interval for the default and robust standard errors respectively as reported in Table 6-5. The age of the VC industry shows significant positive relation with health sector growth. VC fund as a percentage of GDP shows 1% significant positive relation with health sector growth for default OLS model, whereas healthcare cost as a percentage of GDP shows positive and statistically significant relation with health sector growth at 1%. Per-capita expenditure on health as the other control variable shows no significant relation with health sector growth for the fixed effect models. The interactive term between age of the VC industry and time shows significant negative relation with health sector growth. However, since fixed effect models do not effectively address endogeneity problems of panel data, I employ a dynamic model using the system GMM estimation technique.

6.4.2.3 Analysis of the Dynamic Panel Data Estimation

The GMM system estimator treats combination of both difference and level equations. Instruments used for the difference equation are the delayed values of variables in levels. Moreover, variables are instrumented by their first differences in level equation. This system of equations is estimated simultaneously by GMM. The simulations of Monte Carlo by Blundell & Bond, (1998) showed that system estimator is the most efficient. The analysis tests for over-identification and validity of instruments using the Hansen test and test of second order serial correlation of Arellano and Bond. For serial correlation test, results validate the hypothesis of absence of second order serial correlation of residuals. The values reported for the Hansen test are the p-values for the validity of the additional moment restrictions necessary for system GMM. The result does not reject the null hypothesis that the additional moment conditions are valid. The values reported for Arellano-Bond test for second order serial correlation are the p-values for second order autocorrelated disturbances

in the equation. As reported in Table 6-6, there is no evidence of significant second order autocorrelation and that the model is well-specified.

Table 6-6: System GMM (2-Step) for health sector growth and VC investments

VARIABLES	Ln Health sector growth
Ln Health sector growth $_{t-1}$	0.454***
	(0.073)
Healthcare cost as percentage of GDP_{t-1}	-0.000
	(0.001)
VC fund as a percentage of GDP_{t-1}	0.009***
	(0.003)
Ln per capita expenditure on $health_{t-1}$	0.022***
	(0.003)
Ln VC allocation to $healthcare_{t-1}$	-0.002**
	(0.001)
VC industry age*year	0.000*
	(0.000)
Year dummies	-0.001
	(0.000)
Constant	3.395***
	(0.822)
Observations	382
Number of countries	23
Country effect	YES
Hansen Test (stat.)	2.98
Sargan Test (stat.)	3.81
Test AR(1) (z-stat.)	-3.12
Test AR(2) (z-stat.)	1.50

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The result of the system GMM from Table 6-6 shows significant negative relationship between VC investment allocation to health and health sector growth contrary to the theory of growth. One percent increase in health sector growth leads to 0.2 percentage decrease in VC investments in healthcare. This suggest that VC investments in healthcare does not lead to increase in health sector growth in Europe.

The first hypothesis tests whether the age of the VC industry (measured by an interactive between age and year dummies) helps increase health sector growth. The system GMM result sustains the hypothesis that long existing VC industry increases health sector growth. This result is not unexpected because such long-existing markets have prevailing structures and relations for growth and development. The coefficient associated with number of years the VC industry has been in operation (age of VC industry) is also statistically significant at 10%. This is in line with Qiong et al (2018) who report that the age and experience of the VC affect the performance.

For the second hypothesis, the result reports that VC investment in health decreases health sector growth. The coefficient for the main variable of interest VC investment allocation to health has a negative coefficient and is statistically significant at five percent, suggesting that a 1% change in VC investments to health reduces life expectancy and for that matter health sector growth. This is in line with van den Heuvel & Olaroiu, (2017) study that the relationship between health care expenditures and health outcomes, such as life expectancy and mortality, is complex hence the effect of health care expenditures on health outcomes such as life expectancy is not clear as a causal link between the two is not proven. They again report that since the relationship between health care expenditures and health outcomes such as life expectancy is not clear, the effect of increase or decrease in healthcare expenses on health outcomes may be overestimated or underestimated. Their study further suggest that healthcare expenditures are not the main determinant of life expectancy at birth but social protection expenditures. However, this finding runs contrary to Reeves *et al.*, (2013) that expenditure on health may have short-term effect that may make recovery more likely thus increasing the life expectancy of people.

The control variables report positive and statistically significant effect between VC fund as a percentage of GDP and health sector growth. This implies that increase in VC fund as a percentage of GDP increase health sector growth. This is in line with Lago-Peñas, Cantarero-Prieto & Blázquez-Fernández, (2013) study confirming the relationship between GDP and health care expenditure. Healthcare expenditure as a percentage of GDP reports negative insignificant relation with health sector growth which is somehow in line with van den

Heuvel & Olaroiu, (2017) that effects of increase/decrease in health care expenses on health outcomes may be overestimated/underestimated. Per-capita expenditure on health as a control variable on the other hand records significantly positive effect on health sector growth at 99% confidence interval as reported in Table 6-6. GMM results report short run relations. In order to estimate long run relations, I calculate the long run coefficients for only the significant short-run coefficients. The long run k^{th} parameter is computed as $\beta_k \div (1 - \Phi)$ (Jung, 2012; Nafngiyana, Setiawan & Rahayu, 2019). The result indicates that VC allocation to healthcare, VC fund as percentage of GDP and per capita expenditure on health significantly affect health sector growth in the long-run all other things being equal. Thus a percentage change in VC allocation to healthcare is associated with 0.004 percentage decrease in health sector growth. From Table 6-7, the result shows that, all other things being equal, a percentage change in VC fund as a percentage of GDP and per capita expenditure is associated with 0.02 and 0.04 percentage increases in health sector growth respectively.

Table 6-7: Long run coefficients of significant variables

Ln life expectancy	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
Ln VC allocation to $healthcare_{t-1}$	-0.004	0.001	-2.600	0.016	-0.007	-0.001
VC fund as a % of GDP_{t-1}	.0157878	.0039504	4.00	0.001	.0075951	.0239805
Ln per capita expend. on $health_{t-1}$	.0399509	.0047392	8.43	0.000	.0301224	.0497794

6.5. Discussion

VC investments in healthcare shows increasing trend in recent times. This is not peculiar to Europe but also in the US where the VC industry has witnessed a paradigm shift from traditional VC to corporate VCs making huge investments in life sciences especially for start-ups in the biotech, as reported by Simeon-Dubach (2013). Relating the paper to that of van den Heuvel & Olaroiu, (2017), I can conjecture that, VC healthcare investment or allocation has not been enough to increase life expectancy of the people in EU/EEA countries. Although VC investments in healthcare grew by more than 50% over the 2017 figure according to Silicon Valley Bank report, (2018) in Europe, it is not enough to induce

growth in health sector growth. The interest and enormous appetite for healthcare venture investments especially among generalists and crossover investors owing to remarkable science and technology advancements lead to more effective treatments. Despite this encouraging trends in investments, there is still found a case of reduced health sector growth in Europe. The failure of VC investments in healthcare to increase health sector growth in Europe persist in the short-run and in the long-run. There have been innovative driven health sector investments expected to impact positively on the health sector and the economy at large but has however resulted in negative relation.

The negative relation between VC healthcare investments and the health sector growth suggest that attention ought to be directed towards promoting healthy life style and social protection expenditures as a way to correcting the negative trend in European health sector growth (van den Heuvel & Olaroiu, 2017). The result seems to corroborate the perception that there is the need to cut down waste in public-private expenditure in the health sector (Reeves *et al.*, 2013). In the event of perceived waste in health expenditure, the relationship between investments and healthcare outcomes can only be negative.

VCs are private individuals or corporate investors whose economic activities (investments) are expected to increase in life expectancy. Increased life expectancy has implications for the labour market and productivity as well as the overall GDP. Government expenditure on health contributes to health sector growth. In the long run coefficient analyses of significant short-run variables, it is evident that all the long-run coefficients increase as compared to their short-run coefficients. Whilst VC investments in healthcare decreases health sector growth in the long run other things being equal, per capita expenditure on health and VC fund as percentage of GDP increases health sector growth in the long run hence exhibiting inelastic relationships.

The negative relationship between VC investments allocation and health sector growth as reported from the study suggest a bleak picture for the growth of the health sector in Europe despite the improvements in VC activities so far. In a similar study, Zaman *et al.*, (2017) find no association between life expectancy and total health expenditure. It is however, refreshing to report from the study that, the age of the VC industry increases health sector

growth. Even though the European VC industry is not as vibrant as that of the US, there is evidence of seeing a vivacious industry in the near future. In developed VC markets such as the US, there are deliberate models established by the government available for VCs to leverage in pushing the triple agenda of better health, better care and lower cost (Perla *et al.*, 2018). These models serve as catalysts to spur innovation and health-based investments.

In Table 6-6, GMM-system model, when I adjust our model by VC fund as a percentage of GDP, per-capita expenditure on health, healthcare cost as a percentage of GDP, it presents the expected effect. This measurement tries to consider government healthcare expenditure which contributes to health sector growth. The study finds the need to control for these variables in order to truly ascertain the contribution of VC investments and age of the VC industry. It is expected that as VC investments in healthcare increases, it will lessen government burden on health sector commitments. The adjustment of the variables by GDP suggest that the growth of the health sector of a country has relation with the health of its economy. This is in line with economic theory suggesting that a healthy economy affect all other sectors within it. It is also in support of OECD Observer (2004) report indicating that healthcare performance is strongly dependent on the economy.

6.6 Conclusion

The paper seeks to analyze the effect of venture capital investment activities on the growth of the health sector in Europe. I propose that the age of the VC industry significantly increase health sector growth whereas VC investments in health rather decrease health sector growth. The panel analysis carried out in this study covered twenty-three EU/EEA countries for a period of 18 years spanning 2000 to 2017, using GMM-system. Investors may record their return on investments but the social return on VC investments realizable through avenues such as growth in health sector is untenable. The results indicate that VC investments activities in the healthcare sector has not improved the health status of the people when life expectancy is used as a proxy for health sector growth. The results suggest that it is not

enough to pursue channeling resources into healthcare but the constant monitoring to ensure societal benefits such as health sector growth. This call is very vital looking at the devastating impact of Covid-19. The age of the VC industry increases health sector growth. This paper acknowledges the role of the government in health sector through healthcare expenditure. The results thus suggest that though venture capital investments have been made it could not be relied upon to increase health sector growth in Europe. The study further concludes that VC health investment activities does not increase health sector growth in Europe. The study further concludes that health sector growth exhibit inelastic relationship with VC investments in healthcare, VC funds as percentage of GDP and per capita expenditure on health.

Although investments will have to be encouraged into the health sector to enable countries prepare well for unforeseen circumstances like Covid-19 pandemic, there is also the need to promote social protection investments and healthy lifestyles. Again, I recommend the development of inducement policy models to serve as catalyst for growing the health sector. European governments stand to benefit from the social returns to VC capital investments in healthcare as well as promotion of healthier lifestyles because health sector growth (high life expectancy) positively affect the entire economy. Therefore, I suggest public-private partnerships in healthcare investments as well as well-coordinated and sustained policies and programmes aimed at promoting healthy lifestyles in Europe. Future research may consider cross-country analyses of motivations for VC healthcare investments and sustainability of the Industry.

CHAPTER SEVEN

"AN ANALYSIS OF MACROECONOMIC FACTORS ON VENTURE CAPITAL EXITS IN EUROPE".

Abstract

This study investigates macroeconomic factors that may influence the liquidity of venture capital exits in Europe. To explore the influence, the study performed robust standard errors of Two Stage Least Squares method (2SLS) regression estimates on country-level dataset of 22 EU/EEA countries from 2000 to 2017. GDP, inflation, unemployment rate, interest rate and money supply are the macroeconomic factors considered. Findings reveal that interest rate influenced the illiquidity of almost all the VC exits in Europe. Based on data analysis, the study proposes that macroeconomic factors (except inflation) have mixed influencing role on VC exit liquidity or illiquidity. GDP was found to have a negative influence on VC exits in Europe, money supply was also found to have positive influence on VC exits, whereas, unemployment rate had mixed influence on VC exits in Europe. Inflation showed an insignificant influence on venture capital exits. Further, the study found MBO and sale to financial institution exits as addition liquid exit strategies that could be used by European VC funds. The study highlights new facts for enhanced understanding of VC exits in relation to macroeconomic factors in Europe.

7.1 Introduction

Venture capital is touted as a major driver to innovation and entrepreneurial development, with tremendous contribution to economic growth since the early 2000s (Samila & Sorenson 2011; Pradhan *et al.*, 2017). Studies on liquid and illiquid nature of venture capital exit has come on the radar of researchers as a way of helping to address challenges that confront the VC market liquidity (Cumming, Fleming & Schwienbacher, 2005; Franzoni & Phalippou, 2012). While it has been widely acknowledged, both in the academic literature and among practitioners, that economic growth and market liquidity factors are important for sustained and continuous VC exits, the direction of influence between these variables is still under-researched by means of robust empirical investigation. This study attempts to close this gap in the literature by examining the influence of macroeconomic factors on VC exits in Europe. The study is interested in examining the influencing role of macroeconomic factors on exits avaialable to European VC funds.

A liquid VC market provides investors the opportunity to easily exit their investment. Hege, Palomino & Schwienbacher, (2009) studies reported that the illiquid nature of the venture capital market in Europe could serve as a hindrance to the development of the market. And that the current prevailing economic environment may not provide the necessary market conditions to facilitate exits in Europe. The study therefore attempts to assess the influence macroeconomic factors could have on venture capital exits in Europe. This is necessary in view of the fact that liquidity of the venture capital market has the potential to make it easy for investors to easily exit their investment without loss of value. Although venture capital practitioners have largely been able to adhere to specific VC guidelines for managing liquidity and illiquid nature of the market, factors affecting exit liquidity in Europe remain relatively unidentified due to limited studies on venture capital exits.

The study is inspired by the work of Hege, Palomino & Schwienbacher, (2009) who assessed the disparity of venture capital performance between Europe and the United States and reported VC professionals in Europe concession of low returns on VC investments as hindrance to a strong VC industry. They again reported that the absence of attractive and liquid markets for VC exits especially IPO could be attributable to relative lack of VC

funding in Europe. Macroeconomic indicators play a central role in determining the liquidity of a market. Liquidity has been identified as a leading indicator of real economy (Næs et al., 2011) and is thought to be a reliable predictor of future economic growth (Levine & Zervos, 1998). The illiquidity nature of a market could be a reason for recession and market crashes (Jaccard, 2013), hence the need to examine the influence of macroeconomic factors on venture capital exits in Europe to ascertain its liquidity in relation to macroeconomic factors.

The present study seeks to fill a gap by empirically analyzing macroeconomic [gross domestic product (GDP), inflation (INFLA), unemployment rate (UNEM), interest rate (INT) and money supply (MON)) factors affecting venture capital exits, thus making a contribution to existing body of literature, and bringing originality value. Also, because I have considered macroeconomic factors to observe their probable influence on venture capital exits, the study provides a holistic view of the set of factors that influence venture capital exit, and the relationship that each factor shares with exits in Europe. This study provides insights into the relationships that VC exits share with various macroeconomic factors. Findings will enable venture capitalists to anticipate appropriate strategies to maintain adequate exit liquidity while incurring minimum losses of investment. In addition, the objective of this study is to identify macroeconomic factors which may influence VC exit liquidity and illiquidity.

There are at least eight (8) exit strategies for European VC funds. While IPO and trade sale exits have been extensively researched (Black & Gilson, 1998;Cumming, Macintosh & Cumming, 2003), academic research interestingly have not focused much on the other types of exits to comprehensively analyze and ascertain the liquidity or illiquid nature of the other exit types in Europe. Again, no existing study focuses on the exit strategies of VC funds from a macro perspective and its influence in relation to macroeconomic factors. This study aims to examine the influence of macroeconomic factors on venture capital exits in Europe? I therefore focus on two aspects of this question. First, I investigate the influence of macroeconomic factors on VC exits. Second, I ascertain whether a certain exit route has better liquidity over the other exit routes in relation to the macroeconomic factors.

These questions are important for practical and theoretical reasons. In practical terms, investors in the VC market prefer investing in an environment that provides them opportunity to easily exit their investment as and when necessary and recover their investment as well as returns on the investments. However, the existing conditions that influence the liquidity and illiquidity of the VC market is essential for understanding those factors relative to macroeconomic factors. Again every VC contracting agreement requires taking into account preferred exit route for the investment and identification of additional viable exit options for investors. In addition to the practical importance, the above questions contribute to entrepreneurial finance research that seeks to understand the influence of macroeconomic factors on the liquidity or illiquid nature of VC exits (Robinson & Sensoy 2011).

The study distinctive contribution is to examine the liquidity or illiquid nature of venture capital exit strategies using a country-level data in Europe relative to macroeconomic factors so as to guide policy formulation. This is necessary because it helps in addressing effectively aggregate impact of the macroeconomic conditions which is usually not the case with firm-level data.

7.2. Theory and hypothesis development

7.2.1 Overview of venture capital exits in Europe.

While previous research has examined the impact of micro-economic factors on firm exit decisions and performance, little research has explored macroeconomic factors on exits decisions. Existing literature suggest that market liquidity is a function of macroeconomic factors (Chowdhury, Uddin & Anderson, 2018). Studies reveal that macroeconomic factors have the likelihood to impact VC exit. Macroeconomic factors such as money supply, inflation, interest rate, unemployment, GDP and economic growth in general may affect venture capital exit. Venture capital market as a contributor to economic growth and development in Europe and elsewhere in the world has dominated entrepreneurial finance research (Pradhan *et al.*, 2017; Bezerra *et al.*, 2013; Zhang *et al.*, 2013). And as such efforts

are being made by governments especially in Europe to increase the levels of VC activities to support its growth agenda. Despite concerted efforts to support the growth of the market, activities of the market in the last few years after the crisis has been mixed due to low returns and illiquid nature of the market. The illiquid nature of the market creates difficulty for exiting which is the most important aspect of the contracting relationship between the venture capitalist and the entrepreneur.

VC firms invest primarily with an exit in mind after a few years spanning between 2-7 years, therefore exit plays a critical role in a VC firm, as successful exit enables the VC firms to develop (Cumming *et al.*, 2008; Black & Gilson, 1998). The exit comes in the form of divestment or liquidation that is often the last and final stage of the venture capital relationship. There is evidence suggesting prospective suitability of various exit4 strategies (initial public offering –IPO, trade sale, management buy-back, acquisition, write-off, secondary sale, etc.) that may be considered by the venture capitalist before an investment is made in a firm. Studies indicate the most commonly used exit strategies in Europe are the IPO and the trade sale (NVCA, 2010). These two types of exits have been extensively studies in Europe but not so much have been done regarding the reminder of the exit strategies. This paper attempts to examine the various exit strategies available to European VC funds from a macro perspective in relation to macroeconomic indicators and also to identify additional liquid exit options that could be used by investors in Europe.

Maclntosh (1997) research provide five principal types of venture capital exits (IPO-in which majority of the company's shares are sold to the public, acquisition exit- in which the entire company is bought or acquired by a third party, secondary sale- in which only the VC firm shares are sold to a third party while the entrepreneur maintains its shares, buyback-in which the entrepreneur buys back the shares held by the VC firm and write-off- in which the VC firm decides to walk away from the investment. Cumming, Maclntosh & Cumming (2003) in line with previous studies provide theoretical overview of the exit strategies in venture capital relationship. They reported five probable exit strategies listed in order of preference for the venture capitalist. They included IPO, acquisition, secondary sale, buyback and write-off. The venture capital process ends with an opportunity for the VC to

fully exit an investment by divesting all of its shares or partially exiting by selling a percentage of its shares. These are possible in instances where conditions for divestment becomes inevitable. Research indicates that illiquid markets make it difficult for shares to be sold (Wall & Smith, 1997). The study therefore attempts to examine these exits with country-level data from the European perspective. The EVCA now Invest Europe, the umbrella body of the National Venture Capital Associations reports at least eight exit strategies for European VC funds. They can be examined as follows:

Generally, VCs may decide to exit their investment using one of the following methods for its funds in Europe. In a trade sale exit, the private company is sold or merged with an acquirer for stocks, cash, or combination of both. In other words, it is the sale of business, or part of the business to another business. This type of exit is usually a common form of exit for a company's management and investors. It is also one of the most popular exit routes for VC funds in Europe and the United States (NVCA Report, 2010). The acquiring company makes a strategic decision to purchase the company to acquire the underlying property owned by, or the market share captured by, the company it is purchasing. In this strategy the entrepreneur is made to cede control to the acquirer.

Firms may decide to go public by offering for sale its share for the first time in an initial public offering (IPO) process. This issuance of shares to the public allows the company to raise capital from public investors. The transition from a private to a public company appears to be an important time for private investors (i.e. VCs firms) to fully realize gains from their investment as it typically includes share premiums for current private investors. After the listing of the portfolio firm, the VCs may then decide after a while to sell its shares. Evidence suggest VCs firms are very much likely to opt for IPO exiting strategy as the preferred exiting vehicle (Cumming & Johan, 2009; Black & Gilson, 1998; Gompers & Lerner, 1999). Because exiting through an IPO route provides VCs the fastest time to exit their portfolio firms as compared to that of other exit routes such as M&A and liquidations.

Another exit is write-off which essentially occurs when a VC firm decides to take its holding value of an investment in a portfolio firm to zero, because they do believe the investment in the portfolio company will not return any money to the fund. This usually represent a

complete failure of the portfolio firm and also a total loss of invested capital for the VC firm. However, the VC firm may still continue to own its shares in the portfolio company and probably decide to sell the shares at discounted value to other buyers if available so that part of the face value of its shares could be recouped (Caselli & Negri 2018).

In mezzanine/loans divestment vehicle, the VC firm provides loan or buys preference share in the company at the time of investment, so that in the course of the repayment regarding amortization of the loan it will represent a decrease of the financial claim of the firm into the company. In this type of exit VCs are willing to provide funding to firms with even negative cash flow while demanding higher rates of return to compensate for the risk in that exchange. This is referred to as hybrid which comes in the form of equity and debt.

Another type happens in instances where a VC firm decides to sell its stake in its portfolio firm to another VC firm for reasons best known to that VC firm. This type comes under the secondary sale exit strategy where the VC sell its shares in a portfolio firm to a third party usually a private equity firm. This type is different from acquisition where the entire shares is purchased by a third party.

Another type of exit is effected when the VC firm sells its shares to a financial institution who is a third party in a secondary sale transaction.

In the management buyback strategy, an arrangement is made for the majority shareholder to repurchase back the shares from the venture capitalists or executives of the portfolio company to repurchase back the shares. In this deal, the majority shareholder or executives of portfolio firm repurchases shares back from the investors in an agreed deal as a result of negotiation following the exit. This form of exit is not popular in Europe and the USA. However, according to Wang & Wang (2017) this type of exit strategy is the most popular form of exiting VC funds in emerging economics like China. They further provided evidence to the effect that buyback can be an efficient exiting solution in emerging markets.

Another type is divesting by other means which includes: repayment of silent partnerships, repayment of principal loans, write-off, sale to financial institutions, sale to management, etc. as reported by Acevedo et al., (2016).

Michelacci & Suarez (2004) underscored the importance of exiting to make way for recycling of capital to redirect previously invested capital into new investments or startups as well as to raise capital for follow-up investments on the stock market through an IPO. They indicate this as a necessity because of limited flow of funds. Schwienbacher, (2008) study support the idea that an IPO as an exit route may be limited to the most promising ventures while a trade sale seems to represent the more general exit route, i.e., for both more and less promising ventures. He further reports that with respect to exit choices, the likelihood for venture-backed companies to go public is affected by the number of financing rounds, the investment duration and the reporting requirements of the investee to the venture capitalist. Giot & Schwienbacher, (2007) on their part examined the dynamics of available exit options for US venture capital funds using a detailed sample of more than 20,000 investments rounds. They found that venture capital-backed firms exhibit increased likelihood of exiting through an IPO as time tickles away. They further report that venture capitalists do a trade sale for highly successful as well as less successful portfolio companies and can sometimes chose a trade sale for unprofitable venture. The authors further claim that the location of an entrepreneurial firm does not appear to affect the dynamics of the IPO process but a trade sale is impacted by the location of the entrepreneurial firms.

Cumming et al., (2005) in their study also investigated exit market liquidity effect on the frequency of VC investment in emerging early stage and high-tech firms and indicated that VC firms willingness to undertake high risk technological projects are premised on conditions of liquidity risk. They further claimed that conditions of high liquidity risk give rise to more syndication, which in turn shows that while VCs assume more technological risk in period of low liquidity, prudent steps are taken to mitigate the risk through syndication. Furthermore, they indicated that in instance of high exit market liquidity, VCs would prefer investing more in later-stage projects in order to quickly push through for exit and invest in early-stage when the liquidity of exit market is low so as to delay an exit. Evidence from the US and Canada shows that venture capitalists on average stay 4 to 6 years with their portfolio companies before divesting from the venture (Cumming & MacIntosh Cumming, 2003).

Cumming, MacIntosh & Cumming (2003) studies provide empirical analysis of share buybacks and secondary sales as alternative exit routes from the Canadian perspective. They report that venture capitalists sell their shares either back to management or to other institutional investors (with the entrepreneur in this case not selling his shares) and emphasized that these routes involve only partial exits in that not all shares are sold at once. Instead, VCs retain some equity stake in the investees as a way to signal quality when the degree of asymmetric information is severe.

Gompers (1995) indicate that the common way for venture capitalist to exit an investment is by staging their financing in several rounds as it enables the VCs to exit each financing round as and when it matures. Espenlaub, Khurshed & Mohamed, (2015) and Cumming and Fleming, Grant & Schwienbacher, (2006) on their part demonstrate the relevance of venture capital market liquidity in ensuring a successful exit.

Some studies have focused on appropriate exit strategy a VC firm can use with firm level data, but this present study focus on how VC exit could be influenced by macroeconomic factors in Europe with country-level data. Aghion et al (2004) paper provides first study of optimal design of active monitors' exit option. They indicate that an active monitor's claim is more likely to be liquid because the more intense and frequent his liquidity needs are the more informative the speculative monitoring in a trade sale, IPO or secondary market. They further underscore the need for claims of active monitors to be more liquid when more money flows into the venture capital industry.

7.2.2 Trends of venture capital market Liquidity.

Some academic research has examined venture capital market liquidity in developed and emerging economies (Hearn, Piesse & Strange, 2010; Lesmond, 2005; Cumming, Fleming & Schwienbacher, 2005; Perera, Bertsch & Wickremanayake, 2010). There are probable contradictions between the objectives of venture capital market liquidity. Evidence suggest that venture capitalists adjust their investment decisions according to liquidity conditions on IPO markets. In times of illiquid nature of the market, venture capitalists invest more in high-

tech and early stage firms in order to postpone exit requirement but would invest more in later stage when the market is liquid (Cumming, Fleming & Schwienbacher 2005). The theoretical support for the study is derived from liquidity risk theory for venture capital exit types. According to Cumming, Fleming & Schwienbacher (2005) liquidity risk refers to the risk of not being able to effectively exit and thus being forced either to remain much longer than expected in a venture capital contractual relationship or to sell the shares at a high discount. The risk of not being able to effectively exit an investment is an important reason why VCs require high returns on their investments (Lerner & Schoar, 2005).

Venture capital market liquidity is an event that allows VC firms to cash out some or all of their ownership shares in an investment (Cumming, 2005). Studies suggest the role of liquidity in explaining fundraising, returns in the venture capital market (Black & Gilson, 1998; Cumming et al, 2006). Bauma, Caglayan, Ozkan, & Talavera, (2006) studies report that macroeconomic factors impact market liquidity. This present study therefore seeks to identify the effect of the movements of macroeconomic factors on venture capital exits in Europe. The rationale for choosing these key macroeconomic variables revolve around the fact that they do not only affect the economy but also affect individuals and businesses that operate in that space.

The macroeconomic factors convey useful information that guide decision making in a firm (Bondareva & Zatrochová, 2014). Cumming et al, (2005) show VC firms adjust their investment decisions according to the prevailing liquidity conditions on IPO exit markets while Robinson & Sensoy, (2016) highlights cyclicality in fund-level cash flows and its implications for fund performance. Ellul & Pagano, (2006) on their part report IPOs underpricing as a result of liquidity risk. Chordia, Roll & Subrahmanyam, (2001) studied liquidity and trading activity for a sample of New York Stock Exchange listed stocks over a 11-year period and found that trading activity and market depth increases prior to macroeconomic announcements of GDP and the unemployment rate. Bekaert, Harvey & Lumsdaine, (2002) used a number of time series for 20 emerging markets and found that financial markets tend to be more liquid following regulatory changes that enhance market integration. However, Gao & Kling (2006) studied regulatory changes and market liquidity

in Chinese stock markets with monthly stock prices of all 'A shares' listed on the SSE and SZSE from December 1990 to December 2002 and found that reforms can increase liquidity but did not find a steady improvement of market liquidity over time. They again found that announcement of policy changes in daily newspapers trigger pronounced reactions in market liquidity regardless of whether turnover or turnover-volatility ratios measure liquidity. They however conclude that macroeconomic shocks hardly affect market liquidity contrary to Chordia et al., (2001) conclusion.

Bekaert, Harvey & Lundblad, (2007) in their study on liquidity and expected returns in a panel vector auto regression model for 18 emerging countries concluded that liquidity significantly predicts returns and unexpected liquidity shocks are positively correlated with returns and negatively correlated with dividend yields. They again conclude that local systematic liquidity risk to be important empirically, much more so than local market risk in explaining expected returns. Cumming & Johan, (2012) in their study that focuses on the state of venture capital before and after the crisis examined the challenge often faced by VC investors in their attempt to obtain liquidity through the preferred and most profitable exit routes even before the crisis. They found that the difficulties faced by the VC investors have caused the reduction in available amount of venture capital for investment.

The crisis undoubtedly caused venture capital to be slow (Block & Sandner, 2009), thus confirming the thought of the industry being in crisis even before the financial crisis. The huge amount of funds that flowed into the industry according to Cumming & Johan, (2012) drove down returns causing knock-on effects on fundraising and investment activities. They again reported that the crisis caused venture capital performance to be weakened thus making it difficult for venture capitalists to exit from their investments, sometimes forcing some VC firms to extend the traditional life of the fund.

7.2.3 Overview of macroeconomic factors and venture capital liquidity.

Existing literature suggests that venture capital exit liquidity is a function of macroeconomic factors. Macroeconomic factors are external factors that influence venture capital exit

liquidity but are not under the control of VC firm management. Venture capital liquidity has been investigated by researchers in the past while taking into account some macroeconomic variables (Robinson & Sensoy, 2016; Sprague, 2015; Lahr & Mina, 2014; Franzoni, Nowak & Phalippou, 2012; Da-Rin, Hellmann & Puri, 2011; Groh, von Liechtenstein & Lieser, 2010; Cumming, Fleming & Schwienbacher, 2005; Aghion, Bolton & Tirole, 2004). The various macroeconomic factors are explained as follows:

7.2.3.1 GDP

Gross domestic product (GDP) is the value of goods and services produced in a country in a given period of time (quarterly or yearly). GDP is one of the most common indicators used to track or gauge the health of a nation's economy. GDP is perhaps the most closely-watched and important economic indicator for both economists and investors alike because it is a representation of the total dollar value of all goods and services produced by an economy over a specific time period. As a measurement, it is often described as being a calculation of the total size of an economy. Gompers and Lerner, (1999) studies found the relationship between macroeconomic factors and venture capital activity. Groh, von Liechtenstein and Lieser, (2010) on their part specifically found GDP to be significantly related to venture capital activity. Yang, (2018) studies also report that the growth of GDP has the potential to significantly increase the likelihood of an IPO exit. Venture capital Investors pay attention to the GDP because a significant percentage change in the GDP–either up or down–can have a significant impact on the market. In general, a bad economy usually means lower returns for investors. And this can translate into lower liquidity. I therefore expect a positive or negative relationship.

7.2.3.2 Interest rate

Interest rates have an effect on businesses and determine economic activity and asset prices (lower interest rates mean that people have more money, which increases asset prices due to

increased demand). Venture capital funds are sensitive to interest rate changes and benefit greatly from lower interest rates. Venture capital activity tends to slow down when interest rates rise, and VC firms may hedge their interest rate risk accordingly. Gompers & Lerner, (1998) empirically studied the determinants of venture capital and their findings revealed that the level of interest rates can influence venture capital activity. Félix, Pires & Gulamhussen, (2013) also on their part report that factors such as interest rates are expected to influence demand for venture capital. I therefore expect positive or negative relationship.

7.2.3.3 Inflation

Inflation is the rate at which the general price level of goods and services rises and, as a result, purchasing power of currency falls. In the financial markets, the rate of inflation is important as it represents the rate at which the real value of an investment is eroded. Inflation relates to the venture capital market as it gives investors an idea as to exactly how much of a return or loss (in percentage terms) their investments will make or suffer. Bliss, (1999) analysed venture capital model in transitional economies and found the potential impact of inflation on project returns of the venture capitalists. He further suggested that the potential impact of high levels of inflation on expected return projections must be carefully considered during the evaluation of proposals by venture capitalists. I therefore expect inflation to be either positively or negatively affect venture capital market exits.

7.2.3.4 Money Supply

Money supply is all the currency and other liquid instruments in a country's economy on the date measured. The money supply roughly includes both cash and deposits that can be used almost as easily as cash. The argument is that an increase in money supply at low interest rates will lead to increase in cash balances and discourage people investment. The money which the financial institution utilizes for their daily operations is termed as the demand. When an economy overheats central banks raise interest rates and take other contractionary

measures to slow things down thereby discouraging investment and depressing asset prices. Whereas in times of a recession, the central bank lowers rates and adds money and liquidity to the economy thereby stimulating investment and consumption, having a generally positive impact on asset prices. Gilad & Levine, (1986) reports that the growth of money supply seems to offer its own inducement opportunities for innovative responses. A clear understanding of how monetary policy can influence various financial asset like venture capital can position investors to take advantage of changes in rates or other measures taken by central banks. I therefore expect a positive or a negative relationship with venture capital exit.

7.2.3.5 Unemployment

Unemployment rate is the percentage of the unemployed work force in a country. A high unemployment rate represents a weak or failing economy. Félix, Pires & Gulamhussen, (2013) analysed the determinants of venture capital activity with an aggregate data from 23 European countries and found that the unemployment rate negatively influences venture capital market. According to Belke, Fehn & Foster, (2001), venture capital investment has a positive effect on labour market performance in a more dynamic than static nature possibly due to a time-to-build period. I therefore expect a negative relationship with venture capital exit.

7.2.4 Conceptual framework

Studies on venture capital liquidity has been on the radar of researchers over the past years, as practitioners, policy-makers and academics use liquidity of market as a barometer for the 'healthy functioning' of an economy (Cumming, Fleming & Schwienbacher 2005; Næs et al., 2011; Lahr & Mina, 2014). A liquid VC market provides investors the opportunity to easily exit their investment. And favourable economic environment is expected to provide the necessary conditions that facilitate successful exits in Europe. The illiquid nature of the

market on the other hand pose serious threat to VC investors and makes it impossible for them to exit their investment (Hege, Palomino and Schwienbacher, 2009). The illiquid nature of the market would equally affect all exit options available to European VC funds. In view of the above I postulate that some exits may have better liquidity over others relative to macroeconomic factors influence. I therefore hypothesize as follows:

H1: Some exit types have better liquidity over other exit routes

Gross domestic product growth stimulates business activities and the general economic environment. During economic downturn, investors tend to sell riskier holdings and move into safer securities, such as government debt. Investors may want to own equity investment in companies with long histories since these companies tend to hold up better during recessions times.

This suggest that as GDP growth increases, liquidity of venture capital market increases to facilitate exit, and as GDP growth falls, liquidity of the venture capital market decreases to stunt exit. Thus, I hypothesize as follows:

H2: GDP growth has positive influence on venture capital exit.

Inflation rate decreases currency value and increases vulnerability of venture capital market which affects exits that is an important decision in venture capital contracting relationship. Hence, I propose:

H3: Increase in inflation decreases venture capital market liquidity and hence exits.

Unemployment rate in a country significantly affect venture capital market. A well-functioning venture capital market may very well make a difference for spurring employment creation even under perfectly flexible labor markets because labor supply might react positively to improved and efficient market possibilities. High unemployment shutters

economic growth and hurts venture capital exits. The higher the unemployment rate, the slower the economic recovery. When there is a high unemployment rate, there are fewer people to spend money. This in turn leads to less money being spent and circulated around to businesses and therefore formulate the following hypothesis:

H4: Increase in unemployment rate decreases venture capital liquidity and hence exits.

Interest rate in a country significantly affect economic activities. The rate of interest in a country influences the level of investment in the economy. Typically, higher interest rates reduce investment, because higher rates increase the cost of borrowing and require investment to have a higher rate of return to be profitable. Venture capital activities are very much sensitive to interest rate changes and therefore lower interest rate will positively influence exits. I therefore formulate the following hypothesis:

H5: Decrease in interest rate increase venture capital exits.

The management of money supplied in a country greatly affect an economy. An increase in the supply of money works both through lowering interest rates, which increase investment, and through putting more money in the hands of consumers, making them feel wealthier, and thus stimulating spending. In a resilient economy, venture capital market liquidity may increase and therefore more exits would be expected. If money supply continues to increase, more money would be available to investors and therefore positively affect venture capital exits. I therefore hypothesize as follows:

H6: Increase in money supply positively affect venture capital exits.

7.3.0 Data and Methodology

7.3.1 Data collection

The study aims to explore macroeconomic factors influence on venture capital exits in Europe. The macroeconomic factors include GDP, inflation, interest rate, unemployment rate and money supply; and the venture capital exits include all available exit options to European VC funds: trade sale, IPO, write-off, Mezzanine/loans, MBO, sale to PE firm, sale to financial institution, divestment by other means (Tran and Jeon, 2011; Lahr and Mina, 2014). The data used annual country-level data in the analysis for 22[i] countries over the period 2000-2017. The country coverage sample are determined by data availability and also the fact that they are members of EU/EEA. This is a different methodology that is commonly used in literature utilizing industry or firm level data to analyse venture capital exit and its liquidity (Cumming, Fleming & Schwienbacher, 2006; Giot & Schwienbacher, 2007; Cumming & Maclntosh, 2013). The venture capital data used in this study is sourced from EVCA now Invest Europe (VC exiting strategies data). The databases compile VC exiting variables and macro-economic data on each country. The analyses exclude countries with less than ten years of data on the variables of interest. This makes the panel data unbalanced. Even though the data shows an initial 388 observations in the descriptive statistics, the regressions use 337 observations for the analyses. To measure macroeconomic factors, we use the most prominent macroeconomic variables: GDP, inflation, interest rate, unemployment rate, and money supply. All the macroeconomic variables are sourced from the World Bank, Eurostat and OECD databases on an annual basis.

[3]In order to account for the other variables that can explain venture capital exits, the study adopts three control variables in our model specification. Specifically, political risk, age of VC industry and capital gain tax. The choice of control variables is dictated by capital market theory in which these variables along with measures of financial economics are found to be the most robust determinants of venture capital exit liquidity (see Table 1 for variable definitions and sources of data). All the data is averaged over 10 years to examine the

[3] The countries include Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, and United Kingdom.

influence of macroeconomic factors on venture capital exits. There is a belief by investors that the control of the government can hurt or benefit them. This is especially true in instances where a government elected into office will consistently be hostile to a sector thereby pushing down the market or causing the market to run low. Again political uncertainties generally move market lower. Furthermore, lower taxes influence the liquidity of the market. Taxes on income, profits, and capital gains are levied on the actual or presumptive net income of individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets. Excessive taxes on gains affect the liquidity of the venture capital market. Also the age of VC industry has been shown in literature to impact exit outcomes in the venture capital market and so I include it in the model. The age and experience of players in a market affect the activities of the venture capital market. I suspect that a young VC industry may not be able to create the enabling environment that can facilitate successful exits.

Though IPO and trade sale have been widely investigated in literature focusing on USA and Europe and buyback also on emerging markets like China but this study looks at the influence of macroeconomic factors on all exit options available to European VC funds. Macroeconomic factors may affect the liquidity of VC market exit. That notwithstanding in empirical analysis, the study ought to take into account the potential endogeneity problem. So to address this problem, the study employs two stage least squares (2SLS) approach to ascertain the influence of macroeconomic factors on venture capital exits in Europe. The fundamental problem of using 2SLS is that there are no ideal instruments available. So the study attempts to use some of the variables on the right-hand side in the reduced form as instruments (ie lag of GDP, money supply and interest rate) whereas log of GDP and interest rate would be treated as endogenous variables in the model because the activities and state of the VC market reflect in the GDP and interest rates of a country. The validity of these instrumental variables is confirmed by the correlation matrix which shows that these are indeed uncorrelated with the residuals but correlated with the dependent variables.

7.3.2 Data Variables

This section provides an economic motivation for the choice of variables. Table 1 summarizes the definitions of the variables and how they have been constructed. Table 2 contains descriptive statistics for all the variables used in the analysis.

Table 7-1 (Definition of variables)

Variable	Definition and unit of measurement	Source
Dependent variable (s):		
Sale to trade sale	Total value of companies exited through trade sale and expressed in natural log.	EVCA now Invest Europe
IPO	Total value of companies exited through IPO and expressed in natural log	EVCA now Invest Europe
Write-off	Total value of companies exited through write-off and expressed in natural log.	EVCA now Invest Europe
Mezzanine/loans	Total value of companies exited through mezzanine/loans and expressed in natural log.	EVCA now Invest Europe
Sale to PE firm	Total value of companies exited through sale to PE firms and expressed in natural log.	EVCA now Invest Europe
Sale to Fin Institution	Total value of companies exited through sale to financial institution and expressed in natural log.	EVCA now Invest Europe
MBO	Total value of companies exited through MBO and expressed in natural log.	EVCA now Invest Europe
Divestment by other means	Total value of companies exited through Divestment by other means and expressed in natural log.	EVCA now Invest Europe
Independent variables:		

Variable	Definition and unit of measurement	Source
Money Supply	The money supply is the total amount of currency and other liquid instruments circulating in the economy. The indicator represents the broad money that include currency outside banks; demand, time, saving, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper. The natural logarithm of money supplied for a year in Euros.	World Development Indicators of World Bank
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	World Development Indicators of World Bank
Interest rate	The real return on a savings account or any interest-paying investment when the effects of compounding over time are taken into account.	World Development Indicators of World Bank
GDP	The value of all government current expenditures for purchases of goods and services (including compensation of employees). The natural logarithm of GDP for a year in Euros.	World Development Indicators of World Bank
Control variables		
Tax policy (Capital gain tax)	Taxes on income, profits, and capital gains are levied on the actual or presumptive net income of individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets. Intragovernmental payments are eliminated in consolidation.	World Development Indicators of World Bank
Political climate	The belief that the control of government by one party or the other can hurt or benefit movements of markets as a whole. If a government appear consistently hostile to a market, it will push the market lower. Political uncertainties in a country will also push the markets low. This is measured by political risk.	World Development Indicators of World Bank

Table 7-2: Summary of variable, expected relationship with dependent variable(s) and data source.

Variable	Proxy/Measurement	Notation	Expected effect	Data Source

Dependent Variable				
Exit types				**EVCA now Invest Europe**
Independent Variables				
GDP	GDP is the natural logarithm of the value of GDP for a year in Euros.	**GDP**	+	**World Development Indicators of World Bank**
Interest rate	Annual interest rate	**INT**	+	**World Development Indicators of World Bank**
Inflation	Annual percentage of inflation.	**INF**	-/+	**World Development Indicators of World Bank**
Money supply	The natural logarithm of money supplied for a year in Euros.	**MON**	-/+	**World Development Indicators of World Bank**
Unemployment	Annual unemployment rate7	**UNE**	-/+	**World Development Indicators of World Bank**

Table 7-3: Summary of country-level VC exits and macroeconomic factors

Country	Exits (No of years)	GDP (No of years)	Inflation (No of years)	Interest rate	Money supply	Unemployment rate	Political risk	Capital gain tax
Austria	18	18	18	18	18	18	17	18
Belgium	18	18	18	18	18	18	17	18
Bulgaria	11	18	18	15	18	18	15	13
Czech Rep	18	18	18	17	18	18	17	18
Denmark	18	18	18	18	18	18	17	18
Slovakia	6	18	18	17	9	18	17	18
Finland	18	18	17	18	18	18	17	18
France	18	18	17	18	18	18	17	18
Germany	18	18	18	18	18	18	17	18
Greece	18	18	18	18	17	18	17	18
Hungary	18	18	18	18	18	18	17	18
Ireland	18	18	17	18	18	18	17	18
Italy	18	18	17	18	18	18	17	18
Luxembourg	11	18	18	15	18	18	17	18
Netherland	18	18	18	18	18	18	17	18
Norway	18	18	18	18	18	18	17	18
Poland	18	18	18	17	18	18	17	18
Portugal	18	18	18	18	18	18	17	18

Romania	18	18	18	13	11	18	17	18
Spain	18	18	18	18	18	18	17	18
Sweden	18	18	16	18	18	18	17	18
Switzerland	18	18	17	18	18	18	17	18
UK	18	18	18	18	18	18	17	18
	388	**414**	**407**	**400**	**397**	**414**	**389**	**409**

7.3.3. Model specification

The theoretical literature shows that there is an endogeniety problem that may arise among the variables. In order to solve this problem, two stage least square (2SLS) estimation technique which consider the mutual relation among variables is used. So as to be able to determine the various exit types, equation (1) has been used:

$\ln(\text{Trade Sale}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(IPO_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(\text{Write-off}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(\text{Mezzanine/loan}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(\text{Sale to PE}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(\text{Sale to Fin Inst}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(MBO_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

$\ln(\text{Other}_i) = \alpha + \beta_1 \ln(GDP_{1i}) + \beta_2 INF_{2i} + \beta_3 INT_{3i} + \beta_4 \ln(MON_{4i}) + \beta_5 UNEM_{5i} + \beta_6 CAP_{6i} + \beta_7 POL_{7I} + \xi_i$

In the model, index i (i= 1,2, ……, 22) specifies the countries, α specifies the constant term, β specifies the parameters to be estimated, and ξ specifies the error term.

7.4. Analysis of Results and discussion

The analysis of the data would be presented in the descriptive analysis, correlation analysis and empirical analysis.

7.4.1 Results of the study

Descriptive Statistics

Table 7-4 contains descriptive statistics for all the dependent and the independent variables used in the analysis. The dependent variables are all the various exit options available to European VC funds. The main independent variables are macroeconomic factors of the countries. The analysis also controls for the political risk in country and the capital gain tax that can affect venture capital exit liquidity as well as the age of VC industry.

Table 7-4 Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
logntrades~e	382	10.593	3.46	0	15.3
lognipo	382	8.15	4.774	0	15.09
lognwriteoff	382	8.291	4.34	0	14.64
lognmezzan~e	382	8.17	4.324	0	15.47
lognsaletope	381	8.621	4.891	0	15.05
lognsaleto~n	382	6.079	5.124	0	14.28
lognmbo	343	7.748	4.301	0	14.61
lognother	382	7.743	4.428	0	14.94
logngdp	396	13.327	1.487	10.05	17.38
unemployment	396	8.007	4.364	1.8	27.5
inflation	389	2.483	3.597	-4.5	45.7
interest	383	3.919	2.326	-.4	22.5
lognmoneys~y	394	5.718	1.362	2.129	11.685
politicalr~k	373	.829	.467	-.47	1.76
capitalgai~x	391	25.197	8.981	10.14	49.66
avf	396	19.533	8.789	0	44

Table 7-5: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
(1) logntradesale	1.000															
(2) lognipo	0.660	1.000														
(3) lognwriteoff	0.574	0.585	1.000													
(4) lognmezzanine	0.636	0.522	0.573	1.000												
(5) lognsaletopefirm	0.646	0.604	0.515	0.560	1.000											
(6) lognsaletofini~t	0.590	0.585	0.480	0.534	0.591	1.000										
(7) lognmbo	0.550	0.494	0.516	0.613	0.589	0.442	1.000									
(8) logndivestment~s	0.612	0.575	0.572	0.635	0.617	0.603	0.531	1.000								
(9) logngdp	0.176	0.186	0.051	-0.021	0.181	0.194	0.162	0.067	1.000							
(10) unemploymentr~e	-0.175	-0.126	-0.016	-0.143	-0.105	-0.029	-0.023	-0.080	-0.047	1.000						
(11) inflation	-0.220	-0.182	-0.237	-0.197	-0.199	-0.183	-0.115	-0.175	0.061	-0.169	1.000					
(12) interestrate	-0.420	-0.359	-0.271	-0.374	-0.342	-0.336	-0.246	-0.315	0.021	0.423	0.389	1.000				
(13) lognmoenysupply	0.380	0.363	0.386	0.305	0.338	0.377	0.220	0.320	0.253	-0.079	-0.271	-0.387	1.000			
(14) politicalrisk	0.149	0.089	0.117	0.081	-0.020	-0.142	0.050	0.023	-0.108	-0.541	-0.091	-0.290	-0.121	1.000		
(15) capitalgaintax	0.317	0.287	0.361	0.246	0.245	0.165	0.223	0.275	-0.112	-0.053	-0.034	-0.130	0.295	-0.075	1.000	
(16) avf	0.495	0.463	0.483	0.446	0.551	0.421	0.425	0.439	0.190	0.053	-0.411	-0.406	0.448	0.013	0.258	1.

Table 7-5 shows the association between the variables. There is a weak correlation between the independent variables (GDP, unemployment, inflation, interest rate, money supply, political risk, capital gain tax and avf) with the highest being less than 0.5 thus indicating no multicollinearity. Possibly the absence of multicollinearity suggests the independent variables do not influence themselves, which is a vital assumption for multivariate analysis. Problems of multicollinearity lead to overestimation of standard errors of coefficient estimators resulting in large confidence intervals and smaller t-statistic (Wonsuk, Mayberry, Bae, Karan, Qinghua, & Lillard Jr., 2014). Apart from Mezzanine/Loans, MBO and Divestment by other means whose strength of correlation with the macroeconomic variables such as GDP and political risk is not significant, all other correlation coefficients are significant.

Table 7-6: OLS REGRESSION WITH INDEPENDENT VARIABLES ONLY

	(1) logntradesale	(2) lognipo	(3) lognwriteoff	(4) lognmezzanine	(5) lognsaletope	(6) lognsaletofin	(7) lognmbo	(8) lognother
lngdp	0.276*	0.318	-0.140	-0.197	0.441*	0.536**	0.444*	-0.0605
	(0.124)	(0.176)	(0.162)	(0.161)	(0.178)	(0.186)	(0.175)	(0.167)
unemploymen trate	-0.0401	-0.0337	0.00232	-0.0280	0.0120	0.109	0.0995	-0.00342
	(0.0435)	(0.0619)	(0.0569)	(0.0567)	(0.0626)	(0.0653)	(0.0622)	(0.0586)
inflation	-0.109	-0.0492	-0.131	-0.0320	-0.172	0.00412	0.0539	-0.00066
	(0.107)	(0.153)	(0.140)	(0.140)	(0.154)	(0.161)	(0.154)	(0.145)
interestrate	-0.403***	-0.457***	-0.158	-0.445***	-0.499***	-0.579***	-0.477***	-0.357**
	(0.0923)	(0.131)	(0.121)	(0.120)	(0.133)	(0.139)	(0.130)	(0.124)
lognmoneysu pply	0.619***	0.861***	1.141***	0.745***	0.804***	0.992***	0.299	0.867***
	(0.147)	(0.209)	(0.192)	(0.191)	(0.211)	(0.220)	(0.205)	(0.198)
_cons	5.444**	1.131	4.541*	8.630***	0.339	-5.468*	0.922	5.059*
	(1.675)	(2.384)	(2.192)	(2.184)	(2.406)	(2.518)	(2.373)	(2.260)
N	363	363	363	363	362	363	329	363
R^2	0.240	0.180	0.161	0.161	0.198	0.211	0.102	0.138

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-7: OLS REGRESSION RESULTS WITH CONTROL VARIABLES

	(1) logntradesale	(2) lognipo	(3) lognwriteoff	(4) lnmezzanin	(5) lognsaletope	(6) lnsaletofin	(7) lognmbo	(8) lognother
lngdp	0.381*	0.510*	0.0246	-0.268	0.302	0.449*	0.405**	0.0233
	(0.160)	(0.209)	(0.190)	(0.166)	(0.202)	(0.192)	(0.142)	(0.191)
interestrate	-0.294	-0.318**	-0.0317	-0.287**	-0.192*	-0.461***	-0.285*	-0.228*
	(0.122)	(0.103)	(0.143)	(0.107)	(0.153)	(0.114)	(0.111)	(0.113)
inflation	0.0279	0.123	0.0256	0.0817	-0.0177	0.0536	0.248	0.0977
	(0.129)	(0.150)	(0.141)	(0.146)	(0.152)	(0.160)	(0.147)	(0.148)
unemploymentrate	-0.00265	-0.0211	0.131*	-0.0674	-0.138	-0.0309	0.0985	-0.0105
	(0.0526)	(0.0694)	(0.0629)	(0.0663)	(0.0721)	(0.0699)	(0.0667)	(0.0630)
lognmoenysupply	0.260	0.399	0.699**	0.323	0.143	0.476	-0.0894	0.336
	(0.182)	(0.265)	(0.238)	(0.229)	(0.244)	(0.264)	(0.206)	(0.248)
politicalrisk	1.128*	1.402*	2.328***	0.184	-0.900	-1.945**	0.820	0.270
	(0.535)	(0.604)	(0.570)	(0.587)	(0.651)	(0.682)	(0.634)	(0.588)
capitalgaintax	0.0858***	0.108***	0.121***	0.0504	0.0547	0.0275	0.0721*	0.0779**
	(0.0185)	(0.0258)	(0.0261)	(0.0271)	(0.0286)	(0.0310)	(0.0260)	(0.0297)
avf	0.131***	0.164***	0.175***	0.190***	0.289***	0.159***	0.196***	0.171***
	(0.0262)	(0.0374)	(0.0336)	(0.0366)	(0.0366)	(0.0379)	(0.0331)	(0.0332)
_cons	-0.759	-7.506*	-5.765	6.086*	-0.871	-3.193	-3.994	0.171
	(1.723)	(2.944)	(2.972)	(2.680)	(3.189)	(3.259)	(2.691)	(2.922)
N	345	345	345	345	345	345	328	345
R^2	0.368	0.291	0.338	0.262	0.346	0.265	0.225	0.225

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-8: TWO STAGE LEAST SQUARES (2SLS) INSTRUMENTAL VARIABLES REGRESSION (Default standard errors)

	(1) lntradesale	(2) lognipo	(3) lognwriteoff	(4) lognmezzanine	(5) lnsaletopefir	(6) lognsaletofininst	(7) lognmbo	(8) lndivhermns
logngdp	0.238	-0.00606	-0.605**	-0.734**	-0.0823	-0.165	0.465*	-0.499*
	(1.38)	(0.250)	(0.255)	(0.233)	(0.244)	(0.275)	(0.230)	(-2.05)
interestrate	-0.524***	-0.554**	0.322	-0.521**	-0.548**	-0.813***	-0.526**	-0.512*
	(-3.57)	(0.213)	(0.192)	(0.199)	(0.208)	(0.235)	(0.177)	(-2.47)
inflation	0.126	0.278	-0.0453	0.244	0.200	0.364	0.384*	0.395*
	(1.04)	(0.176)	(0.158)	(0.164)	(0.172)	(0.194)	(0.162)	(1.71)
unemployme~e	0.0670	-0.0938	0.0365	-0.0165	-0.0440	-0.0487	0.154*	0.0410
	(1.14)	(0.0852)	(0.0768)	(0.0794)	(0.0832)	(0.0939)	(0.0774)	(0.0828)
lognmoenys~y	0.316	0.611**	1.023***	-0.435*	0.149	0.616*	-0.206	0.359
	(1.93)	(0.237)	(0.214)	(0.221)	(0.231)	(0.261)	(0.223)	(0.231)
politicalr~k	1.337**	1.575*	2.250***	-0.0720	-1.831	-2.057**	0.627	-0.00348
	(3.02)	(0.641)	(0.214)	(0.597)	(0.626)	(0.703)	(0.623)	(0.623)
capitalgai~x	0.0843***	0.0894***	0.0985***	0.0325	0.0495	0.00772	0.0687**	0.0624*
	(4.41)	(0.0277)	(0.0250)	(0.0258)	(0.0271)	(0.0305)	(0.0265)	(0.0269)
avf	0.114***	0.164***	0.230***	0.186***	0.271***	0.150***	0.182***	0.173***
	(4.02)	(0.0411)	(0.0371)	(0.0383)	(0.0401)	(0.0453)	(0.0383)	(0.0400)
_cons	1.159	-1.500	-0.188	12.51***	2.716	5.194	-3.387	8.151*
	(2.429)	(3.523)	(3.175)	(3.282)	(3.439)	(3.884)	(3.249)	(3.425)
N	337	337	337	337	337	337	320	337
R^2	0.361	0.277	0.302	0.225	0.323	0.220	0.212	0.182
Chi-sq(1)	*8.92846*	*18.964*	*19.2225*	*17.5974*	*10.3953*	*19.933*	*3.8699*	*16.1273*
	(p=0.0115)	*(p=0.0001)*	*(p=0.0001)*	*(p=0.0002)*	*(p= 0.0055)*	*(p=0.0000)*	*(p= 0.1444)*	*(p= 0.0003)*
Wu-Hausman F-test	*4.43604*	*9.71945*	*9.85997*	*8.98047*	*5.18802*	*10.2473*	*1.89131*	*8.19249*
	(p=0.0126)	*(p=0.0001)*	*(p= 0.0001)*	*(p=0.0002)*	*(p= 0.0061)*	*(p=0.0000)*	*(p =0.1526)*	*(p= 0.0003)*
End-Partial R^2	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.5080*	*0.3899*

Minimum eigenvalue statistic	*68.8423*	*68.8423*	*68.8423*	*68.8423*	*68.8423*	*68.8423*	*93.3594*	*68.8423*
Sargan (score) Chi2	*0.070491 (p=0.7906)*	*0.136616 (p=0.7117)*	*0.082126 (p=0.7744)*	*0.00462 (p=0.9829)*	*0.037634 (p=0.8462)*	*0.277515 (p=0.5983)*	*0.352944 (p=0.5525)*	*0.1711 (p=0.6791)*
Basmann Chi2(1)	*0.068413 (p=0.7937)*	*0.132616 (p=0.7157)*	*0.079709 (p=0.7777)*	*0.000448 (p=0.9831)*	*0.36521 (0.8484)*	*0.269502 (p=0.6037)*	*0.342292 (p=0.5585)*	*0.166107 (p=0.6836)*

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-9: ROBUST STANDARD ERRORS 2SLS INSTRUMENTAL VARIABLES REGRESSION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	logntradesale	lognipo	lnwriteoff	lnmezzanine	lnsalepefirm	lnsaletofininst	lognmbo	lndivother
lngdp	0.238	-0.00606	-0.605**	-0.734**	0.0823	-0.165	0.465**	-0.499*
	(0.205)	(0.242)	(0.199)	(0.275)	(0.259)	(0.239)	(0.150)	(-2.03)
interestrate	-0.524**	-0.554**	0.322	-0.521*	-0.548*	-0.813***	-0.526**	-0.512*
	(0.197)	(0.196)	(0.216)	(0.206)	(0.236)	(0.224)	(0.177)	(-2.57)
inflation	0.126	0.278	-0.0453	0.244	0.200	0.364	0.384*	0.395*
	(0.150)	(0.174)	(0.158)	(0.185)	(0.178)	(0.191)	(0.170)	(0.2.42)
unemployme~e	0.0670	0.0938*	-0.0365	-0.0165	-0.0440	-0.0487***	0.154*	0.0410
	(0.0562)	(0.0762)	(0.0714)	(0.0738)	(0.0749)	(0.0833)	(0.0691)	(0.57)
lognmoenys~y	0.316	0.611*	1.023***	0.435	0.149	0.616*	-0.206	0.359
	(0.201)	(0.275)	(0.250)	(0.272)	(0.269)	(0.279)	(0.226)	(1.33)
politicalr~k	1.337*	1.575*	2.250***	0.0720	-0.831	-2.057**	0.627	-0.00348
	(0.564)	(0.640)	(0.611)	(0.620)	(0.693)	(0.736)	(0.674)	(-0.01)
capitalgai~x	0.0843***	0.0894***	0.0985***	0.0325	0.0495	0.00772	0.0687*	0.0624*
	(0.0191)	(0.0260)	(0.0269)	(0.0281)	(0.0285)	(0.0322)	(0.0289)	(2.06)
avf	0.114***	0.164***	0.230***	0.186***	0.271***	0.150***	0.182***	0.173***
	(0.0287)	(0.0377)	(0.0360)	(0.0371)	(0.0388)	(0.0427)	(0.0342)	(0.0330)
_cons	1.159	-1.500	-0.188	12.51***	2.716	5.194	-3.387	8.151*
	(3.360)	(3.551)	(3.392)	(3.555)	(3.889)	(3.955)	(3.039)	(2.28)
N	337	337	337	337	337	337	320	337
R^2	0.361	0.277	0.302	0.225	0.323	0.220	0.212	0.182

Robust Chi-sq(1)	*5.94832 (p=0.0511)*	*13.8299 (p=0.0010)*	*15.1106 (p=0.0005)*	*11.0395 (p=0.0040)*	*8.48131 (p= 0.0144)*	*19.6705 (p=0.0001)*	*2.71182 (p= 0.2577)*	*13.6487 (p= 0.0011)*
Robust F-test	*4.68664 (p=0.009)*	*7.47103 (p=0.0007)*	*4.40072 (p= 0.0130)*	*13.7716 (p=0.0000)*	*6.04493 (p= 0.0026)*	*15.2172 (p=0.0000)*	*2.81559 (p =0.0614)*	*8.75496 (p= 0.0002)*
End-Partial R^2	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.3899*	*0.5080*	*0.3899*
Score Chi (2)	*0.458749 (p=0.4982)*	*0.735041 (p=0.3913)*	*1.41545 (p=0.2342)*	*0.012084 (p=0.9125)*	*0.330745 (p=0.5652)*	*0.389118 (p=0.5328)*	*1.10469 (p=0.2932)*	*0.289395 (p=0.5906)*

7.4.2 Analysis of Results

This section provides both OLS and 2SLS regression results of empirical estimations on the possible influence of macroeconomic factors on venture capital exits in Europe. These methods Pooled OLS and 2SLS by Heckman's (1979) are the econometric approaches used on the possible influence of macroeconomic factors on venture capital exits as described. Using the log of annual value of the various exit types in Europe as the dependent variables, the results of the pooled OLS estimator reported in tables 7-6 & 7-7 are both positive and negative and also show statistical significance and insignificance.

First, the study specifies the 2SLS estimation procedures since it is widely used in the cross section models of differences in financial economics across countries. The coefficients of GDP variable for trade sale and MBO exits do show positive but statistically insignificant influence whereas that of IPO, sale to another private equity firm, sale to financial institution and divestment by other means show negative but statistically insignificant. I however report negative but statistically significant coefficients of GDP for write-off and mezzanine/loan exit types. The coefficients of inflation for trade sale, IPO, mezzanine/loans, sale to another PE firm and sale to financial institution do show positive and also statistically insignificant influence whereas write-off exit reports negative and statistically insignificant influence. MBO and divestment by other means exits on the other hand show positive and statistically significant influence. The coefficients of interest rate for all the exit types with the exception of write-off show negative and statistically significant indicating strong influence of this macroeconomic variable on venture capital exits illiquidity. The coefficients of money supply variable for IPO, write-off and sale to financial institution exit types show positive and statistical significance indicating that the level of money supply in the system positively influence these venture capital exits in Europe whereas that of mezzanine/loans exit shows negative but statistically significant. The coefficients of money supply for trade sale, sale to another PE firm and divestment by other means exit types show positive but statistically insignificant influence whereas MBO exit show negative but statistically insignificant.

The results are being interpreted with caution since MBO exit have overidentification test that reject the null at 5%, and so the instruments are not valid. Comparing the 2SLS

and the OLS coefficients for almost all the exit types one can see that the 2SLS estimation provides higher estimates.

With the introduction of control variables in the model, a positive and statistically significant influence of age of VC industry is reported for all the exit types (see Tables 7-8 and 7-9) suggesting that the longer the existence of VC industry the more likely it will impact the liquidity growth of the market. This is in line with financial literature that confirms the relationship between age of VC firm and growth (Ouimet & Zarutskie, 2014). Capital gains tax as the other control variable also in the model reports positive and statistically significant influence on trade sale, IPO, Write-off, MBO and divestment by other means exit types whereas the coefficients for capital gains tax show positive but statistically insignificant influence on sale to financial institution, sale to another PE firm, and mezzanine/loan exit types. Political risk as the other control variable in the model show some positive and statistical significant influence on trade sale, IPO and write-off whereas it shows negative and statistically significant influence on sale to financial institution. The study report negative and statistically insignificant influence of political risk on mezzanine/loans, sale to another PE firm and divestment by other means exits but report positive and statistically insignificant influence on MBO exit type.

After the reported estimations for the various exit types, the study develops an empirical investigation on the issue of weak instruments following Cameron & Trivedi (2008) and the tests are reported in tables 7-8 and 7-9. Basically the tests have a null hypothesis that the instruments are weak against the alternative that they are strong and the idea is to look at the Robust F statistics for joint significance of instruments and the minimum eigenvalue statistics and compare these with the critical values from Stock & Yogo (2005) tables. A rule of thumb for the F statistics is that if it is greater than 10, then I can say that it is possible to reject the null of weak instruments. Examining table 7-9 it can be observed that the Robust F statistics do not reject the null for MBO exit type only indicating evidence of weak instruments. Looking at the minimum eigenvalue statistics there is evidence of weak instruments for MBO exit type. Summarizing the results for the study of macroeconomic factors influence on VC exits in Europe, it is fair to say that there are some mixed evidences regarding the influence of macroeconomic factors influence on VC exits in Europe. Some of the estimated coefficients are positive and statistically significant and insignificant as well, whereas some are also negative and statistically

significant and insignificant as well but there is evidence that the instruments are not valid for MBO exit type only, whilst they appear valid for the rest of the exit types. GDP, interest rate and money supply do appear to play a direct and significant role in influencing the liquidity or illiquidity of almost all the exit types across the study sample when logGDP and interest rate are modelled as endogenous variables. While Interest rate appears to have negative and significant influence on almost all the exit types, inflation on the other hand appears to have positive and insignificant influence on almost all the exit types. Unemployment rate also appears to have mixed influence on all the exit types whereas money supply has positive insignificant influnce on almost asll the exit types.

7.4.3 Discussion of results

This study attempts to analyze the influence of macroeconomic factors (GDP, unemployment rate, inflation rate, interest rate, money supply) on VC exits in Europe. There has been studies that examine the various exit strategies and its liquid or illiquid nature in both developed and emerging economies. These studies provided the foundation for the development of the hypothesis for this study.

Empirical findings suggest that MBO, IPO and sale to financial institution exits are the exit strategies that its liquidity are influenced most by macroeconomic factors in Europe. It is worth mentioning that, even though most VC firms quest to achieve maximum returns would opt for IPO exit and sometimes trade sale exit as the preferred means of exiting investment in Europe (NVCA 2010), some acquisition deals like MBO and secondary sale to financial institution exits could offer reasonable liquidity as well. Sale to another PE firm and other available exit strategies to European VC funds were all found to be illiquid in relation to macroeconomic factors under study.

The results highlight that at 5% significance level, GDP has a negative influence on write-off, mezzanine/loans and divestment by other means exits whereas it has positive influence on MBO exit. The study however found insignificant positive influence of GDP on trade sale and sale to another PE firm exits whereas it is negative but insignificant influence of GDP on IPO and sale to financial institution exits. The result is suggestive of Espenlaub, Khurshed & Mohamed (2015) findings confirming that GDP slows down the time to exit for IPO. It is however contrary with Yang, (2018) study reporting that

the growth of GDP has the potential to significantly increase the likelihood of an IPO exit. The results run contrary to Groh, von Liechtenstein & Lieser, (2010) and Félix, Pires & Gulamhussen, (2013) claim that GDP significantly relate to venture capital activity.

The results suggest that at 5% significance level, unemployment rate has significant positive influence on IPO and MBO exits whereas it has negative and significant influence on sale to financial institution exit. The study however report positive but insignificant influence of unemployment rate on trade sale and divestment by other means exits but negative and insignificant influence on write-off, mezzanine/loans and sale to another PE exits available to European VC funds. Thurik , Carree , Stel & Audretsch (2008) indicate that unemployment rate may lead to start-up activity and that higher rates of self-employment may indicate increased entrepreneurial activity reducing unemployment in subsequent periods. The results are reflective of Félix, Pires & Gulamhussen, (2013) studies indicating that a higher unemployment rate is likely to be associated with lower expectations for the economy and consequently with lower entrepreneurial activity. But the unemployment rate may influence the incentive to become an entrepreneur in other ways.

Research regarding the influence of interest rate on venture capital activities suggest that the level of interest rates in the economy affects the supply of venture capital negatively (Félix, Pires & Gulamhussen, 2013). An increase in interest rate will lower the supply of funds because a given return on venture capital investment would be affected. The results of the study reflect previous studies suggesting an increased interest rate negatively affect venture capital activity. The study report negative and statistically significant influence of interest rate on trade sale, IPO, mezzanine/loans, sale to another PE firm, sale to financial institution, MBO and divestment by other means exits.

At 5% significance level inflation influence the liquidity of MBO and divestment by other means exits whereas it has positive but insignificant influence on trade sale, IPO, mezzanine/loans, sale to another PE firm and sale to financial institution exits. It however has negative but insignificant influence on write-off exit. There are studies on the impact of inflation on VC exiting activities. Bliss, (1999) studies found the impact of inflation on project returns of venture capitalists in transitional economies. Végh (1992) studies also found evidence that very high rates of inflation, inflation inertia is quite low,

permitting the use of an exchange rate peg to achieve rapid disinflation without significant costs in economic activity. Money supply influence some of the exits available to European VC funds. At 5% significance level, the results showed that IPO, write-off and sale to financial institution exits were significantly and positively influenced by money supply whereas it positively and insignificantly influenced trade sale, mezzanine/loan, sale to another PE firm and divestment by other means exits but has negative and statistically insignificant influence on MBO exit. This is in line with Gilad & Levine (1986) studies reporting that the growth of money supply seems to offer its own inducement opportunities for innovative responses.

Lastly, when the control variables such as age of VC industry, political risk and number of taxes with capital gain tax as proxy are introduced in the model, they all appear consistent throughout the model for the study. The influence of the age of VC industry is clearly positive and statistically significant in all the exit strategies. This is in line with Espenlaub, Khurshed & Mohamed (2015) studies suggesting that the more experienced VC firms (VC age) may have superior skills in adding value to unpromising portfolio companies thus facilitating venture capital exits. Again the number of taxes as measured by capital gain tax is positive and statistically significant for almost all the exit types except mezzanine/loans, sale to another PE firm and sale to financial institution exits. This is contrary to Cumming & MacIntosh, (2003) assertion that tax factors are unimportant in influencing the choice of an exit strategy by a venture capitalist because they all pay a uniform capital gain tax, irrespectively of the exit form used. But consistent with Gompers & Lerner (1998) study that stresses that the capital gains tax rate influences VC/PE activity. Political risk as another control variable was found to influence trade sale, IPO and write-off exit strategies whereas it was found to negatively influence sale to financial institution exit. It however reports positive but insignificant influence of political risk on mezzanine/loans and MBO exits but negative and insignificant influence of sale to financial institution and divestment by other means exits. This is in line with Yong, & Shaker (2012) studies indicating that formal institutions and culture such as political risk could have effect on venture capital actvtity.

Generally, market conditions are strong determinant of venture capital exit (Douglas Cumming & Johan, 2008). Venture capitalist are more likely to exit their investments when the prevailing market conditions are suitable. The study has partial support for the

fact that macroeconomic factors influence the liquidity or illiquidity of VC exits in Europe. A VC firm would take their portfolio firms to the public when the stock market is at its peak and valuation is likely to be higher. Improved stock market conditions facilitate venture capital exit decision making (Black & Gilson, 1998).

7.5 Conclusion

In this study I examine a sample of 22 EU/EEA countries with annual level data over the period of 2000-2017 to assess the influence of macroeconomic factors on VC exits using robust standard errors of Two Stage Least Method (2SLS). The study aims to answer two questions. First, do macroeconomic factors have any influencing role on VC exits in Europe? Second, do exits available to European VC funds have better liquidity over others relative to macroeconomic factors? Considering the results for the various exits available to European VC funds there are mixed evidence regarding the influence of macroeconomic factors on VC exit liquidity and illiquidity as some of the estimated coefficients are negative and statistically significant and the set of instruments are valid. GDP and interest rate appear to play a direct and significant influencing role of the illiquidity of some exits in Europe. The results of money supply, unemployment and inflation suggest that there are mixed evidence of the influencing role of macroeconomic factors on venture capital exits in Europe. The study provides two main contributions to the literature. First, the empirical analysis of macroeconomic factors influencing the liquidity and illiquidity of VC exit has been rigorously examined. The second contribution is related to the fact that the study proposes some additional viable exit options that could be used by European VC funds.

The empirical findings appear to confirm mixed evidence of the influence of macroeconomic factors on the venture capital exits in Europe. However, the influence varies considerably depending on the type of exit. Macroeconomic factors create conditions for VC market liquidity to thrive so as to promote VC exits which is the most important event in VC contractual relationship. The analysis made have demonstrated that whereas money supply, inflation, political risk, capital gains tax and age of VC industry positively influence the liquidity of VC exits, GDP, interest rate, and unemployment rate on the other hand have mixed influence on VC exits in Europe. The

findings have important policy implications as evidence suggest that enhancing these macroeconomic factors can improve the liquidity of the VC market and also facilitate successful exits. Moreover, among the various exits available to European VC investors MBO, IPO and sale to financial institution exits appear to have better liquidity in relation to macroeconomic factors under the study.

In summary, the present study found that GDP shared a positive influence on trade sale, MBO and sale to financial institution exits whereas it had negative influence on IPO, write-off, mezzanine/loans, sale to another PE firm and divestment by other means exits. Unemployment had significant positive influence on IPO and MBO exits, significant negative influence on sale to financial institution exit, insignificant negative influence on write-off, mezzanine/loans and sale to another PE firm exits and insignificant positive influence on trade sale and divestment by other means exits. Interest rate was found to have significant negative influence on trade sale, IPO, mezzanine/loans, sale to another PE firm, sale to financial institution, MBO, divestment by other means exits while it has positive relationship with write-off exit. Inflation was found to have significant positive influence on MBO and divestment by other means exits while it had insignificant positive influence on trade sale, IPO, mezzanine/loans, sale to another PE firm and sale to financial institution exits. Money supply was found to have significant positive influence on IPO, write-off and sale to financial institution exits but was found to have insignificant positive influence on trade sale, mezzanine/loans, sale to another PE firm and divestment by other means exits. No study in European context has examined these variables in relation to VC exits, more so considering a number of European countries as this study has done. This highlights the contribution of the present study to existing body of literature because an attempt to study VC exits in relation to macroeconomic factors in an European context has not been made before.

The overall findings, of this study help academicians, investors, practitioners, and policymakers to have better understanding of macroeconomic factors on VC exits so as to promote and facilitate exits in Europe. In the light of the above, future research could consider analysing further how different country characteristics such as institutional reforms and quality can influence the liquidity of the venture capital market and promote successful exits.

CHAPTER EIGHT

Final Conclusion

8.1 Summary of Results

Based on the four-parted set-up, this thesis has pursued four primary research objectives. The combination of these research objectives has been to increase the understanding of aspects of VC activities in Europe. This purpose has been accomplished through work reported in chapters four of this thesis. All these elements contribute to the overall purpose on different levels. A brief summary of major results are presented below:

Specifically, the first objective sought to establish whether VC financing could be used as innovative alternative financing scheme for businesses during crisis period, the second objective also examined the effect of the financial crisis on geographical sources of VC fundraising and investments activities in Europe so as to establish which of the geopraphical source, investment stage or country was affected the most, while the third objective established whether health sector growth in Europe can be explained by VC investments directed to the sector, and finally the fourth objective analysed the influencing role macroeconomic factors could have on VC exits in Europe. The thesis employed quantitative type of a research design for the study. The study used secondary data in a panel format from 2000 – 2017 and the estimation models were vector error correction model, quantile regression model, generalised method of moments and two-stage least square instrumental variable estimation.

Apart from the first study which was a single country study focusing on Spain, all the remaining studies were multiple country study. The first study focusing on Spain (objective # 1) concludes that the two main sources of VC fundraising are institutional and geographical sources and that the Spanish VC market use diversified sources of funds to support the stock market in financing equity risk capital. The main institutional sources of VC fundraising are financial institutions, pension funds, insurance and non-financial institutions. Geographically, VC funds come from within Spain, Europe, the US and other parts of the world. The external sources of VC funds were increasing after the financial crisis, which indicates an expression of confidence in the Spanish VC industry by

international investors. Based on robust empirical analyses the study found that VC can be used as alternative financing scheme for businesses during crisis period.

Again the second study (objective # 2) concludes that the crisis affected all geographical sources of VC fundraising, however the impact was stronger on the unknown and outside Europe sources of VC fundraising especially in countries with high levels of VC activity. The crisis also affected all types of investment activity with the strongest impact occurring in seed stage investments in countries with high levels of VC activity. The empirical analysis revealed that the impact of the crisis on VC fundraising and investment activities differ among countries in Europe so it would be necessary policy formulation targeted at encouraging VC fundraising and investments activities reflect same.

Furthermore, the third study (objective # 3) sought to ascetain whether health sector growth can be explained by VC investments directed to the health sector. From the study, VC healthcare investments affect health sector growth in Europe but in different directions. Even though life expectancy (proxy for health sector growth) shows increasing trends, VC healthcare investment decrease health sector growth. The study therefore conjecture that VC investors may enjoy returns on investments, but may not decipher into social returns to health sector outcomes. The study makes justification for private-public partnership to support health sector growth since economic growth and development depends on a healthy population. The study recommends more funding support and inducement policy models tailor-made to reap benefits from overall health sector growth. The study finds that venture capital investments does not increase health sector growth contrary to growth theory.

The last study (objective # 4) sought to ascertain the influencing role macroeconomic factors could have on exits available to European VC funds and to identify whether addtional liquid exit options apart from the traditional exit options would be available for European VC investors. This study introduces new evidence that interest rate affects the illiquidity of all the VC exits with the exception of write-off exit strategy which represent a total loss of investment in Europe. Based on data analysis, the study proposes that macroeconomic (except inflation) factors significantly affect the probability of VC exit being liquid or illiquid. These include GDP, interest rate, and money supply. Furthermore, GDP and money supply were found to have mixed influencing role on VC exits in Europe.

Inflation however showed an insignificant effect on VC exits in Europe. The study found additional liquid exit types (namely MBO and sale to financial institution exits) that may be used by European VC investors. The study highlights new facts for enhanced understanding of VC exits in Europe.

8.2 Contribution of the study

8.2.1 Theoretical contributions

It is fair to say that the existing body of literature on the aspects of VC actvtites is rather limited both in scale (number of studies) and scope (range of specific issues addressed) compared to established research areas like corporate finance. The VC research field has had a tradition of often being more empirical than theoretical (Amita, Brandera & Zotta,1998; Mason & Harrison, 1999). The agency theoretical framework (Eisenhardt, 1998) has been the dominating theoretical approach in understanding and explaining the aspects of VC financing relationship (Landstrom, 1993; Osnabrugge, 2000; Clercq & Sapienza, 2001; Yoshikawa, Phan & Linton, 2004; Lahti 2014). However, this framework has also been criticised for being too limited in understanding the complexity of a VC relationship (Landström, 1992; Arthurs & Busenit, 2003). The theoretical contribution of this thesis has been to show how complementary or alternative theories can contribute to an increased understanding of aspects of VC activities in Europe.

• Paper 1 (VC as alternative financing) builds upon mordern potfolio theory of diversification in order to explain the behaviour of investors in a capital market environment. This study intends to encourage the spread of risk by distributing expectation so that the associated risks cancels out by their unique characteristics. The study also contributes to persuasive theoretical approach where VCs persuade investors to commit funds to them for onward investment in startup firms that need financing.

• The main theoretical contribution of paper 2 (diffrences in the impact of crisis on geographical sources of VC fundraising) lies in underscoring the problems inherent in applying traditional financial theories when trying to understand the extent of the impact of the crisis on VC fundraising sources and investment activities in Europe.

• Paper 2 also contributes to a rather limited theoretical attempts to explain how the crisis affected businesses and the variations with respect to the impact on geographical sources and countries.

• Paper 3 (VC investment and health sector growth) applies human capital theory and shows ways to integrate the concept of healthcare investments modules that provide not only a socioeconomic status (SES)-health gradient but more generally an improved framework for the production of health.

• Paper 4 (macroeconomic factors influence on VC exits) contributes to theories on allocation of control in relation to contract theory and exits by Europe VC funds.

8.2.2 Methodological contributions

Methodological contributions are important for a field as important as venture capital. The main methodological contributions of this thesis are:

• Chapter 1 shows how private equity and public equity relate in Spain. All aspects dealt with in the thesis have parts in their methods that have some methodological contributions. Below are the itermised contributions;

• Testing of mordern portfolio theory of diversification in paper 1.

• Use of quantile regression in panel data for venture capital financing studies in paper 2.

• Empirical measurement of VC investments in health sector in paper 3.

• Empirical measurement of macroeconomic factors on VC exits in Europe in paper 4.

8.2.3 Empirical contributions

Venture capital research has undergone tremendous traction though still considered a young research field. Reseacrh in this feild first emerged in the early 1990s (Barry, 1994). Despite considerable research efforts, “there still remains much that is unknown or inadequately understood about this financial instrument (Mason and Harrison, 1999). Venture capital research has been dominated by studies from the U.S however in recent

times apreciable research have been seen coming gradually from Europe. Given that institutional and legal framework/environment go a long way to affect the behaviour of the VC market (Manigart et al., 2000; Cumming and MacIntosh, 2002), the need for empirical contributions becomes necassary. The work reported in this thesis builds upon research work done in Europe, and thus fills in the recognized lack of empirical research on European VC market. Furthermore, a significant portion of the material presented has empirical relevance even in the international context. The study contributes to venture capital debate taking place within Europe. The main empirical contributions can be summarized as follows:

• VC could be used as alternative financing scheme for businesses even during crisis periods in Spain.

• the impact of the crisis on VC fundraising sources and investment activities differ among countries in Europe so policy formulation should reflect the variation.

• the study has provided evidence that VC investments in healthcare does not increase health sector growth and that private sector investments in healthcare fails to remove the skepticisms surrounding public expenditure on health outcomes.

• Some macroeconomic factors (ie GDP and interest rate) have direct influncing role on the illiquidity of VC exits in Europe whereas others (unemployment, money supply etc) have mixed inflencing role on the liquidity of VC exits in Europe. The second contribution is related to the fact that the study proposes some additional viable exit options (MBO and sale to financial instituition exits) that could be used by European VC funds.

8.3 Avenues for future research

Future research may consider the impact of alternative financing on local job creation in Europe and other geographical locations as well as country-level analyses of motivations for VC health investments and sustainability of the Industry.

Again one could pointedly consider analysing further how different country characteristics such as institutional reforms and quality can influence the liquidity of the venture capital market and promote successful exits as well as fundraising activities.

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ASCRI – Spanish Association of Capital, Growth in investment

ENISA – European Union Agency for Network and Information Security

FOND ICO Global –The Instituto de Credito Oficial