Venture Capital, Economic Growth and Innovation

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Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Finance

Eastern Mediterranean University
July 2018
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

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ABSTRACT

The aim of the thesis is to investigate the relationships between the three concepts of venture capital (VC), economic growth, and innovation prospects in the European Union (EU) and European Free Trade Association (EFTA) member states. The research differs significantly from the existing literature in two ways. First, no studies up until now have considered that monetary integration differences exist in the European market. Due to this, interaction variables such as the Eurozone and meeting the European Exchange Rate Mechanism (ERM) criteria to be a Eurozone member are specifically used in Sections 5 and 6. Second, this study uses indexes extensively to represent findings, rather than independent secondary data. The relationships between the three aforementioned concepts are investigated with random effects (RE) and fixed effects (FE) models. Chapter 4 analyzes how primary economic variables affect Europe's VC activity. Section 5 takes into account how post-secondary education, labor, goods, the financial market, market size, and innovation-boosting activities affect VC investments in high-income European states, with a specific focus on the Eurozone, opt-outs, and others. Section 6 investigates human capital and the innovation ecosystem, with the focus again on the Eurozone, opt-outs, and others.

The findings in Section 4 outline how the private sector's institutional quality, infrastructure, and primary education system are equally essential for strengthening VC activity within the continent. In Section 5, the results suggest that the effect is predominantly dependent on the specification tested. The general sample indicates that post-secondary education and innovation-related activities promote the performance

of VC activity, but when the interaction variables for all the models are used, the story differs.

Finally, Section 6 shows that human capital is essential for VC investments. For the whole sample, post-secondary education promotes VC. However, when the Eurozone and ERM interaction variables are applied, those countries show an adverse impact on post-secondary education while primary education and the healthcare system prove otherwise. For the remaining countries, the post-secondary education effect is significant. For the innovation ecosystem, it is found that for the general sample, technological readiness and innovation exert a strengthening impact on VC activity, while for Eurozone and ERM countries, innovation and exports both promote VC investments. Furthermore, technological readiness has a promoting effect on non-ERM countries while exports have harmful effects. Additionally, it is highlighted that sophisticated techniques in business are likely to adversely affect VC investment in Eurozone states.

Keywords: European Union, Venture Capital, Innovation, Eurozone, Economic Growth

ÖZ

Tezin amacı, Avrupa Birliği (AB) ve Avrupa Serbest Ticaret Birliği (EFTA) üye devletlerinde risk sermayesi (VC), ekonomik büyüme ve inovasyon beklentileri arasındaki üçlü ilişkiyi araştırmaktır. Araştırma mevcut literatürden iki şekilde önemli ölçüde farklıdır. İlk olarak, şimdiye kadar yapılan hiçbir çalışma, Avrupa pazarında parasal entegrasyon farklılıklarının var olduğunu düşünmemiştir. Bu nedenle, Avro Bölgesi gibi etkileşim değişkenleri ve Avro Bölgesi üyesi olmak için Avrupa Döviz Kuru Mekanizması (ERM) kriterlerinin karşılanması özellikle 5 ve 6'ncı bölümlerde kullanılmıştır. İkinci olarak, bu çalışma bağımsız ikincil veriler olarak değil, bulguları temsil etmek için geniş kapsamlı indeksler kullanmaktadır. Yukarıda bahsedilen üç kavram arasındaki ilişkiler rastgele etkiler (RE) ve sabit etkiler (FE) modelleri ile incelenmiştir. Bölüm 4, birincil ekonomik değişkenlerin Avrupa'nın VC etkinliğini nasıl etkilediğini analiz etmektedir. Bölüm 5, orta öğretim sonrası eğitim, işçilik, mallar, finans piyasası, pazar büyüklüğü ve inovasyon artırıcı faaliyetlerin, Avrupa Bölgesi'ne özel odaklanarak, yüksek gelirli Avrupa ülkelerindeki VC yatırımlarını nasıl etkilediğini dikkate almaktadır. diğerleri. Bölüm 6, insan sermayesini ve inovasyon ekosistemini, Avro Bölgesi'ne tekrar tekrar odaklanmayı ve diğerlerini araştırıyor.

Bölüm 4'teki bulgular, özel sektörün kurumsal kalitesi, altyapısı ve ilköğretim sisteminin kıtadaki VC faaliyetlerini güçlendirmek için eşit derecede önemli olduğunu ana hatlarıyla ortaya koymaktadır. Bölüm 5'te, sonuçlar, etkinin baskın olarak test edilen spesifikasyona bağlı olduğunu göstermektedir. Genel örnek orta öğretim sonrası eğitim ve inovasyonla ilgili faaliyetlerin VC aktivitesinin performansını

artırdığını, ancak tüm modellerin etkileşim değişkenlerini kullandığında senaryonun farklı olduğunu göstermektedir.

Son olarak, Bölüm 6, insan sermayesinin VC yatırımları için gerekli olduğunu göstermektedir. Tüm örneklem için orta öğretim sonrası eğitim VC'yi desteklemektedir. Ancak, Euro Bölgesi ve ERM etkileşimi değişkenleri uygulandığında, bu ülkeler orta öğretim ve sağlık hizmetleri sistemi aksi yönde etkilediği kanıtlanırken, orta öğretim sonrası eğitim, olumsuz etkilemektedir. Geri kalan ülkeler için ortaöğretim sonrası eğitim etkisi önemlidir. İnovasyon ekosistemi için, genel örneklem için, teknolojik hazırbulunuşluk ve inovasyonun VC faaliyeti üzerinde güçlü bir etki yarattığı, Eurozone ve ERM ülkeleri için ise inovasyon ve ihracatın VC yatırımlarını teşvik ettiği bulunmuştur. Ayrıca, teknolojik hazırlığın ERM dışı ülkeler üzerinde bir etkisi vardır, ihracat ise zararlı etkilere sahiptir. Ek olarak, iş dünyasındaki sofistike tekniklerin Avro Bölgesi ülkelerindeki VC yatırımını olumsuz etkileyebileceği vurgulanmaktadır.

Anahtar Kelimeler: Avrupa birliği, Risk sermayesi, İnovasyon, Euro bölgesi, Ekonomik büyüme

TO MY FAMILY AND MY LOVE

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to my supervisor, Prof. Dr. Salih Katırcıoğlu, for his patience and his passion while motivating me during this slow, challenging path toward completing my dissertation. The support and experience he shared with me during this time have had an actual effect on my progress and analytical approach to cases.

Also, I would like to thank my thesis monitoring committee members, Prof. Dr. Cahit Adaoğlu and Assoc. Prof. Dr. Korhan Gökmenoğlu, for their comments during my monitoring progress. Their remarks were precious and kept me progressing at a much higher pace.

Lastly, I would like to thank my family. Thank you to my parents, Fatma Sargon and Ibrahim Sargon; without your vital financial and emotional support, this was not possible. Also, I would like to thank my sister, my brother-in-law, and my girlfriend for their patience, encouragement, and passion for helping me during this process. Eliz Altuner, Ali Altuner, and Çağla Elektrikçi, you mean a lot to me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATIONS

DCF Discounted Cashflow

EFTA European Free Trade Association

ERISA Employee Retirement Income Security Act

ERM Exchange Rate Mechanism

EU European Union

FDI Foreign Direct Investment

FE Fixed Effects

GDP Gross Domestic Product

IPO Initial Public Offerings

M&A Mergers and Acquisitions

OLS Ordinary Least Square

PE Private Equity

P/E Price to Earnings

PPP Purchasing Power Parity

R&D Research and Development

RE Random Effects

TEA Total Entrepreneurial Activity

UK United Kingdom

US United States of America

VC Venture Capital

Chapter 1

INTRODUCTION

This research aims to investigate the connections between the three concepts of venture capital (VC), economic growth, and innovation. The literature has shown that the interactions between VC involvement, competitiveness, and economic growth are constant. M. E. Porter (1990) outlined that to gain a competitive advantage, every economy must achieve a specific diamond system. He explains that to achieve a competitive advantage, countries must focus on four critical points of the economy. M. E. Porter also clarifies that the competitive advantage comes from the companies, and not the countries themselves.

He further emphasizes that competitiveness is composed of four factors and one auxiliary factor. One factor is the country's resources, such as a necessary infrastructure, and its human capital conditions, capital structure, and innovation adaptation. The second is the organization of the companies in the current market, the type of competition in the market, and the firms' targets. The third factor is whether there are enough industries to support the firms' activities, such as suppliers (in terms of both quality and quantity). Last is whether a demand exists in the market, and if the produced goods and services can be sold in the existing market and abroad. The auxiliary factor is the government's ability to control swift continuation of these processes.

Although M. E. Porter's (1990) general findings apply to all types of firms in the economy, his factors can be applied to the VC industry as well, some of which are more important for VC investments. The findings of previous scholars support this hypothesis. VC investment attractiveness might be related with the institutions, infrastructure, macroeconomic atmosphere, health service and primary education infrastructure, post-secondary education infrastructure, labor markets, goods market, financial development, market size and innovation-led growth (Acemoglu & Finkelstein, 2008; Acemoglu & Johnson, 2007; Armour & Cumming, 2006; Arora, 2001; Audretsch & Acs, 1994; Banerjee & Iyer, 2005; D. E. Bloom & Canning, 2000; Cumming, 2005; Djankov, Ganser, McLiesh, Ramalho, & Shleifer, 2010; Djankov, La Porta, Lopez-de-Silanes, & Shleifer, 2008; Esfahani & Ramírez, 2003; Estrin, Korosteleva, & Mickiewicz, 2013; Fischer, 1993; Gompers & Lerner, 2004; Knack & Keefer, 1995; Mayer, 2002 and many others).

VC originated in the US, but over the years, more and more investors have entered other markets as well. Currently, the European market is one of the most significant VC and private equity (PE) markets in the world. Invest Europe (2018) reported that in 2017, total transactions, including fundraising, investments, and divestments, reached 640 billion euros, and further investigations on this market should be done as such studies are seriously lacking (Bertoni & Tykvová, 2015; Cherif & Gazdar, 2011; Cumming, 2008; Félix et al., 2013; Manigart et al., 2006; Mayer, 2002; Popov & Roosenboom, 2012).

In line with the abovementioned, this research will investigate how indirect economic competitiveness and economic growth variables affect VC investments on the continent of Europe. This thesis relies on index variables more than individual

quantitative variables. Additionally, discriminating between the Eurozone and states that meet the Exchange Rate Mechanism (ERM) criteria is a new insight into the existing literature as presented in Chapters 5 and 6.

The remainder of the thesis will be structured as follows. Chapters 2 and 3 will investigate the related literature on VC, and economic growth and competitiveness, respectively. Chapter 4 will investigate the effect of factor-driven variables on the European VC market. Chapter 5 will investigate efficiency-driven variables and innovation on high-income European states. Finally, Chapter 6 will investigate the human capital index and the innovation ecosystem on high-income European countries, and the last chapter will conclude the thesis.

Chapter 2

LITERATURE REVIEW ON VC

In this section, the literature review will be outlined with consideration of what might be determining factors for VC investments. According to many scholars, VC is the money invested in young companies that provide novel growth prospects (B. S. Black & Gilson, 1998). However, it is not just money that is invested in these young companies; the VC firms also provide the expertise of their management to the investee firms. Thus, VC firms focus on young businesses that have real potential to grow. The main reason behind this is that young companies are not large enough to have excellent internal governance and access to finance is difficult for these investee firms. Therefore, as investors, VC firms provide financing for these types of firms to reach their long-term goals.

It is important to distinguish the differences between VC and PE. VC, in the end, is some stage of PE. VC and PE firms tend to focus on the funding of businesses at different stages. Due to this, they form different types of financing schemes. The funding scheme determines the type of capital invested in a firm, and at the same time, it outlines the expectations of both the investee and the investor. The funds determine in which stage(s) of the VC/PE firms invest. For example, VC funds are invested in three stages: Seed stage, Start-up stage and Later stage venture.

Table 1: The Fund Stage Focus of VC vs. PE Firms

Venture Capital	Private Equity
Early Stage Fund	Growth Fund
Later Stage Fund	Buyout Fund
Balanced Fund	Generalist Fund
-	Mezzanine Fund

As previously outlined, the VC firm, which has established funds at the early stage, is focused on funding at the seed stage and the start-up stage. Private equity also focuses on the later stage venture; and lastly, a balanced fund focuses on all three stages of a business as outlined above.

In the following, the literature review is segmented under subheadings to delineate the VC works of various scholars around the world.

2.1 Information Asymmetry and Investee Determination

VC is one of the necessary types of financing for novel and high-growth potential firms. To receive finances for themselves, entrepreneurs have to show their potential to the environment in which they operate. Information asymmetry is an especially huge issue for these young firms because they have not yet established a reputation within the sector. In the initial stages of every company, firms will try to finance themselves via debt financing. However, this option is not available to these young firms due to their reputation in the market. According to Majluf and Myers (1984), financing via debt can mitigate information asymmetry the most in contrast to the

other funding options. The wise solution for young companies is to obtain financing through VC. VC firms use sophisticated techniques to minimize their investees' information asymmetry, and various success stories about investing in successful young enterprises have been shared. Furthermore, VC companies can research the investee before funding. Foremost scholars have provided a pass-through stage of action while granting VC funding to these new businesses.

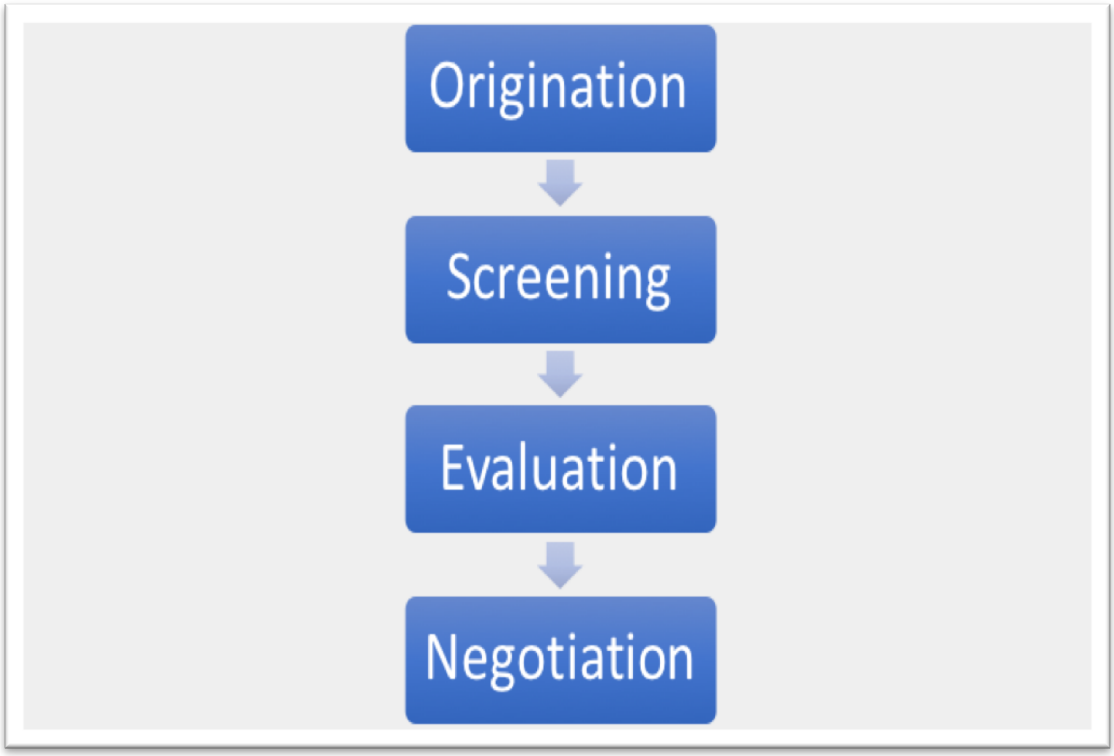

Figure 1: Investment Stages of VC/PE

2.1.1 Origination

The first stage is called origination and is merely identifying possible candidates for investment purposes. Investing in a young firm is particularly problematic; thus, VC firms must decide if the potential candidate is worthy of receiving their investment. Venture capitalists use various techniques to identify potential recipients, one of which is to have the investee prepare a proposal that is sent to the VC firm.

The information received by the VC firms might not grasp their interest very easily. For example, according to Hall and Hofer (1993), VC firms can only inspect these proposals for a moment, which rarely exceeds 10 minutes in total.

To capture the attention of venture capitalists, young companies either have to build a reputation or establish contacts within the sector who are close to the VC companies (Shane & Cable, 2002).

As previously argued, sending a proposal to a venture capitalist cannot guarantee that the young firm will receive the funding. The foremost reason behind this issue is that VC firms are not interested in these proposals due to information asymmetry.[1] This adverse selection problem is created because young firms tend to have more information about their company than the VC firm. To overcome this issue, VC firms either reject the proposal or search for a proposal that has close ties with their network.

Shane and Cable (2002) concluded that to qualify for financing, a young firm must have close interactions in the sector in which they operate. Both Tyebjee and Bruno (1984) and Fried and Hirsch (1994) confirmed that networking has essential perks when attempting to obtain funding from a VC firm. At this stage, venture capitalists might shortlist potential firms to invest in if the received proposals are deemed worthy.

[1] See the works of Akerlof (1970).

2.1.2 Screening

Screening is the second stage whereby VC firms further examine the shortlisted candidates for investment purposes. At this juncture, venture capitalists try to identify unique factors that might be the determinants for deciding whether or not to invest.

Early studies identified leadership and management as the primary determinants for granting VC funding to enterprises. A causality exists between the capabilities of an institution's management and the VC funding received (Robinson, 1987; Stevenson, Muzyka, & Timmons, 1987; Timmons, Muzyka, Stevenson, & Bygrave, 1987; Tyebjee & Bruno, 1984).

Some studies have focused on the prejudices that occur in the selection criteria. Gompers and Lerner (1998) argued that some VC companies follow their counterparts' investment decisions, especially if their portfolios are subject to forecast higher returns. A VC firm's decision may lead to assessing the young firm as insufficient due to herding psychology. At the same time, an overconfident venture capitalist can be a problem. Shepherd and Zacharakis (2001) determined that if a venture capitalist has a well-known reputation and is confident in a specific sector, they tend to use the same strategies to screen their current portfolios. They also concluded that overconfident venture capitalists are likely to stop their information gathering practices once they decide that they already have enough information. In contrast to Shepherd and Zacharis (2001), Busenitz and Barney (1997) argued that overconfident investors are likely to boost the performance of firms. Busenitz and Barney (1997) show that businesspersons' performance might be related to investors' overconfidence.

Human capital is another consideration in venture capitalists' decision-making. While looking at the VC, it is essential to identify the effect of the human capital. The success of the VC funding determination will depend on the governance ability of the VC firm. For example, the expertise of the VC firm in their previous experiences, both in terms of the management of the investee and the funding experience, will present the overconfidence problem as well. Walske and Zacharakis (2009) focused on venture capitalists' previous experience as businesspeople and top management. They argued that there are mixed results on the performance of VC when there is a negative relationship between previous experience as an entrepreneur but a positive relationship with previous experience in top management.

One of the primary determinants for how information is processed by venture capitalists is location. Some scholars have argued that venture capitalists are likely to depend on market-oriented factors. Zacharakis, McMullen, and Shepherd (2007) investigated three countries with different attributes in the economy, and they found that the locations of the venture capitalists were related to how they assessed information. For example, innovation-driven economies, such as the United States (US) and South Korea, focus on market factors, while factor-driven economies, such as China, focus more on human capital information.

2.1.3 Due Diligence

Due diligence is the stage where venture capitalists conduct a more in-depth processing of information. The information collected from various resources, including the entrepreneur who requires the financing, is likely to be implemented at this stage. In contrast to screening, due diligence, as outlined by Smart (1999), is the stage where market conditions are put aside, and a more centralized focus is made to

the assets of the firm. The investee under consideration has various kinds of assets, and these can be classified into two broad headings. The first is tangible assets, such as accounts and patent agreements, which are easy to assess; however, intangible assets are difficult to assess (Brush, Edelman, & Manolova, 2012; Harvey & Lusch, 1995).

Venture capitalists' portfolios are made up of young firms, and generally, the intangible assets are likely to outnumber the tangible assets. The magnitude of intangible assets is especially valid in the early financing stage (Amit, Brander, & Zott, 1998; Harvey & Lusch, 1995; Sohl, 1999). Numerous intangible assets create problems for venture capitalists who are in the process of assessing the firm because they consist of entrepreneurial activities, the business culture, etc. It is not surprising that venture capitalists are likely to face substantial costs with due diligence. In theory, various approaches have been discussed; for example, if the venture capitalist believes that the tradeoff between benefits and information assessment is costly, it is likely to pass on funding that venture (Kaplan & Stromberg, 2001, 2004; Sah & Stiglitz, 1986).

It is a common practice in the finance world to use syndication while financing a transaction, and it is equally utilized in the VC investment process. Venture capitalists are likely to syndicate to increase the mitigation of potential risk by sharing it (Brander, Amit, & Antweiler, 2002; Bygrave, 1987; Cumming, 2006; Hochberg, Ljungqvist, & Lu, 2007; Lerner, 1994, 1995; Manigart et al., 2006; Sorenson & Stuart, 2001). However, the mitigation of risk is not the only benefit of syndication; several researchers have found that syndication enriches performance (Cumming & Dai, 2010; X. Tian, 2011).

2.1.4 Negotiation

Negotiation is when the venture capitalist has gathered the information and is now ready to negotiate with the targeted investee. The negotiation process does not only involve the amount of money that will be granted to the investee but other techniques as well. The main problem for the VC firms is that traditional techniques, such as discounted cash flow (DCF) and price to earnings (P/E) analyses (Seppa & Laamanen, 2001) have been proved useless with investees that are young firms. Instead, firms are likely to value the company according to the market and the information obtained from the financial statements (Armstrong, Davila, & Foster, 2006; Gompers, 1995; Gompers & Lerner, 2000; Hand, 2005; Heughebaert & Manigart, 2012).

The type of venture capitalist is also likely to affect the negotiation process, such as the investor's reputation and the amount of the fund, both of which have a significant impact on whether or not the investee accepts the proposed deal. For example, Cumming and Dai (2010) showed that there is a U-shape relationship with the valuation of the investee and the venture capitalist's funds. Also, investors who are accepted by the venture capitalist based on their reputations are likely to be accepted by the investee (Cable & Shane, 2011; Chemmanur, Krishnan, & Debarshi, 2011; Cumming & Dai, 2010; Shane & Cable, 2002). In addition to this, the experience of the founder also has a significant positive effect, as suggested by Hsu (2007).

The venture capitalist's valuation does not end with the initial investment. There is a certain asymmetry of information (Leland & Pyle, 1977; Shane & Stuart, 2002; Tyebjee & Bruno, 1984). Due to this information asymmetry problem, venture capitalists try to insure themselves as much as possible. Employing more than one type of financing option is likely to perform better for several reasons. For example,

Gilson and Schizer (2003) reported that if the capital gains tax is increasing in a market, it is more likely that the venture capitalist will use convertible stocks for the later payments in contracts. There are some contradictory views on this point, however, as such techniques are used more in the US while other countries are likely to use less convertible securities for contracting purposes (Cumming, 2005). In addition to this, some evidence has indicated that convertible securities are more likely to be used with specific sectors. Cumming (2005) and Gompers and Lerner (2000) agreed that the high technology sectors are likely to use convertible securities more compared to other sectors.

2.2 Link Between VC and Innovation

The pioneering work of the endogenous growth models (Lucas, 1988; Romer, 1986, 1990) has changed how policy is applied in governments of economic growth. Since the proposal of these models, innovation has become one of the critical drivers of economic growth. The breakthroughs in innovation have led to the enormous growth of the VC markets. Although VC markets go back decades, such as the 1960s (Gompers & Lerner, 1998), venture capitalists' selection criteria are now based on certain characteristics, such as small firms with innovation and growth prospects. The main benefit of investing in small firms is that they are likely to be more innovative. In the seminal paper by Acs and Audretsch (1988), they measured if firms' innovation potential differs based on their size. They found that large firms are likely to be less innovative than their smaller counterparts. Consequently, venture capitalists try to limit their investment horizon.

Researchers have endeavored to identify the effect of VC on innovations. As a result, the links between VC and innovation have been documented at the firm, industry, and country levels in various studies, as detailed in the following sections.

2.2.1 Firm-Level Studies on VC Investments on Innovation

In Massachusetts in the US, Kortum and Lerner (2000) studied whether VC-backed firms are more likely to produce patents than non–VC-backed firms. In another study, Hellmann and Puri (2000) divided Silicon Valley companies into two primary samples, "innovators" and "imitators." They found that innovator companies with higher innovation activity are more likely to be VC-backed. Another study conducted by Chemmanur, Krishnan, and Debarshi (2011) used multifactor productivity growth as the innovation variable. The authors found that VC-backed manufacturing firms are likely to outperform non–VC-backed private firms.

Some scholars also tested the patenting of innovation activities at the firm-level. Bertoni, Croce, and D'Adda (2010) researched the innovation output of 351 Italian high-tech startups from 1993 to 2003; notably, they did not conclude that VC-backed firms provided superior performance compared to their non–VC-backed counterparts. Arqué-Castells (2012) also researched the effect of patenting activity on VC-backed enterprises in Spain and found a potential increase in the patenting activity within the country. Lahr and Mina (Lahr & Mina, 2016) showed that there is a significant positive relationship between patenting activity and investment; however, the reverse relationship was either non-significant or negative from 2004 to 2005 in the US and United Kingdom (UK) markets. Furthermore, in a comparison of angel investments with VC, Dutta and Folta (2016)found that patenting activity increased more with VC involvement than angel financing.

The evidence is mixed on whether VC-backed investments are likely to change according to the investment stage. For example, the staging of the investment has been the subject of several studies in the literature. Some studies, such as Hellmann and Puri's (2000) research among Silicon Valley companies, have found that VC-backed investors are more successful bringing their products to the market. However, a few works in the literature do not concur with Hellmann and Puri's (2000) results (Caselli, Gatti, & Perrini, 2009; Engel & Keilbach, 2007). Engel and Keilbach (2007) studied German firms within the period of 1995–1998 and found that the pace of innovation deteriorated after VC involvement. Caselli et al. (2009) showed similar results as Engel and Keilbach (2007) after an analysis of the Italian market during the period of 1995–2004. A more recent study by Chemmanur, Krishnan, and Debarshi (2011) showed that innovative activity is more vital again, but instead of patents, they used total productivity growth as the primary determinant of VC activity.

2.2.2 Industry and Country Level Studies on VC Investments on Innovation

The firm-level measurements on innovation for a specific time period have been the main area of study, but industrial- and country-level data also provide some information on the overall effect of VC investment on innovation. Initial industrial studies (Gompers & Lerner, 2003; Kortum & Lerner, 2000, 2001) conducted in the US tried to explain that VC involvement is likely to increase patenting activity. However, the aforementioned studies concur that patenting activity is not just due to the VC funding awarded to the investee. Katila and Shane (2005) also showed that the patents of enterprises are more likely to be introduced to the market if VC backing is in place. Compared to the initial studies, more recently, Ueda and Hirukawa (2008) showed that the increase in innovation activity might actually be related to the internet boom experienced at the beginning of the early 2000s.

The explanations from earlier studies are in some dispute with enterprise-level researches. More recent results, such as Hirukawa and Ueda's (2011) study within the manufacturing industry, support the view that VC backing promotes innovation activity. Using patent applications and total factor productivity measures, they found a positive effect on patent applications. However, they failed to achieve any significant results with total factor productivity during the period of 1968–2001.

Initial country-level studies were accompanied by industry-level studies (Hirukawa & Ueda, 2011; Kortum & Lerner, 2000, 2001; Ueda & Hirukawa, 2008). Before 2010, the lack of cross-country studies led to studies at the cross-sectional level, which were distorted. Starting with Popov and Roosenboom (2012), cross-country studies captured the attention of many scholars, where the focus was on the manufacturing sector. They tried to measure the effect of VC and the R&D of governments and private companies on patenting activities during the period of 1991–2008, and they found that VC backing was a contributing factor for the innovations.

Faria and Barbosa (2014) investigated the effect of VC on patents across European countries. They found that patents are more likely to increase with VC funding; however, they emphasized that later stage VC investments are more likely to contribute to patents than early stage investments.

2.2.3 Reverse Relationship Between VC and Innovation

Most studies have tried to determine if VC is the driver of innovation. However, various scholars have proven the reverse relationship, since most of the VC firms' main targets are innovative companies.

Gompers (1998) employed the R&D expenditure as a percentage of the GDP and the stock of knowledge as the innovation variables and showed their contributing effect on the growth of VC investment in the US market during the period of 1972-1994. Romain and van Pottelsberghe La Potterie (2004) added another variable, triadic patents, to Gompers' (1998) research and found that all of the potential innovation variables had a significant positive effect on VC activity among 16 OECD countries. Félix, Pires, and Gulamhussen (2013) only employed R&D as a percentage of GDP as an innovation variable among 23 European states from 1998 to 2003, and their findings were in line with previous studies. More recently, Groh and Wallmeroth (2016) extended their sample to 118 countries, which considered 40 countries as high-income countries and the rest were called emerging economies. Again, innovation was found to be a significant driver. Groh and Wallmeroth (2016) showed that the innovativeness index and intellectual property rights are significant drivers. Furthermore, they emphasized that the innovative index is significant for both developed and emerging market economies, but intellectual property rights are only valid for developed economies.

2.3 Other Determinants of VC

Although VC is likely to drive innovation, other variables, such as macroeconomic and entrepreneurial variables, are equally important. We can divide the current literature into two subheadings. Some researchers have directly tried to investigate the determinants of VC (Félix et al., 2013; Gompers & Lerner, 1998; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004), while others have focused on the specific variables that might relate to VC investments .

Scholarly studies that have considered the determinants of VC have divided the determinants into several subheadings, such as macroeconomic setting, entrepreneurial activity within the economy, innovation, and the legal performance of specific countries.

2.3.1 Macroeconomic Settings as the Determinants of VC

Various macroeconomic variables have been considered in the literature, including GDP (Gompers & Lerner, 1998; Jeng & Wells, 2000), GDP growth (Félix et al., 2013; Gompers & Lerner, 1998; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004), interest rates (Félix et al., 2013; Gompers & Lerner, 1998; Romain & van Pottelsberghe de la Potterie, 2004), private pension fund involvement (Gompers & Lerner, 1998; Jeng & Wells, 2000), unemployment (Félix et al., 2013; Groh & Wallmeroth, 2016), and exports (Groh & Wallmeroth, 2016).

Gompers and Lerner (1998) were among the first to investigate the determinants of VC activity. By using a dataset on the US Market from 1961–1992, they concluded that GDP, GDP growth, and pension fund investments significantly and positively contribute to VC activity. They also reported that short-term interest rates have a mixed effect on the US market, with a significant positive relationship with the aggregate level but a significant negative association at the state level. Jeng and Wells (2000) employed various macroeconomic variables to investigate the determinants of VC activity among 21 countries from 1986–1995. In contrast to the previous study by Gompers and Lerner (1998), they were unable to find any significant relationship between GDP and GDP growth rate, but they were able to find a significant positive relationship with private pension fund involvement over time. Jeng and Wells (2000) also reported that private pension fund investment did not have a significant positive

relationship with all the studied countries. Romain and van Pottelsberghe de la Potterie (2004) conducted their research among OECD countries, and their results were in line with Gompers and Lerner (1998) regarding GDP growth and short-term interest rates. Additionally, Romain and van Pottelsberghe de la Potterie (2004) employed long-term interest rates and the interest rate difference, and found a significant positive effect from long-term interest rates but a significant adverse effect from interest rate difference. Félix et al. (2013) also used GDP growth and short-term interest rates as macroeconomic variables with 23 European countries from 1998 to 2003. Their results were in line with Gompers and Lerner (1998) and Romain and van Pottelsberghe de la Potterie (2004), where they found a positive significant contribution to VC activity. In addition to this, Félix et al. (2013) also employed unemployment rate as another macroeconomic variable. Their results indicated that unemployment has a negative significant relationship with VC investment activity. Groh and Wallmeroth (2016) focused more on the entrepreneurial variables, rather than the macroeconomic variables, and added emerging markets to their research. That addition increased the depth of the literature, as emerging markets had not been previously investigated. They employed unemployment rate and exports as macroeconomic environmental effectors. Regarding unemployment, Groh and Wallmeroth (2016) gave some mixed results, which were only partially in line with previous research (Félix et al., 2013). They reported that unemployment only negatively affects VC in emerging markets, but they were unable to find the effect of unemployment on VC among the developed economies. Groh and Wallmeroth (2016) also reported that exports have a significant positive relationship with the developed world but no significant relationship with developing economies.

2.3.2 The Entrepreneurial Variables as the Determinants of the VC Investments

VC is directly affected by entrepreneurial settings in the economy. Scholars in the field have used entrepreneurial variables to determine their effect on VC activity. Significant entrepreneurial variables, such as capital gains tax, the Prudent Man Rule of the Employee Retirement Income Security Act (ERISA), labor market rigidities, initial public offerings (IPO), mergers and acquisitions (M&A), opportunities based on stock markets, corruption, investor protection, and entrepreneurial magnitude, have been employed in the literature (Félix et al., 2013; Gompers & Lerner, 1998; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004).

Gompers and Lerner (1998) showed that capital gains tax, ERISA's Prudent Man Rule, and equity returns are significant variables to explain VC activity in the US market. They outlined that the Prudent Man Rule and equity returns have positive significant effects, whereas capital gains tax represents negative significance.[2] Jeng and Wells (2000) also showed that labor market rigidities and partial IPOs have significant effects. They employed two variables for labor market rigidities where they tested the effect of elasticity of skilled labor and the total labor market. In their cross-country study, Jeng and Wells (2000) found that labor market rigidities have a negative significant effect. In addition, they only found a significant positive effect of IPOs when early-stage VC funds were not taken into account. Romain and van Pottelsberghe de la Potterie (2004) used labor market rigidities and total

[2] Gompers and Lerner (1998) used ERISA's Prudent Man rule where it was represented as a dummy variable of the legislation change in the US, which enabled pension funds to be involved in investment activity with risky investments during the late 1970s (see for US Department of Labor, 2016)

entrepreneurial activity (TEA) as active entrepreneurial variables. They were able to confirm the results of Jeng and Wells (2000) that labor market rigidities have a significant adverse impact, while TEA has a significant positive impact. Félix et al. (2013) showed that IPOs, M&A, market-to-book ratio, TEA index, and stock market capitalization have a significant effect on VC activity within European countries. Félix et al. (2013) showed that IPOs, M&A, and market-to-book have positive impacts whereas stock market growth and TEA have negative impacts on VC investment activity, which contradicts the results of Romain and van Pottelsberghe de la Potterie (2004). Groh and Wallmeroth (2016) used a variety of indexes to show the effect of entrepreneurial activity. They found that if a country performs better regarding investor protection, it is more likely to promote VC activity, and they concluded that emerging economies fail to show significant results with these variables. Furthermore, Groh and Wallmeroth (2016) showed that corruption also affects this variable.

Chapter 3

LITERATURE REVIEW ON THE ECONOMIC GROWTH AND COMPETITIVENESS

This part of the thesis will delve into the economic growth literature. This section is divided into 12 headings, and among some of them, further subheadings are included. The economic growth literature shows that long and tedious research has been ongoing. However, before putting countries in the same basket, their economies must be classified. Every country values the various determinants differently. The World Bank (2016b) classifies countries according to their income level as follows: lower income, lower-middle income, upper-middle income, and high income. As reported at the beginning of this section, all of our sample countries are either upper-middle income or high-income countries. The World Bank's classification must be taken into consideration with the following model, with the idea being to classify countries according to their type of economy and their income level. Rostow (1990) explained the five stages of development; every economy starts with a traditional economy and has a tendency to develop when they satisfy the basic guidelines. First, every economy must satisfy the basic needs of an economy, and without satisfying these requirements, it is not easy to transition to the next stage. Several scholars delineated economies as factor-driven, efficiency-driven, and innovation-driven (Porter, Sachs, & McArthur, 2002; Porter, 1990; Schwab, Porter, & Sachs, 2001). Factor-driven economies tend to focus on the importance of managing natural resources and solely depend on the labor. Following this, efficiency-driven economies provide a good infrastructure for the

basic needs of the economy, thereby improving their ability to compete with other countries regarding the market infrastructure. Finally, innovation-driven economies consider all the previous functions of the factor-driven economies and efficiency-driven economies plus the effect of innovation on the accountability of innovation within businesses and the whole macroeconomic level.

Factor-driven economies must satisfy the necessary requirements of an economy in order to boost entrepreneurial activity. Factor-driven economies consider the basic needs of the economy, such as the institutional infrastructure, necessary infrastructure, health infrastructure, and primary education. Factor-driven economies do not tend to focus on the market infrastructure and innovation techniques. This type of classification can be entirely related to the income levels of the economy. According to research conducted by the World Economic Forum (2016), a factor-driven economy is any country that has a GDP per capita smaller or equal to $2,000. The next sections will review the economic growth literature on institutional frameworks, infrastructures, macroeconomic environments, and health and primary education.

3.1 Institutions

The institutional framework within any country is subject to change according to geography and demographics. For example, Acemoglu (2009) discussed the possible determinants of economic growth and summarized the necessary criteria. Concerning the institutional effect of economic growth, Acemoglu (2009) highlighted that discrepancies between country-level institutional frameworks will lead to different binding legalities with various implementation procedures. The institutional differences that coexist within countries might be due to the ethical and formal organization of each society. It would be unwise to assume that governmental

organizations, such as public institutions, are just lawmakers. In addition to this, there are constant interactions between state institutions and entrepreneurs. So, this outlines that in order for any entrepreneur to establish a businesses in a particular location, they have to ensure that the ethical practices of the public authorities are transparent and that government practices are legally binding. In the following sections, institutions will be divided into two main subsections that construct the institutional framework. Within these subsections, the institutional framework will be further split into subheadings.

3.1.1 Public Institutions

Public institutions are especially significant determinants of productivity within economies. They must supply better frameworks, such as property rights, and maintain the balance between the government institutions' capabilities and the policies applied (Acemoglu, Johnson, & Robinson, 2001; R. E. Hall & Jones, 1999; North & Thomas, 1973; Rodrik, Subramanian, & Trebbi, 2004). In addition to this, governments have to instill some confidence in entrepreneurs, by providing sound policies, acting morally, and ensuring that the current involvements are efficient.

3.1.1.1 Property Rights

There is excellent documentation on property rights as one of the critical determinants of economic growth and competitiveness. Historically, property rights have been a critical issue in every economy. The right to own any property changes from era to era. It is much easier to own property today than it was, for example, in the Middle Ages and even before then. This fact has been documented by several researchers, such as Acemoglu, Johnson, and Robinson (2005), who documented the differences in economic growth during the Middle Ages and the modern eras by taking account of property rights. Another study by Banerjee and Iyer (2005) evaluated the historical

differences of property rights and the institutional effect on the economy in India from the colonial era to the modern era.

Both historical studies and some supporting studies have emphasized the importance of ownership rights within the period in which we currently live. Property rights can be a determining factor for investors who are considering investing in a particular economy. Notably, two studies are particularly significant. De Soto (2000) provided a comparative study of developing nations and developing countries, and showed that more advanced property rights will lead to higher competitiveness, and in the end, higher economic growth prospects. By taking this study as a building block, Lea (2008) investigated the effect of intellectual property rights on developing nations. Both studies reached the consensus that ownership rights is a determining factor for investments coming into the country. The basis of these studies tends to provide a crowding out effect if governments fail to provide well-developed property rights schemes.

Also, another side effect might be an increase in informal economic activities within the economy. If ownership in an economy is weak, this can be directly linked to the inability of individuals or entrepreneurs within the economy to own property, which may result in them switching their operations underground or pursuing other illegal activities within the economy. Knack and Keefer (1995) also supported this view that inefficient property rights create some discouraging effects on the investments of entrepreneurs. They showed that these inhibiting activities might lead to illegal operations, over-taxing, and many other issues that affect the incentive to invest in a particular economy.

3.1.1.2 Security

Another essential measure is for every government to ensure the safety of its citizens living in the country. Insecurity also affects entrepreneurial activities within economies. Any individual interested in establishing a business will consider many factors, including the ability to make a profit, the prospects of their firm's success, as well as the costs they might incur by operating in a specific economy. As mentioned in the previous section, if there are no efficient property rights, a crowding effect may be created for investors, and this holds true when there is not enough security within an economy. For example, Detotto and Otranto (2010) found an adverse effect of crime on the economic growth of an Italian peninsula. Also, some papers have argued that increasing crime rates also increase the illegal employment of individuals within the economy, which can create some distortions related to economic growth (Detotto & Pulina, 2013; Goulas & Zervoyianni, 2013). In line with the findings reported above, Pinotti (2015) also found that the presence of the mafia in southern parts of Italy during certain periods led to a decrease in legal employment and diminished the economic growth in the area.

3.1.1.3 Undue Influence and Corruption

Corruption and undue influence within governmental institutions is of considerable importance. Corruption has a direct effect on the confidence levels of citizens and firms. The World Bank (2016a) defines corruption as follows: "A corrupt practice is the offering, giving, receiving or soliciting, directly or indirectly, anything of value to influence the actions of another party improperly."

From the above definition, we can understand that if a system is corrupt, some specific groups within the system will incur some advantages, resulting in them gaining a

competitive advantage within their respective sectors. Especially, corruption may lead to unfair competition between small investors and large investors. In a corrupt system, it is more likely for large investors to have the ability to use bribery or other corrupt methods, which will lead to a decrease in TEA due to monopolization of the political regime. Two studies have specifically addressed this issue in the literature. For example, Shleifer and Vishny (1993) explained how an economy's political and governmental organizations determine its corruption level. Shleifer and Vishny (1993) asserted that a weak government organization tends to lead to increased corruption, and state-based organizations will be inefficient in protecting the rights of small-time investors within the economy. A much more recent study found that government size affects the corruption level, and smaller governments have an adverse effect on the economy by increasing the corruption standards (Estrin et al., 2013). There is also some evidence that corruption might lead to increased expenditure levels. For example, Mauro (1995) indicated that corrupt government officials might tend to improve the spending levels of specific sectors where bribes and other influences emanate, thus decreasing the effect of human capital. In support of Mauro (1995), Tanzi and Davoodi (1997) illustrated that if funds are diverted into efficiency-lacking sectors by government officials, it is easy to collect illegal payoffs.

Another important aspect that must be taken into account is undue influence. The judiciary environment also affects entrepreneurs' decisions to continue their operations in a specific sector or country. The validity of a court order might be a matter of debate. So, there might be a difference between the rules and bylaws, and the judges' specific decisions in certain cases. In some countries, judges might be in favor of government officials instead of the real standards and regulations while taking

the decisions. The impact of undue influence was outlined in the study by Feld and Voigt (2003) conducted among 66 countries from 1980 to 1998. They found that where the judicial setting is independent, it is more likely that economic growth will be higher.

3.1.2 Private Institutions

In addition to the effect of public institutions, there are other institutions within the entrepreneurial environment. An enterprise does not only interact with public institutions; they also share the same environment with fellow competitors and stakeholders, whose ability to conduct themselves in a responsible and ethical manner also affects the choices of the individual entrepreneur. For example, some supporting studies, such as Cowling (2003), mention that better governance within small firms tends to create more productivity. Meanwhile, an Australian study conducted by the Tian and Twite (2011) found that corporate governance is equally a contributing factor for productivity; however, they also found that if a firm is faced with high competition, corporate governance might not be a contributing factor to the productivity level. Another factor of non-governmental organizations is their moral infrastructure. Corporate ethics constructs a bridge between the two other factors of quality and productivity. If there is a connection between these three components, a firm is more likely to have better prospects and gain competitiveness among its competitors. Stainer and Stainer (1995) explored this trio to find a relationship between these variables that affects competitiveness. Stainer and Stainer (1995) summarized their work by investigating the UK, France, and Germany; those countries were more likely to boost their competitive advantage and growth potential compared to their counterparts.

Another approach was mentioned by Karmann et al. (2016), who suggested that the determination of corruption might be affected by the firm's focus. They concentrated on two types of firm behavior and revealed that risk-focused firms are more likely to be corrupt than innovative, focused firms.

Corporate governance and corporate ethics have been described above, but it would be prudent to emphasize one crucial characteristic of corporate governance and corporate ethics. A well-governed, ethical firm boosts productivity levels, while creating a trust-building effect between the governance of the company and the investors of any individual company. Managers are the agents of shareholders, and they have two potential responsibilities for increasing productivity. They have to promote shareholders' maximization, and they must ensure continued transparency (Jensen, 2010; John & Senbet, 1998).

3.2 Infrastructure

Infrastructure is a significant determinant of the economy. Since ancient times, countries have tried to enrich their infrastructures by investing in various projects. Infrastructures are subject to change as developments in particular sectors come into place. For example, from the ancient era to the Industrial Revolution, transferring goods and services was considered vital for economic soundness. Thus, countries invested more on both the road infrastructure and marine transportation systems.

The evolution of technological advances has led to changes in the infrastructure concept. Previously, infrastructure was only considered in relation to transportation, but after the evolution of technology, connectivity became equally important. This has led to the transfer of information from one place to another within milliseconds.

The following subsections will try to dig into the literature to consider the above mentioned facts.

3.2.1 Transport Infrastructure

Transport infrastructures are of the utmost importance, especially for the transfer of goods and services. Having a sound infrastructure has a significant causal relationship between economic growth and competitiveness. For example, Esfehani and Ramírez (2003) found that there is constant relativity between infrastructures and economic growth. Among 75 countries, they found that better transport infrastructures led to confidence and affected better policies in the future regarding the transportation infrastructure. Another more recent study by Lakshmanan (2011) supports this earlier study, but they also concluded that a good transport infrastructure leads to the development of entrepreneurial activities, trade profits, and even the enhancement of innovation-related activities. The previous two studies considered the long-running relationship between economic growth and transport infrastructures.

However, Achour and Belloumi (2016) argued that transportation infrastructures are not just a long-running phenomenon. They can also affect a country in the short-term as well. Their approach focused more on the small determinants of the environmental economy. They argued that a better infrastructure will lead to mitigating any unwanted externalities due to the transport infrastructure, such as CO2 emissions and energy consumption-related environmental drawbacks. Another interesting study conducted in China mentions another drawback of the transport infrastructure. Ansar et al. (2016) mentioned that countries must be careful when developing the transport infrastructure. Ansar et al. (2016) further highlight that inadequately planned infrastructure projects

may reap short-term benefits, but such projects might have long-term costs, which can ultimately mitigate economic growth in the long-run.

3.2.2 Electricity and Telephony Infrastructure

Both electricity and telephony infrastructures are also of the utmost importance for economic growth, especially when considering the factor-driven economies. Presently, we are pretty much dependent on electricity. Citizens, governments, and enterprises need access to well-supplied and uninterrupted electricity.

Taking that into account, the general consensus is that telephony and power infrastructures boost economic growth in the long run. For example, Canning and Pedroni (2008) found that electricity and telephony infrastructures do not directly affect economic growth, but instead, they provide indirect effects by promoting the possibility of attracting foreign direct investment (FDI) in these sectors. They argued that some countries can potentially overinvest in some specific resources which can, in the end, slow their economic growth. In addition to this, they reported a causal effect between telephony and electricity infrastructures and the GDP.

Canning and Pedroni (2008) further supported the views of previous studies, asserting that specific infrastructure projects might be products of corruption (Knack & Keefer, 1995; Tanzi & Davoodi, 1997).

3.3 Macroeconomic Environment

It has been argued by many scholars if macroeconomic steadiness ensures economic growth. Taking this into account, many scholars have tried to identify if stability at the macroeconomic level provides productivity and growth prospects, which eventually lead to economic growth. The pioneering work of Fischer (1993) showed

that in order to seal macroeconomic stability, sound fiscal policies and controllable inflation are a must. These two variables tend to increase the productivity of any economy. If governments are held accountable for controlling these variables, entrepreneurs' costs will decrease, and they may even be able to increase their entrepreneurial activities within the economy.

Inflation is considered the main contributor to TEA within economies. For example, when the inflation rate is kept stable and at a low level, investors and entrepreneurs can more easily forecast future prices along with the citizens. Keeping inflation under control can give an idea of when to invest and when to save. In the literature, it has been proven that there is a nonlinear relationship between inflation and economic growth. Therefore, maintaining a stable inflation rate is beneficial for economic growth, but after some time, it is not feasible to keep the inflation rate high (Fischer, 1993; Omay & Öznur Kan, 2010; Seleteng, Bittencourt, & van Eyden, 2013).

Another variable that can disturb macroeconomic growth can be classified as governments' abilities to reassure that they are handling their public finances well. If governments fail to build confidence about their finances, this can adversely affect firms' decisions. In this scenario, Pindyck and Solimano (1993) showed that enterprises would not be inclined to take on new projects. Instead, they might take on short-run or medium projects, according to their forecasts.

Also, governments have to account for how they finance their debt. Governments are free to borrow from both residents and foreigners. However, it is a controversial issue if governments choose to fund their debt via aliens. If they do, they might not be able to seize the opportunity to raise more funds through taxation of the aliens. That is, if

governments finance their debt via citizens, it is easy to tax them, but it is not possible to tax individuals who are not residents of the country (Gros, 2013). It is also easy to construct the relationship between interest rates and the debt structure of a government. Excessive borrowing for government finances can lead to an increase in the interest rate, which can create a crowding out effect (Abel, 2017; Ahmed & Miller, 1999; Benzing & Andrews, 2004; Du & Schreger, 2016).

After the 2008 crisis, the so-called credit crunch, the markets were in a deep slump due to their inability to ensure credit for the demanders. This created a downturn for the biggest Western economies that survived through securitization. After 10 years, the markets are slowly recovering. The 2008 crisis led to failures of the banks' organizations and so on. If we take the US as an example, more than 25 big shots failed to continue their operations, from the largest financial institutions, like Lehman Brothers, to the best-known automobile manufacturers, like General Motors (Schaefer, 2011). Although there are many explanations for the crisis, one factor has to be addressed to understand the macroeconomic environment. Sovereign debt ratings are one of the vital factors to consider before investing in a particular country. Before the credit crunch, one of the most crucial mistakes was to manipulate the credit ratings. The manipulation of credit ratings might have been due to various factors, such as miscalculations, deregulation before the crisis, and manipulation of the figures by the agencies (Alp, 2013; Bolton, Freixas, & Shapiro, 2012; Jorion, Shi, & Zhang, 2009; L. J. White, 2010). Therefore, provided that deregulation cost governments and institutions a significant share, regulatory powers within every economy focused more on regulated systems for the credit rating agencies (Alp, 2013).

There is an ongoing debate if investments bound to sovereign credit ratings affect the investments within the country. It is a proven fact that credit agencies establish a ceiling rating for their respective countries. The ceiling is particularly important when taking into account that credit rating agencies rate firms based on their country's credit rating. A few scholars have shown that the three biggest rating agencies—S&P, Moody's, and Fitch—did not allow firms to have higher credit ratings than their country's ratings until the early years of the 21st century. They also showed that until recently, there was not a shred of evidence that enterprises (financial or nonfinancial) could overcome this barrier established by the rating agencies (Almeida, Cunha, Ferreira, & Restrepo, 2017; Borensztein, Cowan, & Valenzuela, 2013). The interconnection of the country ratings with the enterprise ratings can be related to the macroeconomic environments. For instance, Bannier and Hirsch (2010) found that sovereign credit ratings and firm-specific credit ratings play an essential role in economies. Bannier and Hirsch (2010) also reported that credit ratings play a monitoring role for the whole economy based on the differences between countries' and firms' ratings. For example, credit rating downgrades and upgrades can affect the cost of capital of any firm, and in the long run, this can affect interest rates (Almeida et al., 2017; Kisgen, 2006; Kisgen & Strahan, 2010). For example, Almeida et al. (2017) reported that a downgrade that might happen within a country can directly affect the borrowing rate, which can have a macroeconomic result in the long run.

3.4 Health and Primary Education

The determinants previously discussed were concerned with the institutional level of factor-driven economies. This section will discuss human capital. Human capital was first proposed by Schultz (1961, p.1), who defined human capital as: ". . . useful skills and knowledge that is part of a deliberate investment."

Although the concept of human capital has been subject to change due to additional scholarly contributions, it is sufficient to use Schultz's (1961) definition of human capital to explain its contribution to economic growth. Human capital as quoted above does not end with healthy citizens and primary education, but they can be considered the starting points of human capital. In the following sections, connections will be made in terms of how health and primary education can affect economic growth and productivity.

3.4.1 Health

There is a high correlation between a country's income levels and its health infrastructure. A better infrastructure of health organizations within an economy can lead to healthy and happy citizens. With the help of utilities, healthy citizens can be linked with better productivity levels. Healthy citizens are more likely to be more productive (Arora, 2001; Banerjee & Iyer, 2005; D. E. Bloom & Canning, 2000; Mattke, Balakrishnan, Bergamo, & Newberry, 2007). This has been proven in many studies, such as Laxminarayan et al. (2007), who related the effects of malaria on productivity. He described that due to sickness, employees' productivity decreased because of fatigue. Thus, better health infrastructures can prevent adverse outcomes of diseases such as malaria, tuberculosis, and many others. This may not be a concern of middle- and high-income countries where it is unlikely to see many cases related to these diseases. However, productivity levels might decrease in middle- and high-income countries due to potential diseases such as cancer, HIV, and swine flu (Arndt & Lewis, 2000; Bradley et al., 2008).

Another critical factor for productivity might be the relationship between life expectancy and economic growth (An & Jeon, 2006; Cervellati & Sunde, 2011;

Kunze, 2014; Lorentzen, McMillan, & Wacziarg, 2008). There is no consensus in the literature whether life expectancy contributes positively or negatively to economic growth. For example, Acemoglu and Johnson (2007) failed to prove that there is a relationship between economic growth and life expectancy, even though Lorentzen et al. (2008) found a positive relationship between the two variables. In addition, two scholars suggested that the demographic composition might be a determining factor in the relationship between economic growth and life expectancy. There is also some evidence that economic growth and life expectancy has a nonlinear relationship (An & Jeon, 2006; Cervellati & Sunde, 2011; Kunze, 2014). This school of thought has shown that the aging population indirectly affects economic growth, whereby some scholars (An & Jeon, 2006; Kunze, 2014) have reported that the aging population's life expectancy decreases the per capita income. However, Cervellatti and Sunde (2011) counter-argued by maintaining that post-transitional demographics positively contribute to per capita income.

3.4.2 Primary Education

As mentioned in the previous section, education can be a determinant of human capital. The health of individuals and their education work hand-in-hand for determining economic growth. Education is one of the keys to enhancing human capital. Schultz (1961) clarified that to be successful, attaining quality human capital, including the acquisition of useful skills, is vitally important. Education might be considered a building block for advancements within an economy as it gives both breakthroughs in the social environment and economic growth. Education might be related to health simultaneously. For example, a well-advanced healthcare system will lead to higher participation in education. However, this can also be related to the better advancement of human capital.

This section will separate the educational levels of primary, secondary, and higher education, because primary education is the backbone and building block of the future workforce. Primary education sets the foundation for the skills and knowledge acquired by the future workforce of an economy. One school of thought argues that primary education does not have a direct effect; instead, it increases the advancement of secondary schooling, decreases birth rates, and contributes to the educational expenditure for higher education (Barro, 2001b; Keller, 2006). Another approach made by Papageorgiou (2003) is that primary education does not benefit innovation-related activities; instead, it is directly related to the output that a particular economy produces. Furthermore, Papageorgiou (2003) discriminated between the income levels of countries; he reported that there is an inverse relationship between income levels and the ability of primary education to contribute to income levels. He asserted that in high-income countries, it is more likely to have innovation-led economic growth than final output growth.

Although previous scholars have highlighted the potential effect of primary schooling (Barro, 2001b; Keller, 2006; Papageorgiou, 2003), a distinction should be made between the quality of education and the quantity of education. Many scholars have proven that it is not just the level of education attained that matters, but also the amount of quality education. Quality education is one of the keys toward better human capital. There is some evidence that when students receive a quality education, they are more likely to promote the income levels of the country where they reside. In their efforts to identify the determinants of quality education, scholars have used a variety of variables, such as test scores (Hanushek, 2007; Hanushek & Kimko, 2000), ratio of pupils per teacher (Barro, 1996; Benos & Zotou, 2014; Kalaitzidakis, Mamuneas,

Savvides, & Stengos, 2001) and educational expenditure (Abu Nurudeen, 2010; Benos & Zotou, 2014; Lawal & Wahab, 2011). Although these variables were used to assess the quality of education, there has been no consensus on the model used in this study.

3.5 Secondary Education, Tertiary Education, and Training of the Workforce

As outlined in the previous section, most studies have found that primary education is the backbone for the enhancement of human capital. Many studies have concluded that primary education, rather than innovation, is the determinant of the final output (Papageorgiou, 2003). In contrast, innovation-led economic growth must focus on secondary education, tertiary education, and training the workforce. The following section will investigate their relationship with economic growth through a review of related literature.

3.5.1 Secondary Education and Tertiary Education

In this section, the effect of secondary and tertiary education on economic growth will be investigated. There is a mix of explanations of how these two educational levels affect economic growth. It was also mentioned in the previous section that both the quantity and the quality of education matters to promote long-term economic growth, and this also applies to secondary and tertiary education.

Quantity in education can be classified according to some of the variables examined by various scholars in the field, most of whom found that quantity matters. For example, Barro (2001) found that one or more years' of schooling at the secondary level has a contributing effect on economic growth. Barro (2011) later found that achieving additional schooling will promote global output by approximately 2%.

The prospects of a quality education were discussed in the previous section; thus, it is not necessary to repeat these here. However, secondary and tertiary education can be considered to reap short-term benefits compared to primary schooling. Furthermore, it has been proven that if secondary and tertiary education are more advanced, they are more likely to benefit the economy via R&D (Benos & Zotou, 2014; Hanushek, 2007; Papageorgiou, 2003).

3.5.2 Training the Workforce

Lucas (1988) explained the importance of human capital on the long-term targets for economic growth. The literature investigation revealed that this is more likely to be linked with education that is attained at different educational levels. Training the workforce after employment has been shown to be as important for total productivity and long-term growth.

The initial work on the effect of training is based on a study by Becker (1964), who put great emphasis on how training might positively affect the relationship between the employee and the employer. After Becker (1964) proposed the theory, some studies focused on explaining the causality between job-training and wages (Acemoglu, 1997; Acemoglu & Pischke, 1999a, 1999b; Bassanini, Booth, Brunello, De Paola, & Leuven, 2007; Booth, Francesconi, & Zoega, 2003; Pischke, 2001). It is well-known that wages are one of the critical drivers in an economy, and they determine the ability of consumption and investment at the micro and macro levels.

Unfortunately, there is a massive gap in the literature on the effect of training on productivity. Some of the researched phenomena include training vs. worker productivity and wage growth (Bartel, 1995), training vs. workplace regulations and the implementation of IT advancements (S. E. Black & Lynch, 2001), and training

intensity in relation to sociological class differences vs. productivity (Zwick, 2006). However, these prior studies fail to measure the Baumol effect (Baumol & Bowen, 1965). The famous article by Baumol and Bowen (1965) argued that salary increases will not increase productivity, and to increase productivity, firms have to promote productivity-based salary increases. Previous studies (Bartel, 1995; S. E. Black & Lynch, 2001; Zwick, 2006) have failed to address this by configuring a triangular relationship between training, wages, and productivity. Two studies have tried to address the problem via the triangular relationship and touched upon the Baumol effect (Dearden, Reed, & Van Reenen, 2006; Konings & Vanormelingen, 2015). Dearden et al. (2006) made a sector-level approach on British companies, and they found that training has a positive effect on productivity and employees' wages. However, in a study of Belgian companies, Konings and Vanormelingen (2015) discovered that to increase productivity, training intensiveness has to grow at a higher proportion than the average wage increase.

3.6 The Efficiency of the Markets

For the successful continuation of companies, firms must be aware of the market conditions. If the factors of production are used efficiently, this will enable producers to meet the consumers' needs and wants. If the market is inefficient, it is more likely for prices to hit ceilings, making it unlikely for consumers to acquire their needs and wants. For efficient markets, some preconditions must be discussed. First, both domestic and international competition can affect efficiency. Second, the demand conditions within the market is another important determinant; these show the consumption behavior of individual customers. These two concepts will be discussed in detail in the following sections.

3.6.1 Competition

As mentioned previously, competition is one of the factors that contributes to having an efficient market. For example, if there is a lack of competition within the market, market participants may not be inclined to employ factors of production efficiently. The level of competition is subject to change according to the country and the sector. It has been proven that if one sector is more competitive than another, it will likely be more efficient, and at the same time, it is more probable that some advancements will be made in that sector via innovation. Conclusions are mixed regarding how competition affects competitiveness and economic growth. The underlying theory proposed by Aghion and Howitt (1992) argued that without sufficient employment of innovative capacities, economic growth follows a random walk model, while in other cases, innovation capacities increase economic growth. In support of previous studies, Philippe Aghion et al. (2005) found that competition is a contributing factor to the economy via innovation activities within the economy, which also provide support. They also argued that sectors with higher innovative capacities also have increased amounts of patenting, especially the more prominent players within the industry, which supports the views of Scherer (1967). If a country is more likely to aid the economy, it will lead to firms providing some incentives to companies that are liable to reduce costs and also some incentives for some of the innovation-led firms to enter the market (Aghion & Schankerman, 2004; Buccirossi, Ciari, Duso, Spagnolo, & Vitale, 2013; Nickell, 1996). For example, Nickell (1996) supported and showed that measuring competitiveness via economic rent and a large number of competitors in the market will lead to higher potential for total factor productivity enhancements. In addition to this, Buccirossi et al. (2013) found that a successful policy for competition along with a sound infrastructure and regulatory environment will lead to total factor

productivity increasing at a faster pace. Buccirossi et al.'s (2013) policies can be especially related to those that focus on antitrust policies, where they protect the interests of individuals, firms, and governments mutually.

In today's world, both capital mobility and the establishment of new ventures from abroad are not uncommon. So, accessibility of a market to foreigners also affects the local market. The entrance of new participants to the market from other countries might lead to the exit of local participants. If the new entrants arriving from other countries are more efficient, a creative destruction concept will be the result. Phillipe Aghion and Howitt (1992) proposed that the entrance of active participants makes inefficient participants leave the market, and in the end, the market becomes more competitive via innovation. The theory discussed above shows that the market should be more productive, so that efficient firms will try to reduce their costs and increase their activities (Aghion, Bloom, et al., 2005; Aghion & Howitt, 1992; Aghion & Schankerman, 2004; Buccirossi et al., 2013; Nickell, 1996). There is also some evidence that the level of breakeven points also decreases (Chaney & Ossa, 2013; Corsetti, Martin, & Pesenti, 2007; Melitz, 2003; Melitz & Ottaviano, 2008).

Taxation can be considered another factor that might affect competitiveness, productivity, and economic growth. There is some evidence that taxation policies directly affect a company's investments. For example, several authors found that increased corporate taxation will lead to a decrease in competition (Bond & Xing, 2015; Djankov et al., 2010; Faccio & Xu, 2017; Schwellnus & Arnold, 2008). In addition, these taxations also affect big players more than smaller participants (Galindo & Pombo, 2011). The effect of taxation shows a contributing effect and increases competitiveness in the market.

3.6.2 Demand Conditions in the Market

The request for products within the market has significant implications for how the market evolves. How a firm distributes its product and services evolves according to the needs and wants of its customers. Porter (1990) argues that one of the competitiveness measures that businesses have to take into account is the market demand conditions. According to Porter (1990), the demand conditions is the relationship between what the customers demand and if the firms can supply the product within the customers' given specifications. According to Zimmerman and Blythe (2013), various types of marketing orientations are used in the current marketing environment, but customer orientation weighs in as the most efficient. Customer orientation tries to identify customers' needs and wants. Firms utilize customer orientation to sell their products and innovate according to the demand conditions (Cambra-Fierro, Melero, & Sese, 2015; Deshpande, Farley, & Webster, 1993; Narver & Slater, 1990; M. E. Porter, 1980; Slater & Narver, 2000). It has been proven that a customer-oriented approach is more likely to be more profitable compared to other approaches. For example, a few scholars tested the entrepreneurial-oriented marketing approach against the customer-oriented approach, and concerning profitability, the results showed that firms using the entrepreneurial-oriented approach performed poorly compared to the customer-oriented approach (Narver & Slater, 1990; Slater & Narver, 2000).

It is an underlying economic theory that demand and price have an inverse relationship. This does not always apply due to the utility the customers may get for paying the higher price. Buyer sophistication has to be addressed as well for competitiveness and economic growth. The ability to address buyers' needs and wants

is essential for any profit-seeking firm. Every firm must discern if potential customers are interested in paying more for a complementary product. Porter (2000) used the tourism sector to measure the effect of complementary goods. He showed that accommodation proximity to a tourist attraction and the price charged may be used as an example of a complementary product. If tourists want to stay close to tourist attractions, they may be willing to pay more for the additional convenience. Furthermore, within the context of complementary marketing, several studies reported that certain factors must be taken into account, such as changes in buyers' trends and location (Delgado, Porter, & Stern, 2010; M. E. Porter, 2000; Tallman, Jenkins, Henry, & Pinch, 2004).

3.7 The Efficiency of the Labor Markets

Considerable technological advancements have occurred since the Industrial Revolution, but the ability of labor cannot be downgraded. The effectiveness of labor must be addressed very carefully, as there are long-term implications with how the labor market operates. If the labor market is efficient, it is likely to promote the competitiveness of any country and industry. In the following subsections, labor market efficiency and the related literature will be divided into two subheadings, the efficiency of the labor market and the ability to efficiently use the labor.

3.7.1 The Flexibility of Labor Market

It has been proven that an efficient labor market will lead to competitiveness via productivity. At the same time, the flexibility of the labor market has significant implications for the economy. For example, implementing employment protection policies might affect productivity. Lazear (1990) was the initial contributor on the subject of how dismissal costs affect productivity, especially in the short run. Other scholars, including Autor, Kerr, and Kugler (2007), supported this view; they

concluded that in the short-run, which is depicted as a couple of years in their study, firms switch from labor-intensive production to capital-intensive production when new employment protection is in place. Acemoglu and Finkelstein (2008) had similar findings in their study of the healthcare sector in the US. They found that when employment protection policies are put in place, a change in labor costs is likely to occur, but capital costs are likely to stay the same. This conclusion of fixed capital costs and increased labor costs is in line with the findings of Hopenhayn and Rogerson (1993), who stated that dismissal policies decrease the level of unemployment along with consumption and productivity.

Another effect of a flexible labor market is the ability to switch from one sector to another. Economies are evolving; thus, there might be a need to switch from one industry to another. For several decades, it was possible to see that technological advancements led to higher needs in the technology sector. Firms who failed to keep up with technological advancements had to decrease employment in order to catch up with the other sectors. If dismissal costs are high, firms will choose to invest in areas where the technological pace is slow (Gust & Marquez, 2004; Samaniego, 2006). This shows that inflexible labor markets focus more on the low-tech sectors, and the countries with flexible labor markets are likely to concentrate on the high-tech sectors.

3.7.2 Using Human Capital Efficiently

The previous section discussed the findings of scholars on how the labor market and the associated employment protection rights affect productivity in terms of the costs that they place on firms. The payment schedule that firms use is also effective for capturing the full potential of the human capital that exists within the economy. Performance pay and productivity have been long documented by many scholars. For

example, Booth and Frank (1999) found that by employing performance-related pay increases, wages increased by approximately 7.5% on average, but the awards for productivity surpassed the costs of the salaries for the firms. At the same time, Lazear (2000) found that employing performance-based pay schedules increased the productivity of the current employees and tempted other individuals to apply to work for the company in the future. More recent studies have found that pay boosted productivity and increased employment (Gielen, Kerkhofs, & van Ours, 2009; O'Halloran, 2012); however, some studies have argued that performance-related pay is not always a production enhancement (Cornelissen, Heywood, & Jirjahn, 2011; McCausland, Pouliakas, & Theodossiou, 2005). McCausland et al. (2005) argued that performance-related pay does not boost job satisfaction for every employee, and they emphasized that high earners get more satisfaction than low earners. Similarly, Cornelissen et al. (2011) found that if an employee has high-risk responsibilities and is paid highly, the performance-related pay will boost production levels more than an employee who has low earnings and a high-risk job.

In addition to the rewards that can be used as productivity enhancers, there is a distinction made among employees, which is called the dualities between the employed. In the job market, contracting employees can occur via two methods. The first method is via temporary contracts and the second is to hire employees on a permanent basis. This duality has been proven to have an effect on the motivation of the workers (Boeri, 2011; Boeri & Garibaldi, 2007; Dolado, Ortigueira, & Stucchi, 2012; Kahn, 2010). In addition, it may lead to decreased investments in training programs for workers (Dolado et al., 2012).

3.8 The Efficiency of Financial Markets

The efficiency of financial markets has been discussed with leading scholars in the field, but one scholar particularly stands out. Fama (1970, 1991) showed that market efficiency is the reflection of publicly available information. According to Fama (1970), there are three types of efficient markets: weak, semi-strong, and strong.[3] An efficient market does not just make information available to the public; it also ensures that the market is free from bubbles, it enables mitigation, such as hedging nearly useless investments, and it allows companies to concentrate their investments on guaranteed returns. Fama (1991) asserted that the testability of efficient markets is only possible by testing the joint market hypothesis. Testing the joint market hypothesis involves checking the expected return phenomena via the asset pricing models. Fama (1991) proposed testing the joint market hypothesis because market anomalies exist in the market, and the pricing models generally try to capture these anomalies (Carhart, 1997; Fama & French, 1993, 2015; Roll, 1977).

The main aim here is to test the efficiency of the capital markets, since efficiency is a contributing factor for economic growth. If we examine the efficient markets around the world, we can see that market efficiency, development, and economic growth are interrelated. It is more likely that a financially developed market will lead to market efficiency, and ultimately, the expected outcome will be economic growth. Although the propositions are that financial development is one driver of economic growth, this did not come into focus until the late 20th century (Goldsmith, 1959; King & Levine, 1993; Lucas, 1988; Rajan & Zingales, 1998; Schumpeter, 1934). Initially, studies tried

[3] For more information on market efficiency, refer to Fama (1970)

to make a causal relationship between financial intermediaries and economic growth. For example, Lucas (1988) explored if the demand for changes in the sector caused economic growth via financial development; however, more recent studies have argued that financial development is not just due to changes in the real sector. King and Levine (1993) showed that financial development has a substantial effect on economic growth. Following King and Levine (1993), Rajan and Zingales (1998) showed that labor-intensive industries are not likely to be found in financially developed markets; instead, financially developed markets are more likely to constitute capital-intensive industries.

Financial development can be considered the availability of credit and the liquidity of the markets. According to the Levine (2005), financial development leads to productivity of the economy in four ways. First, developed markets along with the constituted financial stability lead to a risk to be pooled together. This means that investors' risk aversion rates are subject to change according to the level of financial development. In weak financial markets, investors are likely to invest in projects that are less risky, but in sound, developed financial markets, investors are inclined to invest in projects with higher risks and magnitude. As a simple theory, it is a well-known concept that if the risk premium is high enough to take the risk, it is more likely that investors will invest in those projects. This also depends on the capital availability of the projects. For example, Acemoglu and Zilibotti (1997) outlined that higher investment projects are likely to require a vast amount of capital, and if the capital is not available in the financial environment, no investor will willingly accept the project. Financially developed markets, for example, will affect diversification. If the financial market is sound and developed, credit will be more available to each type of investor.

This primarily applies to individuals with small investment criterion and horizon. For example, small investors are more likely to be considered at-risk than large investors within a market, but at the same time, the fact remains that compared to large investors, small investors are more likely to be more productive and innovative (Berger & Udell, 1998; Fredriksson & Moro, 2014; King & Levine, 1993).

Second, financial intermediaries in a market enable better allocation of resources to individual and institutional investors via decreased information asymmetries. For example, Morales (2003) showed that if the capital intensity of the market is efficient, labor productivity will be enhanced via investments in the innovative projects undertaken. This indeed enables investors to quickly find information about the innovative projects, decreasing their time and effort to search for suitable investment options. Actually, financially developed countries enable negative externalities, such as reducing the capital injected into the economy via financial intermediaries (Aghion, Howitt, & Mayer-Foulkes, 2005; Morales, 2003).

Third, individual investors are unlikely to forge as good a relationship as big financial intermediaries, especially those focused on the long-term rapport (Bencivenga & Smith, 1991). This deep rapport enables firms that borrowed the money to use it efficiently and wisely.

Fourth, the financial system provides a payment system for the whole economy that is as efficient as possible. With the main focus on the banking sector, financial development has to provide easy and swift transactions with cheap transaction costs for firms (Bencivenga, Smith, & Starr, 1995; Greenwood & Smith, 1997).

The availability of sound and stable financial institutions within a country is essential. This is not only pertinent for economic growth in the long run, but also for the length of recovery periods. If the pace of financial development is not controlled, it may lead to adverse effects such as a financial crisis. Rousseau and Wachtel (2011) argued that if financial development is not adequately controlled, it may lead to a financial crisis with a long recovery period. Furthermore, the economy will do worse than in the previous economic boom even though the recovery period has ended. Advancements in the financial sector can create problems for the economy, so constant supervision and regulation are needed.

Excessive financial risk can lead to a crisis when we take into account excessive lending within the economy. Arcand, Berkes, and Panizza (2015) showed the vanishing effect of development in the financial sector, and they argued that if the credit lending is equal to or surpasses the value of the GDP, it is likely to promote a financial crisis. The regulatory environment is subject to affecting the potential crisis. Beck Loayza, and Levine (2000) argued that the regulatory environment and its associated practices can both increase financial development. However, if they are not correctly specified, it may lead to further crises due to information asymmetry. Beck (2012) also argued that the financial markets are not stable due to the credit crunch still making a regulatory environment to control the total size of financial markets, but current policies are failing to control the intermediation role of the financial markets. According to Beck (2012), this might lead to volatility of the markets in the long run and even cause a financial crisis in the future. The growth of the financial sector also affects the relationships between the government and the largest financial institutions. For example, Johnson (2009) showed that prior to the credit crunch, the financial

sector became too powerful in the US, controlling how politics were conducted during that era.

3.9 Adaption of the Technology

Employing technology for business is not uncommon in today's world. Since the Industrial Revolution, we have seen more and more firms employing technological practices for the economy.

Generally, there are two types of technological adoption practices. First, the firms either bring the technological practices from other countries or transfer them from other sectors (Bozeman, 2000; Ruffin & Jones, 2007). Second, the spillover effect of technology adoption can be considered, which is the effect of foreign investments on technological adoption (Blalock & Gertler, 2008; Borensztein, De Gregorio, & Lee, 1998).

The implementation of technology depends on the technological standards available in the country where the local businesses reside. The differences between the innovative capacities of countries will determine the businesses' adoption strategies. Parente and Prescott (1994) recognized some discrepancies in how countries use expert knowledge. They asserted that the barriers faced by firms, such as policies implemented by the government, investment horizon, and magnitude, can determine how local firms will adopt technology. A more recent study conducted by Comin and Hobijn (2010) argued that technology adoption generally depends on the investment in human capital and income per capita. If the investment in human capital is likely to be high with higher incomes, the economy is likely to innovate more, which will lead to these countries adopting technologies faster. The adoption policies of other

countries are likely to follow the innovative countries, but Comin and Hobijn (2010) have also shown that the adoption of technology in developing countries is subject to their policies to promote human capital and the per capita income.

Technological adoption is affected by FDI through three types of spillover. One spillover is contagion, where there is an interrelationship between the local and foreign companies presented within a sector. There are two types of contagion effect, known as vertical and horizontal. The vertical contagion effect is technology that is inherited by a local supplier from a foreign firm with whom it is conducting business (Alfaro & Rodriguez-Clare, 2004; Rodríguez-Clare, 1996). This effect is actually an indirect effect because they are not really entering the market physically, but the technology is inherited by the local supplier via a long-term business partner. The second type of contagion effect is horizontal integration, which affects the competitiveness of the sector. This is where the firm establishes its operations directly within the economy, and the adopted technology is either mimicked or transferred to the other operating firms within the sector (Findlay, 1978; Wang & Blomström, 1992). This is especially important in sectors where the control of the sector solely depends on the ability to adopt technology. If the FDI entering the market is superior in terms of technology, the existing participants in the market are likely to replicate the technological practices of the FDI. This closes the gap of their technological differences in the long run, which will eventually be transferred to the labor-training practices of the FDI (Glass & Saggi, 1998, 2002; Poole, 2013).

3.10 Market Size

Since ancient times, trade has existed. In addition, an excavation of ancient cities will reveal artifacts that were used for trade. After the Second World War, the concept of

globalization evolved. How to define globalization has been long debated. Al-Rodhan and Stoudmann (2006, p.2) defined it as follows: "Globalization is a process that encompasses the causes, course, and consequences of transnational and transcultural integration of human and non-human activities."

The above definition also encompasses cultural integration, but that would be beyond the scope of this thesis, so it will not be addressed. Globalization eliminates borders between countries both economically and non-economically. From an economical perspective, this statement means that there are no political borders for the markets. Thus, market size in this section constitutes both local and foreign markets.

Market size has some potential effects on productivity via economy of scale and room for invention. If a country has a market that is large enough, it will lead to specialization. This can be related to an economy of scale, where an economy's production capacity is likely to increase. If the market is big enough and there are enough taxpayers, this will lead to a decrease in the cost of production. For example, Alesina, Ardagna, Nicoletti, and Schiantarelli (2005) argued that with enough taxpayers, the prices of public goods per capita tend to be lower. Alesina et al. (2005) also showed that in a large market, firms can increase their production with fewer inputs and more efficient capital investments. This can be implemented until the marginal cost of production exceeds the average cost of production, where the system has to consider the tradeoff between efficiency and the size of the market.

In addition to economies of scale, it can be argued that the innovative capacities of an economy might be correlated with market size. For example, a historical study conducted by Romer (1996) showed that mass production continued to increase in the

US during the first half of the 19th century, and he argued that due to the massive size of the market, innovative capacities increased more compared to other countries. Romer (1990) also showed that larger markets tend to provide positive externalities, such as enhancements to human capital and positive technological contributions in economies of scale.

3.11 Business Sophistication

It is essential that firms operate within sophisticated networks with advanced business techniques. This is particularly important when we consider the financial integrity of an economy. Previously, it was discussed that different stages of economies are likely to have different focusses. Business sophistication will likely have an effect on productivity if the economy is efficient in the markets. The analyses of previous practitioners showed that business sophistication plays a substantial indirect effect on economic growth (Nicholas Bloom & Reenen, 2007; Nick Bloom, Sadun, & Van Reenen, 2012; Delgado, Ketels, Porter, & Stern, 2012; Delgado, Porter, & Ketels, 1999). Several studies also found that countries with similar business environments are likely to have a diverse selection of business practices, and these are likely to change according to the industry, state, and the competitive environment (Nicholas Bloom & Reenen, 2007; Boschma, 2004; Bristow, 2010).

Porter (1990) showed that critical determinants for an economy's competitiveness is the sophistication and capabilities of its businesses. In an economy, every business must compete with fellow competitors, and there are constant interactions with the stakeholders.

Business strategies evolved after the famous book by Porter, in which he stressed that in order to promote a successful strategy, enterprises have to take care of their customers by providing better products and services (M. E. Porter, 1985). In this book, Porter (1985) introduced the well-known value chain model, which is the foundation of a successful strategy. The value chain model summarizes that for firms to be efficient and competitive, they must implement five main activities and four supporting activities. The value chain model has made essential contributions to a new model called Porter's five forces model (M. E. Porter, 1979, 2008). In the five forces model, Porter (2008) discusses five crucial determinants of a successful strategy. The five forces model says that in order to promote a successful strategy, a business must focus on the competitors that can threaten the firm as well as the logistic lines and the customers' perceptions. The competition variables and customer perceptions were investigated in the previous section. The following two sections will summarize two key facets that are particularly important for any firm. First are the operational strategies and business networks.

3.11.1 Supplier Network and Supporting Industries

Every firm's ability to build a network within the industry is vitally important for its profit-making and survival. Firms should not only focus on how to sell a product, but also on how to draw down costs through economical production. Consequently, interactions with suppliers and supporting networks are vitally important to guarantee these prospects. The quality and the quantity of the suppliers within a country can promote the abilities of any firm to increase its productivity in both the short- and long-term.

As M. E. Porter (2008) described, businesses continually interact with suppliers; thus, considering the quality of suppliers within a specific region is essential. Many scholars in the field have introduced supplier quality variables as critical determinants of total quality management (Ahire & Ravichandran, 2001; Baird, Hu, & Reeve, 2011; Kaynak, 2003; Kaynak & Hartley, 2008; L. J. Porter & Parker, 1993; Sousa & Voss, 2002; Tari, Molina, & Castejon, 2007; Yusof & Aspinwall, 2000). Supplier quality can affect businesses in various ways. M. E. Porter (1980) suggested that if supplier quality is not maintained within the economy, sales within the economy will likely decrease. Supplier quality has been studied from various perspectives. For example, supplier quality has an effect on quality management practices. With a sample of 407 companies within the US and Canada, Ahire and Ravichandran (2001) found that supplier quality management had a direct impact on external cooperation and learning, but they could not find a significant relationship on internal cooperation within the businesses. A later study by Kaynak (2003) extended the findings of Ahire and Ravichandran (2001) and found that supplier quality management is one of the essential drivers of total quality management. In this study of more than 214 US manufacturing and service companies, Kaynak (2003) found that supplier quality management positively contributes to product design, process management, and inventory control. In line with Kaynak (2003), Zu, Fredendall, and Douglas (2008) found a significant relationship between supplier quality management and the individual variables of product design and production. More recent studies also employed innovation-led total quality management practices, which had not been emphasized by previous scholars in the field. For example, some recent studies that focused on innovation-led total quality management also showed that supplier

management has a positive and significant effect on product design and production practices (Kim, Kumar, & Kumar, 2012; Mokhtar & Yusof, 2010).

M. E. Porter (2008) emphasized that suppliers' bargaining power is essential for the implementation of high productivity. Supplier quality is a significant driver, but it is equally important to check the number of suppliers within a region to obtain multiple quotations for goods and services. M. E. Porter (2008) advised that the negotiating power of the supplier should not be eliminated.

The availability of local and international suppliers is another concern, both of which have their pros and cons. For example, Kramer and Porter (2011) maintained that a business can choose to buy from international suppliers, but this bears extra costs for the company, such as transaction costs and costs due to exchange rate differences. Kramer and Porter (2011) also suggested that if a supplier becomes stronger within an industry, this may lead to it having full control over the prices within the sector. A company that produces any good or service constantly interacts with firms, and firms' accessibility to several suppliers has a substantial effect on the service they provide.

The locality of any firm has a substantial effect on productivity. For supplier firms, the questions to be asked are if they are numerous enough, if they have the necessary qualifications, where they are located, and how interconnected they are. M. E. Porter (2000) asserted that clusters are particularly crucial for firms. He defined clusters as ". . . geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions."

Clusters do not only create a marketplace for specific industries; they also provide a concentration of suppliers. Using the example of the Californian Grape Industry, M. E. Porter (2000) provided an insight into clusters as including suppliers within the industry and the supporting industries, such as university collaborations with existing clusters. Previous scholars have pointed out that some regions promote more economic growth than others. As M. E. Porter (2003) found, significant clusters are likely to promote economic growth via wages, increased employment, and increased patenting activity. Another perspective is the causal approach as a result of the availability of clusters. According to M. E. Porter (2003), clusters are more likely to be present in areas where there is substantial entrepreneurial activity, and innovation centers, such as universities, are likely to be linked with businesses operating in these cluster zones.

3.11.2 Operational and Strategical Sophistication of the Firms

Supplier quality and the supporting industries are likely to affect the productivity of firms operating in the sector. Along with this, firms' operational and strategic sophistication are equally crucial for productivity. The strategic connections between productivity and economic growth are explained in M. E. Porter's well-known books (1979, 1985, 1990).

M. E. Porter (1990) explained that firm formation, strategy, and rivalry between firms are essential determinants of a nation's competitive advantage. Porter maintained that there is no such thing as a perfect system on a global basis, and that a compatible managerial system depends on the location and the company's industry. He enriched this idea by showing what is classically crucial for a firm, outlining that companies should have the ability to discriminate between strategy and operational effectiveness

(M. E. Porter, 1996). M. E. Porter (1996) delineated that operational effectiveness is a firm's ability to efficiently transform the inputs to outputs, while strategy is a firm's ability to employ and create a mix of activities to perform. Each firm has to rely on a strategy for better empowerment of their ability to perform and be more competitive. In order to deploy a strategy, M. E. Porter (2008) recommended that firms build a model by taking into consideration five competitive forces. Two forces outlined by M. E. Porter (2008) are the existence of rivals and the ability of new entrants, both of which lead to increased competition and are potentially vital when drawing a conclusion on the strategy to implement.

3.12 Innovation as an Economic Driver

Romer (1990) suggested that implementing a new idea in a business has the potential to effect productivity levels for any given state. With the introduction of endogenous models, some researchers tried to explain the relationship between technology and productivity by using R&D along with patents to show its effect on any state (Aghion & Howitt, 1992, 1998; Dinopoulos & Thompson, 1998; Romer, 1990). Innovation does not just evolve through firms' R&D progress; it is also obtained by firms. The literature shows that non-R&D techniques, such as work procedures, technical learning networks, organizational structure, personal accounting, branding, and FDI spillover effects from logical networks (Blalock & Gertler, 2008; Borensztein et al., 1998; Comin & Mulani, 2006; Olsson, Wadell, Odenrick, & Bergendahl, 2010), can lead to innovation.

Innovation at the firm-level is likely to have two specific effects on the company. First of all, a company's vision and adoption of a new technology is likely to affect its reach. The term "disruptive innovation," first proposed by Christensen (2011), indicates that

an innovation opens the way for a company to reach new markets, which were not available before, for both the production and consumption of new goods. At the same time, these innovations are likely to affect how open the community is to accepting them and absorbing potentially new ideas (Acemoglu, Akcigit, & Celik, 2014). Second, innovation leads to firms' better access to finances, such as VC, private capital, and other forms of financing options (Félix et al., 2013; Gompers & Lerner, 1998; Groh & Wallmeroth, 2016; Romain & van Pottelsberghe de la Potterie, 2004).

Chapter 4

TESTING THE EFFECT OF THE FACTOR DRIVEN ECONOMY VARIABLES ON THE VC ACTIVITY IN EUROPE

4.1 Introduction

The venture capitalists' decision to invest in a particular company is a tedious task, which was outlined in the literature review section. Although these companies consider the firm's performance, other characteristics and economic competitiveness variables have significant implications for venture capitalists. This approach can be characterized as the systematic and individual risk analysis of the individual companies.

Factor-driven economies have been somewhat overlooked by scholars. While assessing VC, the literature tends to omit the fundamental impact factors. The existing literature summarizes the determinants in three primary fields: the effect of macroeconomic conditions existing in the economy, the effect of entrepreneurial variables, and finally, innovation-related variables (Cherif & Gazdar, 2011; Félix et al., 2013; Gompers & Lerner, 1998; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004).

Factor-driven economies tend to focus more on institutional quality (both public and private), infrastructure and the underlying macroeconomic conditions, and the necessary primary education infrastructure. These variables can also be considered the final market variables due to their non-interaction with the markets. The impact of institutional quality on VC has been tested by various scholars, who mutually agree that legal structures and rights given to minority shareholders are likely to determine the attractiveness of VC (Armour & Cumming, 2006; Djankov et al., 2008; Groh & Wallmeroth, 2016). Unfortunately, the impact of infrastructure and the necessary macroeconomic conditions have not been sufficiently tested to our knowledge. Therefore, in this research, infrastructure, necessary macroeconomic conditions, and primary education variables on VC investments are tested. In addition, the existing VC literature and the macroeconomic competitiveness researches are combined in this study.

Primary education is the backbone of the future workforce. As the quantity and quality of the future workforce increases, innovation will increase as well (Barro, 2001a, 2001b; Keller, 2006; Papageorgiou, 2003). However, better infrastructures increase economic growth (Esfahani & Ramírez, 2003) and entrepreneurial activity (Lakshmanan, 2011), and mitigate unwanted externalities, such as CO2 (Canning & Pedroni, 2008). Lastly, the basic macroeconomic environment has an indirect effect on the economy, which can be related to VC investments. A stable inflation rate will increase entrepreneurial activity (Fischer, 1993; Omay & Öznur Kan, 2010; Seleteng et al., 2013), but excessive government debts can increase interest rates in the long run and harm entrepreneurial activity (Abel, 2017; Ahmed & Miller, 1999; Benzing &

Andrews, 2004; Du & Schreger, 2016), while credit ratings can disturb the borrowing rates (Almeida et al., 2017; Bannier & Hirsch, 2010).

The remainder of this study, using the aggregated indexes, attempts to explain the effect of institutional conditions, infrastructure quality, macroeconomic environment, and primary education on VC.

4.2 Sample Selection, Data, and Methodology

This part will be divided into subsections that describe the sample selection, data, and methodology. The first subsection discusses how the countries used in this research were selected and the horizon of the study. The second subsection describes which variables were used and how they were obtained, and the last part discusses the methodology of the study.

4.2.1 Sample Selection

This study takes into account 19 European countries that are members of the European Union (EU) and European Free Trade Association (EFTA). The initial sample consisted of 32 European countries, 28 of which are EU members (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the UK) and four are EFTA members (Iceland, Norway, Principality of Liechtenstein, and Switzerland). After the initial sample was constructed, the following selection criteria were followed for the final sample.

The first criterion to be selected for the sample was that VC data was readily available in the Invest Europe database, formerly known as the European Private Equity &

Venture Capital Association (EVCA). Invest Europe reports VC and private equity data for individual countries and aggregate groups of countries. In the sample selection, countries' VC investments had to be reported individually in the Invest Europe database. Countries not reported on at all in the database included Cyprus, Iceland, Malta, and Liechtenstein. Some of the initial sample countries were also reported as aggregate groups, such as the Baltic countries (Estonia, Latvia, and Lithuania) and other Central East European countries (Croatia, Slovakia, Slovenia, and other out of sample countries). Omitting these countries from the sample left a sample of 20 EU countries (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Spain Sweden and the UK) and two EFTA countries (Norway and Switzerland).

Second, the sample countries were classified according to their income groups, as provided by the World Bank (2016c). Among the sample countries, by the year 2015, all but two countries (Bulgaria and Romania) were high-income countries. A check was also conducted to ensure the countries' income classifications were done during the sample period. Except for one country (Hungary), the income classification of the other countries remained stable during the period of 2007–2015. To eliminate outlier bias, Bulgaria, Hungary, and Romania were excluded from our sample.

The final sample consisted of 17 EU members (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden, and the UK) and two EFTA members (Norway and Switzerland).

4.2.2 Data

The data used in this part of the thesis was obtained from various resources. Aggregate VC data was obtained from the Invest Europe database (2016), and to check the validity of the data, it was cross-checked against the data from the Eurostat database (2016). For the independent variables, this research relied on the variables reported in the World Economic Forum's Executive Opinion Survey (Browne, Di Batista, Geiger, & Verin, 2016). The Executive Opinion Survey is an aggregated index to measure the competitiveness of the economies. In this section, the following variables were employed to measure competitiveness. The factor-driven economies were measured in five main categories, where institutions, the infrastructure of the overall economy, the macroeconomic environment, and primary education were the fundamental determinants. For the institutional framework, the aggregate level institutional quality variable (INSTITUTIONS) was used, and the institutions were divided into two sublevels: Private (PRIVATE) and Governmental Organizations (PUBLIC). To represent the overall infrastructures of the economies, the Infrastructure variable (INFRASTRUCTURE) was used to capture the quality of the transportation infrastructures, and the telecommunication and electricity infrastructures within each economy. Finally, the quality and quantity of primary education was employed by using the underlined variable (PRIMARY).

4.2.3 Methodology

For the data, which spans VC investments from 2007 to 2015, the random effects (RE) model is used to represent this study's findings. The RE model is likely to have superior performance while conducting this research compared to the fixed effects (FE) model. RE captures the country-specific effect on the regression, whereas FE models are lacking in that sense. Also, RE models have only been occasionally

employed in the literature to measure VC investment determinants (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016). In addition to this, using generalized least squares models provides more efficient results when the small sample size, in which the number of observations is smaller than the cross sections, is taken into account (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004). Following these assumptions, the following criteria will be considered, and the results of both the RE and FE models will be reported, as quoted in Equations 1 and 2. The expected result is that the RE model will be more appropriate for this study. However, to support this fact, this study will employ the robust Hausman test to prove the significance of either model.

$$Y_{it} = \beta_0 + \beta_1 x_{it1} + \cdots + \beta_k x_{itk} + \beta_k DUMMYYEAR + a_i + u_i \quad (1)$$

In addition to employing variables, time effects is also employed in this study. Employing time FE also allows for elimination of the cross-section problem, and additionally, the model is estimated using serial correlation, which might be present while estimating the model (Arellano, 2003; H. White, 1980; Wooldridge, 2013).

Before testing the relevance of each model, cross-sectional dependence testing will be performed. It has been proven by many researchers that cross-sectional dependence testing does not produce valid results for micro-panel studies where the micro-panels have more than 200 cross sections (Baltagi, 2012; Baltagi, Feng, & Kao, 2012; Pesaran, 2004; Pesaran, Ullah, & Yamagata, 2008). Due to the problems with cross-sectional dependence testing for the variables, this study relies on regression cross-sectional dependence. Four tests can be used to test regression cross-sectional dependence, such as the Breusch-Pagan (1980) LM test, the Pesaran (2004) CD test,

the Friedman (1937) CD test, and Frees (1995). This thesis will rely on the Pesaran (2004) CD test due to several drawbacks with the other tests. First of all, the Breusch-Pagan (1980) LM test outlined that their test is only valid when the number of periods used in the panel data study is larger than the number of cross sections, whereas our study proves otherwise. When Frees (1937) and Friedman (1995) were taken into account, these tests use semiparametric components where it depends on both parametric and semiparametric components, and they fail to bring out robust results due to their inability to handle unbalanced samples.

The Pesaran (2004) CD test considers the following case that if the number of cross sections is larger than the number of periods, it will promote better results in contrast to the Breusch-Pagan (1980) LM test. The Breusch-Pagan LM test calculates the statistics as follows:

$$CD_{LM} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \qquad (2)$$

where T, N, $\hat{\rho}_{ij}^2$ is the number of periods, is the number of cross sections and residual correlations due to usage of the squared correlations of the residual, there is a tendency to prove that the Breusch-Pagan (1980) LM test will fail to reject the null hypothesis because of the high possibility that calculated statistics will fall into the acceptance region. For an obvious remedy, Pesaran (2004) proposes the following model where statistics are estimated as:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \qquad (3)$$

instead of using the squared version of the residual correlations, Pesaran (2004) uses the serial correlations that will not decrease the power of the test if $N \geq T$. The

following equation shows the null and alternative hypothesis for the Pesaran (2004) CD test:

$$H_o: u_{it} = \sigma_i \epsilon_{it} \quad (4)$$

$$H_A: u_{it} \neq \sigma_i \epsilon_{it} \quad (5)$$

where H_o, H_A represents cross-sectional dependence and cross-sectional independence, respectively.

Although the RE model is more efficiently used in the literature, for consistency, the RE model should also be tested here to see if it is the more efficient model. First of all, we use the Hausman (1978) test:

$$\chi^2 = (\beta_{na} - \beta_{nb})'(V_{na} - V_{nb})^{-1}(\beta_{na} - \beta_{nb}) \quad (6)$$

where β_{na}, β_{n2}, V_{na}, and V_{na} is the coefficient vector of the dependable estimator, the coefficient vector of the efficient estimator, the covariance matrix of the dependable estimator, and the covariance matrix of the dependable estimator, respectively. During the process of estimating the models, the model will be clustered according to the countries using the bootstrapped version of the model. The covariance of the matrix will be bootstrapped to eliminate the effect of biased standard errors that might be due to the presence of heteroscedasticity (Cameron & Trivedi, 2005, p. 717). If the null hypothesis of the Hausman test (1978) fails to be rejected, the RE model will prove to be appropriate.

Following the Hausman (1978) test, the RE model will also be tested to see if it can be represented by the simple pooled ordinary least squares (OLS) estimator. In order to check this possibility, an augmented version of the Breusch-Pagan (1980) LM test

will be used, which was modified by Baltagi and Li (1990), in which they incorporated the possibility to conduct the test in the presence of unbalanced panel data. The model is shown as follows:

$$y_{it} = \alpha + x_{it}\beta + v_i \tag{7}$$

Baltagi and Li (1990) can be calculated as:

$$\lambda_{LM} = \begin{cases} \frac{nT}{2(T-1)}\left\{\frac{\sum_i(\sum_t v_{it})^2}{\sum_i\sum_t v_{it}^2} - 1\right\}^2, & \hat{\sigma}_u^2 \geq 0 \\ 0, & \hat{\sigma}_u^2 \leq 0 \end{cases} \tag{8}$$

The null hypothesis for this statistics test is to test the variance of the error component of the model. If the variance is different from zero, this proves that the RE model is appropriate, and in the case of a reverse scenario, the model must be estimated with the pooled OLS model.

4.3 Empirical Results

Three models are presented in this section. Before we proceed to the models, Table 2 below reports the descriptives and the associated correlation coefficients of the variables used in this section of the study. It can be observed that the evidence is mixed in terms of the high and low correlations among the variables. The high correlations occur between institutional index variables such as INSTITUTIONS, PUBLIC, and PRIVATE. In addition to these, all of the variables document that there is a mid-range positive correlation between them.

Looking at the descriptives, it can be observed that balanced panel data is used with 171 observations, and their associated mean, standard deviation, minimum and maximum are also reported in Table 2. Figure 2 also reports the line plots across time

that are employed in this study. The differences between VC investment activity and the variables used in this study come from the normalized values of the independent variables. All of the countries used in this section provided some stationary processes, as illustrated in Figure 2. The variations of some of the independent variables can be linked to the 2008 crisis, and the businesses view occurred due to limitations of the credit crunch.

Although this study reported both the RE and FE models for estimation purposes, the pooled OLS model was also tested to see if it is appropriate for estimation purposes. The diagnostics tests reported below will help to determine which model is most appropriate for forecasting the effect of factor-based economics variables in the determination of VC activity.

Tables 3 and 4 report the basic diagnostics and model-based diagnostics tests, respectively. First, the variables in this study were tested for autocorrelation. The test employed was the first-order serial correlation test for linear panel models, proposed by the Wooldridge (2003).

Table 2: Correlation Coefficients and Descriptives for Factor Driven Variables

Correlation Coefficients

	1	2	3	4	5	6	7
VENMARKET	1.000						
INSTITUTIONS INDEX	0.684	1.000					
PUBLIC INSTITUTION INDEX	0.667	0.998	1.000				
PRIVATE INSTITUTION INDEX	0.722	0.976	0.960	1.000			
INFRASTRUCTURE INDEX	0.383	0.579	0.589	0.531	1.000		
MACROECONOMIC CONDITION INDEX	0.364	0.663	0.657	0.664	0.234	1.000	
PRIMARY EDUCATION INDEX	0.352	0.526	0.532	0.491	0.399	0.214	1.000

Descriptive Statistics

	Number of Observations	Mean	Std. Dev.	Minimum	Maximum
VENMARKET	171	0.031	0.022	0.000	0.116
INSTITUTIONS INDEX	171	5.032	0.819	3.369	6.182
PUBLIC INSTITUTION INDEX	171	4.971	0.848	3.225	6.177
PRIVATE INSITUTION INDEX	171	5.216	0.756	3.495	6.353
INFRASTRUCTURE INDEX	171	5.444	0.745	2.770	6.650
MACROECONOMIC CONDITION INDEX	171	5.097	0.843	2.421	6.835
PRIMARY EDUCATION INDEX	171	5.713	0.448	4.744	6.874

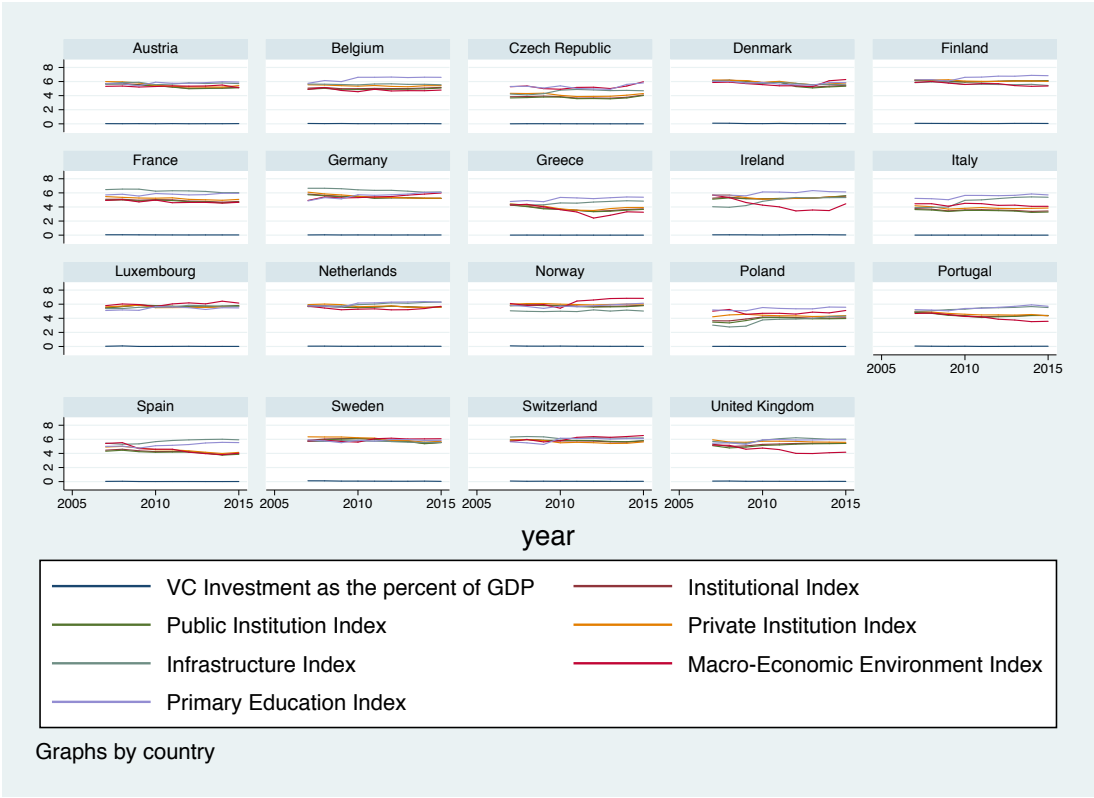

Figure 2: Factor Driven Enhancer Panel Plots

It was not possible to reject the null hypothesis mutually for all models, even for a 10% significance level. The results obtained from Wooldridge (2002) guarantee that the models will be feasible to estimate with either the RE or FE model. In addition to this, poolability was tested by applying the Breusch-Pagan (1980) LM test.

The results obtained from the Breusch-Pagan (1980) LM test indicates that all of the models rejected the hypothesis that they can be estimated using the pooled OLS model, which is not reported in this study. All models rejected the hypothesis of poolability at the 1% level, confirming that the RE model is superior to the pooled OLS model.

Table 3: AR(1) and Hausman Test

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	2.578	0.1258	2.589	0.1250	2.599	0.1243
Hausman Test	8.89	0.7120	8.68	0.7302	7.97	0.7873

The decision to reject poolability enables choosing either the RE or the FE model. In order to test which model is more efficient, the bootstrapped Hausman test was applied. The robust Hausman test could not be rejected for any of the models proposed.

Table 4: Diagnostic Tests for the Related Models

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	119.68	-	126.02	-	108.66	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.385	-1.454	-1.377	-1.477	-1.473	-1.356
Pesaran CD Test p-value	1.8339	1.8541	1.8316	1.8604	1.8593	1.8250

Lastly, the models were checked for cross-sectional dependency. According to the Pesaran (2004) CD test, the null hypothesis could not be rejected for any of the models, including the RE and FE models.

Table 5 reports on both the RE and FE models for models 1–3. The first model tries to estimate the relationships between institutional, infrastructure, macroeconomic environment, and primary education indexes as the drivers of VC activity within Europe.

Table 5 reports on the six models that were estimated during this study. The FE models were not the superior models in this study, but they are also reported for comparison purposes. The first model takes into consideration the effect of institutional, infrastructure, macroeconomic conditions, and the primary education, while public institution quality and private institution quality were tested for models 2 and 3, respectively.

Looking at the first model, it can be seen that among the independent variables employed, the institutional index, infrastructure, and the primary education index positively contributed to VC investment activity in Europe. Taking a closer look at the significant variables, it can be seen that the institutional index provides a beta coefficient of 0.00865, which is significant at the 10% level. This clearly shows that venture capitalists consider the institutional quality of the portfolio country when investing in that country. At the same time, this independent variable must be approached with caution because the institutional index constitutes both public and private institutions within an economy. For this reason, in models 2 and 3, the public and private institutional index is considered as assessing if venture capitalists' decisions are also significant among public and private firms. At the same time, the infrastructure variable is also significant at the 5% level with an associated beta coefficient of 0.00606. This shows that the infrastructure quality of the particular portfolio economy will also positively contribute to VC investment activity. Lastly, the primary education index is also positively significant at the 5% level with a beta coefficient 0.0134, meaning that economies' investments in human capital will lead to increased VC activity in the long run. If the human capital investment is successful,

it will directly affect the secondary and higher education prospects of the economy, which can further impact the innovativeness of the firms.

The second model switches the institutional index variable with the public institution index where it investigates if the significance achieved by the institutional index is due to the public institutions or not. The estimated model shows that the model only provides significant results for the infrastructure and primary education index variable, but not for the rest of the variables that are employed in the model. Utilizing the public institution index variable in the second model has also promoted the following effect for the model. First, public institutions are not significant for the model, but mutually, they provide an increase in the beta coefficients of the primary and infrastructure indexes. Although the significance levels for both the infrastructure and primary education indexes stay same, an increase of 0.0037 and 0.0003 increase at the primary education is observed. This model proves the explanation that primary education and infrastructure are significant positive contributors to VC activity in high-income countries in Europe.

The last model also adds to the assessment of private institutions. Compared to the previous model, the model suggests that private institutions have a significant positive effect on VC activity, providing a 0.0110 beta coefficient and a probability value of less than 5%. The other significant variables followed the prior models, where it was highlighted that infrastructure and primary education are also driving forces, but private institutions make a significant contribution to the overall economy as reported in model 3.

Table 5: Regression Output for Factor-Driven Variables

	Model 1 (RE)	Model 1 (FE)	Model 2 (RE)	Model 2 (FE)	Model 3 (RE)	Model 3 (FE)
Institutional Index	0.00865*	-0.00475				
	(1.67)	(-0.53)				
Public Institution Index			0.00725	-0.00421		
			(1.44)	(-0.53)		
Private Institution Index					0.0110**	-0.00430
					(2.24)	(-0.43)
Infrastructure Index	0.00606**	0.00839*	0.00643**	0.00837*	0.00603**	0.00787*
	(2.13)	(2.04)	(2.14)	(2.04)	(2.45)	(2.04)
Macro-Economic Environment Index	-0.00393	-0.00538	-0.00361	-0.00545	-0.00448	-0.00533
	(-1.25)	(-1.52)	(-1.16)	(-1.56)	(-1.46)	(-1.45)
Primary Education Index	0.0134**	0.0132*	0.0137**	0.0134*	0.0137**	0.0124*
	(2.32)	(2.04)	(2.36)	(2.02)	(2.33)	(1.98)
Constant	-0.0815***	-0.0155	-0.0787***	-0.0191	-0.0950***	-0.00983
	(-3.04)	(-0.35)	(-2.86)	(-0.46)	(-3.49)	(-0.17)
Observations	171	171	171	171	171	171
R^2	0.597	0.203	0.584	0.219	0.611	0.217
χ^2 Stat.	206.017		224.911		152.190	
F-Stat.		15.476		14.578		19.322
Prob.	0.000	0.000	0.000	0.000	0.000	0.000

t statistics in parentheses
All the models are clustered according to sample countries
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.4 Conclusion

This section of the thesis has attempted to construct a relationship between factor-driven economy variables and VC investment activity in 19 high-income countries. Using balanced panel data from 2007 to 2015, this thesis documented that the institutional index, private institution index, infrastructure index, and primary education index contributed positively and significantly while the public institution index, macroeconomic conditions index did not make a significant contribution to VC investments in high-income countries in Europe. Furthermore, as mentioned earlier, the significance of the institutional index depends on both the public and private institutions index. By employing those two indexes in the two models, it can be

concluded that public institutions are not essential determinants for venture capitalists, but the accountability and the ethical basis of private institutions are.

The institutional focus depicted in this study is partially in line with the previous literature. For example, Groh and Walmeroth (2016) showed that investor protection has a significant effect on VC investments. In this study, the investor protection index contributed positively to the private institution index, which was one of the variables used to construct the underlying index. In addition to this finding, our private institution index considers both corporations' moral attitudes toward their counterparts and the accountability of firms. This indicates that accountability also plays a vital role in private institutions and the economy, as previously suggested by scholars (Djankov et al., 2008; Groh & Wallmeroth, 2016; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998).

This study also documented that VC activity is affected by the infrastructure quality of the overall economy. The effect of the infrastructure on VC activity in Europe is exceedingly significant, a finding which can be related with the findings of Lakshmanan (2011), who illustrated that better infrastructures will lead to increases in entrepreneurial activity within the economy. Achour and Belloumi (2016) also clarified that governments' investments in infrastructures will increase countries' overall trade value.

Finally, a significant positive relationship between primary education and VC activity was documented in this study. This result was somewhat expected, where better primary education infrastructures boosted investment activity. Although it has not been documented in previous VC literature, some economics literature supports our

findings. Papageorgiou (2003) asserted that higher income countries target increased innovation while investing in primary education leads to further education at the secondary and tertiary levels. This is apparently related to the innovation industry, whereby venture capitalists target innovative companies, a relationship that is also documented in this study.

This study was aimed at explaining the effect of factor-driven variables where economic prosperity begins. Although Porter (1990) maintains that these variables are least important for economic growth and countries' competitiveness, they cannot be overlooked, as they are the building blocks of every individual economy. Previous literature on the determinants of VC investments has not put too much emphasis on these variables. For future research, the findings suggest that infrastructure and primary education must be investigated more deeply.

Chapter 5

TESTING THE EFFECT OF EFFICIENCY-DRIVEN ECONOMY, INNOVATION, AND SOPHISTICATION ON VC ACTIVITY IN EUROPE

5.1 Introduction

VC and private equity is a growing industry, especially for Europe. According to Invest Europe (2018), over 20 years (1997–2017), private equity investments increased by 630%, and according to 2017 figures, VC investments accounted for 8.9% of 71.4 billion US dollar worth of investments throughout Europe. This upward trend of investment activity requires investigation.

Europe has been undergoing a change, especially after the credit crunch, which also affected the VC industry. During the period of 2007–2010, there was a decreasing trend of investment during this period in the European private equity market (Invest Europe, 2018). Investigated results show that common GDP growth was attributed to (Félix et al., 2013; Gompers & Lerner, 1998; Romain & van Pottelsberghe de la Potterie, 2004) labor market rigidities, such as unemployment, labor force education level, and the employment protection index (Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004), opportunities due to changes in the stock market such as market capitalization, M&A (Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000), and opportunities

received via technological advancements in technology (Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004).

This gives the idea that higher education, the labor market, the goods market, the financial market, market size, and innovation-related variables have essential specifications for the VC market in Europe. One of the most recent studies assessing the determinants of VC for a massive panel of countries discriminated countries according to their lending groups (Groh & Wallmeroth, 2016). In this part of the study, high-income countries within Europe will be assessed according to different markets. In addition to this, this study will test if being a Eurozone member or a country that satisfies the ERM criteria has any impact on the current VC determinants.

5.2 Theoretical Framework

For the data of VC investments spanning 2007–2015, the RE model is used to represent this study's findings. The RE model is expected to have superior performance while conducting this research compared to the FE model. RE captures the country-specific effect on the regression where FE models are lacking in that sense. Also, RE models have only been occasionally employed in the literature to measure VC investment determinants (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016).

In addition to this, using generalized least squares models provides more efficient results when the small sample size, in which the number of observations is smaller than the cross sections, is taken into account (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie,

2004). Following these assumptions, the following criteria will be taken into account, and the results of both the RE and FE models will be reported. The expected result is that the RE model will be more appropriate for this study. However, to support this fact, this study will employ the robust Hausman test to prove the significance of either model.

The analysis that is pursued in this study includes 61 models. To conserve space, the general models for three cases of regression are reported. For the models reported from Equations 1 to 3, the number of independent variables is subject to change and reporting via this technique will save space.

$$VENMARKET = \beta_0 + \beta_1 X_{it1} + \cdots + B_{\mathrm{k}} \mathrm{X}_{\mathrm{itk}} + \beta_3 DUMMY_{YEAR} + a_i + u_{it} \qquad (1)$$

Equation 1 above reports the general model without the interaction effects. VENMARKET is the dependent variable representing the VC investments reported as a percentage of GDP. X represents the independent variable used in the model and k represents several independent variables used in the models. In addition to this, time effects are used by the DUMMY variable.

Equation 2 below exactly mimics Equation 1 with the addition of the interaction variables to test:

$$VENMARKET = \beta_0 + \beta_1 x_{it1} + \beta_2 (Dummy_{EURO} \cdot x_{it1}) + \cdots + \beta_{\mathrm{k}} DUMMY_{YEAR} + a_i + u_{it} \qquad (2)$$

Where additionally the mimicking version of the Equation 1 this model puts into account the interaction variable of Euro where if the country that is included in the

model is within eurozone dummy variable takes the value of 1 either it takes the value of zero, and this value must be multiplied with the concerning independent variable.

Equation 3 presented below will have some alterations to Equation 2, where instead of the euro interaction, it will report the opt-out plus euro countries. Invest Europe (2015) states that among the non-euro adopting countries, two countries, Denmark and the UK, are the recipients of most VC investment. At the same time, these two countries could satisfy the ERM criteria to adopt the euro, but they chose not to. Due to this fact, it is possible that these countries might have more determination power among the non-euro users. By combining these two countries with the euro users, it could be tested to see if there are any differences between countries who satisfied the ERM criteria or not:

$$VENMARKET = \beta_0 + \beta_1 x_{it1} + \beta_2 (Dummy_{OPTOUT} \cdot x_{it1}) + \cdots + \beta_k DUMMY_{YEAR} + a_i + u_{it} \quad (3)$$

Where the only change in Equation 3 is the instead of EURO interaction variables, they are replaced with the opt-out interaction variables where if the country has satisfied the ERM criteria.

if the country has met the ERM criteria the dummy will take the value of 1, and for the remaining cases it will take the value of 0, and this value will be multiplied by the corresponding independent variables.

5.3 Sample Selection, Data, and Methodology

The following subsections will be summarizing the sample, data and the methodology to be used in this study. the sample and methodology will proceed without changes, but the data is subject to change in the cases of different regressions.

5.3.1 Sample Selection

This study takes into account the 19 European Countries that are members of European Union (EU) and European Free Trade Area (EFTA). We started our initial sample with 32 European countries which are constituted of 28 EU members (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom) and 4 EFTA members (Iceland, Norway, Principality of Liechtenstein and Switzerland). After the initial sample is constructed we followed following selection criteria for final sample.

The first criterion to be checked to be selected for the sample is the venture capital data is readily available at InvestEurope Database. Invest Europe database is the European Venture Capital Association. InvestEurope Databases reports venture capital and private equity data for the individual countries and aggregate of a group of countries. In our sample selection countries venture capital investment has to be reported individually at the InvestEurope Database. Among the countries which is not reported at all in the database are Cyprus, Iceland, Malta, and Liechtenstein. Some of the initial sample countries are also reported as aggregate groups as Baltic Countries (Estonia, Latvia, and Lithuania) and Other Central East European Countries (Croatia, Slovakia, Slovenia and other out of sample countries). Omitting these countries with

sample lead us with a decreased sample of 20 European Union Countries (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Spain Sweden and United Kingdom) and 2 EFTA countries (Norway and Switzerland).

Secondly, countries have been classified according to their income groups. the sample countries are classified by their income classification that is provided by the World Bank (2016c). Among the sample countries by the year 2015, except for 2 countries (Bulgaria and Romania) are high-income countries but also, a check has been conducted if the countries' income classification is during the sample period. Except for one country (Hungary), the income classification of other countries remains stable during the period of 2007-2015. To eliminate the outlier bias, we excluded Bulgaria, Hungary, and Romania from our sample.

The final sample constitutes 17 EU members (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden and the United Kingdom) and 2 EFTA members (Norway and Switzerland)

5.3.2 Data

Data used in this part of the thesis is obtained from various resources. Aggregate venture capital data is obtained from InvestEurope database (2016) and to check the validity of the data it is cross-checked with the data that is provided at the Eurostat Database (2016). For the independent variables, we relied on the variables that are reported in the World Economic Forum's Executive Opinion Survey (Browne et al., 2016). An executive Opinion survey is the aggregated index to measure the competitiveness of the economies. In order to test the effect of the education, goods

market, labor market, financial market development and lastly innovation and sophistication factors the data is classified into subsections. All the data but dependent variable is normalized by the World Economic Forum (2016) to a scale of 1-7. The aggregated index components will be reflected in the appendix section of this study.

For the education part of the regression three variables are used. The quantity of Education is the aggregated index provided by the World Economic Forum (2016) where it measures the secondary and tertiary enrolment rates for the associated countries which are the secondary data which is obtained from other databases. Quality of Education variable consists of aggregated survey results asked the entrepreneurs all over the world. The Quality of Education tries to assess how much-qualified education is provided within the local economy. lastly On-the-Job Training variable is trying to assess the amount of training that is available in the workplace. This variable is again obtained from the survey results and tries to measure the quantity of training at the workplace instead of quality.

Goods market will also be assessed where the sophistication of the demand conditions, domestic and foreign competition will be employed. For the Quality of demand condition, it will rely on the quantity of customer orientation and sophistication of demand for goods and services provided within any economy with the reliance on the survey results. Domestic Competition variable relies both on survey results and the secondary data obtained from other databases which measure the amount of competition exists within the economy. The foreign competition follows similar data trend but how the government policies such as trade barriers and similar precautions affect the competition available within the economy.

For the labor market, two sub-indexes will be used where one measures the efficiency of the policies (Labor Efficiency). This includes survey and secondary data where it measures the flexibility of employer-employee relations, wage rates, redundancy costs and effect of taxation on the labor market. Efficient use of Talent variable measures how a country handles existing workforce where it tries to make a link between productivity versus pay-rate, professional management, labor market rigidities and attraction of foreign or local workforce to existing economy.

For the financial market development, two sub-indexes are used. FINMARKET EFFICIENCY measures how easy a firm to finance and access to the financial services within the economy. In addition to this variable, the confidence to the markets and financial institutions are measured using TRUST AND CONFIDENCE index where it includes both the survey and secondary data to measure the competitiveness.

Lastly, it is also investigated if the venture capital has any significant impact on VC investment received by the economies. for the market size, we relied on the World Economic Forum (2016) normalized value of 1-7 scale to measure the market size both for the local and foreign market. World Economic Forum uses the purchasing power parity (PPP) estimates to calculate the market size. For the domestic market size is obtained by the aggregating natural log of the total value of GDP and the number of goods and services imports with the associated country while deducting the total value of exports of goods and services from the market. While the foreign market size is the natural log of aggregated total value exports of goods and services within the economy.

5.3.3 Methodology

For all the models that are represented at Equation 1 to Equation 3 will be reported as the FE and RE models, but it is essential to determine which model is more appropriate to following rule of thumb can be employed. As Félix et al. (2013) suggest that to used RE models the country-specific residuals should not be associated with the independent regressors. Although both of the regressions will be reported in our study it is also a general consensus that RE models better represent of panel data models compared to FE models due to their ability to capture the effects within the independent variable instead of constant term (Félix et al., 2013; Groh & Wallmeroth, 2016; Romain & Van Pottelsberghe de la Potterie, 2004).

In addition to employing variables, there is also time effects employed in this study. employing time fixed effects also gives us to eliminate cross-section problem and additionally the model is estimated using or serial correlation that might be presented while estimating the model (Arellano, 2003; H. White, 1980; Wooldridge, 2013).

Before testing the relevance of each model, the cross-section dependence testing will be performed. It is proven by many researchers that cross-section dependence testing will not produce valid results for micro-panel studies where the micro-panels that have more massive than 200 cross sections provide efficient and robust results for cross-section tests (Baltagi, 2012; Baltagi et al., 2012; Pesaran, 2004; Pesaran et al., 2008). Due to the problems of the cross-section dependence testing for the variables we rely on the regression cross-section dependence. In this thesis, there will be a reliance on Pesaran (2004) CD test due to several drawbacks of the other tests. Pesaran (2004) CD-Test considers the following case that if the number of the cross-section is larger than the number of periods it will promote better results.

Pesaran (2004) proposes the following model where statistics is estimated as:

$$CD = \sqrt{\frac{2T}{N(N-1)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)} \quad (5)$$

where it is similar to test but instead of using the squared version of the residual correlations, Pesaran (2004) uses the serial correlations that will not decrease the power of the test if $N \geq T$. the following equation shows the null and alternative hypothesis for the Pesaran (2004) CD Test.

$$H_o: u_{it} = \sigma_i \epsilon_{it} \quad (6)$$

$$H_A: u_{it} \neq \sigma_i \epsilon_{it} \quad (7)$$

where H_o and H_A represents cross-sectional dependence and cross-sectional independence respectively.

Although the random effects model is more efficiently used in the literature for consistency, it should also be tested if the random effect model more efficient model. first of all, we use Hausman Test (1978).

$$\chi^2 = (\beta_{na} - \beta_{nb})'(V_{na} - V_{nb})^{-1}(\beta_{na} - \beta_{nb}) \quad (8)$$

where β_{na}, β_{n2}, V_{na}, and V_{na} is the coefficient vector of the dependable estimator, coefficient vector of the efficient estimator, the covariance matrix of the of the dependable estimator and covariance matrix of the of the dependable estimator respectively. During the process of estimation of the models we will cluster the model according to the countries we use the bootstrapped version of the model where the covariance of the matrix will be bootstrapped to eliminate the effect of biased standard errors that might be due to presence of heteroscedasticity (Cameron & Trivedi, 2005,

p. 717). If the null hypothesis of the Hausman Test (1978) is failed to be rejected Random effect model is proven to be appropriate.

Following the Hausman Test (1978) random effect model is also tested if it can be represented with the simple pooled ordinary least squares estimator. In order to check this possibility augmented version of Breusch-Pagan LM Test (1980) which is modified by Baltagi and Li (1990) where they incorporate the possibility to conduct the test in the presence of the unbalanced panel data. The model can be shown below:

$$y_{it} = \alpha + x_{it}\beta + v_i \qquad (9)$$

Baltagi and Li (1990) can be calculated as:

$$\lambda_{LM} = \begin{cases} \frac{nT}{2(T-1)}\left\{\frac{\sum_i(\sum_t v_{it})^2}{\sum_i\sum_t v_{it}^2} - 1\right\}^2, & \hat{\sigma}_u^2 \geq 0 \\ 0, & \hat{\sigma}_u^2 \leq 0 \end{cases} \qquad (10)$$

the null hypothesis for this test statistics test is to test the variance of the error component of the model. If the variance is different from zero, this proves that random effect model is appropriate and in the case of vice versa scenario the model must be estimated with pooled OLS model.

5.4 Empirical Results

Before proceeding to the empirical results of the models, it should be mentioned that several effects on VC activity will be tested after testing individual sections of the economy. A general model will be constructed to capture the effects on the overall significance of the investment activity.

5.4.1 Secondary, Higher Education, and Workplace Training as the Determinants of VC

In this section, the impact of secondary and higher education and on-the-job training on VC activity within Europe will be tested. Before checking the results obtained by the regression output, the associated descriptives and the correlation coefficients have to be examined. Table 6 examines this relationship between the independent variables and the dependent variable, VC investments, as a percentage of the GDP. An examination of the dependent variable (VENMARKET) reveals that it constitutes a low portion of the overall GDP. Meanwhile, there is not that much variation, which provides a stable change in VC investments. The rest of the variables show higher means and standard deviations to their normalization procedures as mentioned in the data section. This can also be related to the nature of country-specific variables, which does not capture the global effect. Also, when associated correlation coefficients are checked, it can be observed that the variables present a mixed story. A high correlation is only observed with ON-THE-JOB TRAINING and QUALITY OF EDUCATION. The reason for this is that these variables are mostly based on the survey results instead of the hard data, while the rest of the variables are more focused on the hard data, which promotes weaker relationships between them.

Table 6: Descriptives and the Correlation Matrix for the Higher Education and Training

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3	4
VENMARKET	171	0.031	0.022	0.000	0.116	1.000			
QUALITY OF EDUCATION	171	5.936	0.667	3.920	7.000	0.037	1.000		
QUANTITY OF EDUCATION	171	4.990	0.652	3.631	6.171	0.602	0.035	1.000	
ON-THE-JOB TRAINING	171	5.041	0.649	3.568	6.144	0.593	-0.084	0.894	1.000

Before proceeding to the regression outputs, it is wise to visit the panel line plots and the diagnostic tests. The panel plots are reported in Figure 3, and the following two tables (Table 7 and Table 8) show the common diagnostics and individual diagnostics tests for underlying models. As quoted earlier, the difference between the dependent variable and the independent variables is due to the normalization procedure to report the index. Taking this into account, the data is stable data for all of the variables used in this section. Interim Table 7 reports the autocorrelation test and the bootstrapped Hausman test for the underlying model. None of the models that this study is trying to estimate present any autocorrelation problems. It failed to reject the null hypothesis for the Wooldridge (2002) first-order autocorrelation test with associated probability values of 0.1337, 0.1723, and 0.1745 for models 1, 2, and 3, respectively. Before discussing the bootstrapped Hausman test, the individual diagnostics tests must be visited.

Table 8 reports the Breusch-Pagan (1980) LM test and the Pesaran (2004) CD Test for the associated models. The estimated RE model shows that it has superior explanatory power compared to the pooled OLS model, where it firmly rejected all Breusch-Pagan LM test reports (i.e., 162.12, 118.06, and 116.20) and all with associated probability values of 0. The Pesaran (2004) CD test was used to check for cross-sectional dependence on the models.

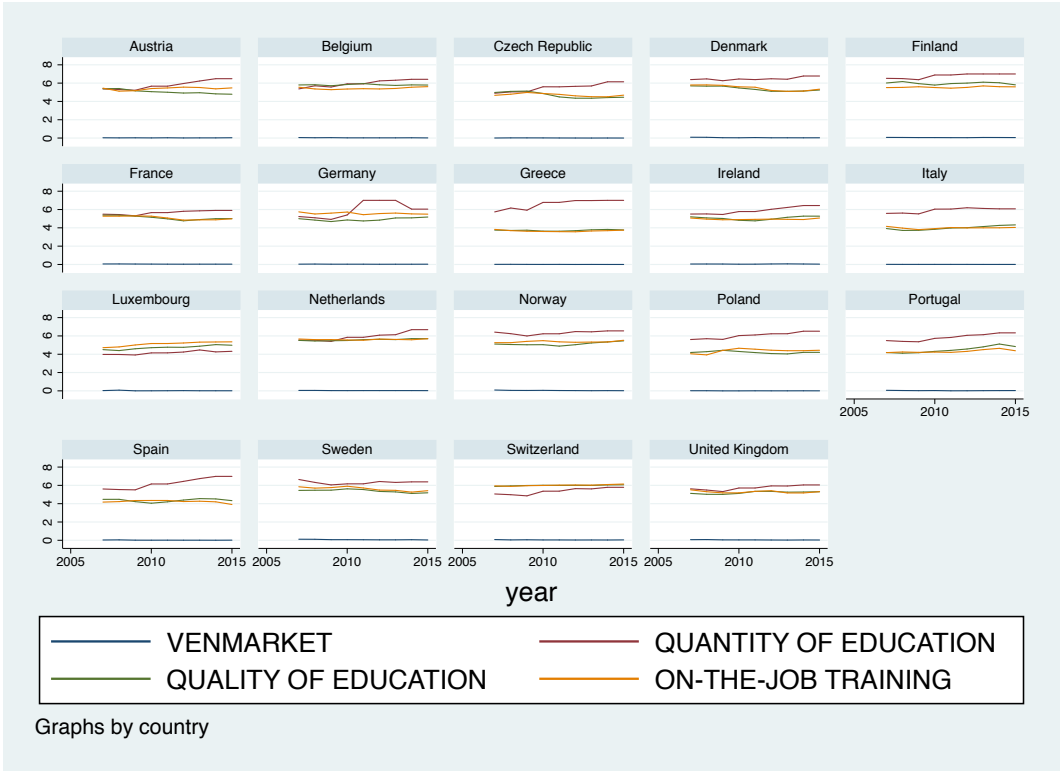

Figure 3: Panel Line Plots for Post-Secondary Education and On-the-Job Training

Table 7: AR(1) and Model Selection Diagnostic For Higher Education And Training

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	2.466	0.1337	2.020	0.1723	1.999	0.1745
Hausman Test	3.57	0.9809	5.87	0.9697	7.24	0.9249

The test revealed that none of the models show cross-sectional dependence for both the RE and FE models. Lastly, in order to determine the most appropriate model (i.e., RE or FE), the bootstrapped Hausman test was employed. As shown in Table 7, when the bootstrapped Hausman test was considered, none of the models rejected the model, even when far from the rejection region. For the models, the associated χ^2 statistics were 3.57, 5.87, 7.24, and the associated probability values were 0.9809, 0.9697, and 0.9249, respectively, for models 1, 2, and 3. From this, it was determined that the RE model is the most appropriate model for the estimation.

Table 8: Other Diagnostics for Higher Education and Training

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	162.12	-	118.06	-	116.20	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.629	-1.641	-1.659	-1.790	-1.800	-1.825
Pesaran CD Test p-value	1.8968	1.8992	1.9028	1.9265	1.9282	1.9320

Table 9 reports the associated models for both the RE and FE models. It has been proven that the FE model is not feasible for estimation, but for illustration purposes, it has been reported in this table. Model 1 considers the overall sample of the countries with no interaction effect, while model 2 demonstrates the interaction effect that is obtained by multiplying the euro-adopting countries as the interaction effect. Lastly, model 3 adds both countries using the euro and the satisfiers of ERM to use the euro but who chose not to.

Considering model 1, two of the variables (quantity of education and on-the-job training) show a significant positive effect, and quality of education bears an adverse but insignificant effect on VC investment activity within Europe. Both quantity of education and on-the-job training are highly significant at the 1% level. This information is helpful as it indicates that if the economy produces more and more secondary and tertiary level graduates, this will promote VC activity within Europe. In the meantime, the most affecting factor in this regression is on-the-job training. This clearly outlines that when company employees receive a sufficient amount of quality training, they tend to be more productive.

Model 2 is assumed to be the generating model, and the moderating effect of euro usage by the sample countries is presented in the sample. Compared with model 1, it can be observed that the previous significance achieved by quantity of education and on-the-job training is partly reversed in model 2. In model 2, the quantity of education is no longer significant; instead, the quality of education and on-the-job training is more significant for the model. Meanwhile, on-the-job training still produces a highly positive significant result (beta = 0.0478 and p-value < 0.01), and quality of education produces a countering with a high but negatively significant value (beta = -0.0255, p-value < 0.01).

These findings demonstrate that the negative coefficient of quality of education might be related to human capital flight, where the receivers of high-quality education might relocate to more advanced economies for more or better opportunities, and being an EU member and an EFTA region country helps ease this possibility. While having a highly significant beta coefficient for on-the-job training indicates that training at the workplace will lead to more competitive and more successful companies in any economy, this will also boost entrepreneurial activity and attract more investors to their corporations.

While having this scenario on the regular terms of model 2, euro adopters will have a different scenario. In this case, all variables constitute high positively significant effects. However, quantity of education and quality of education make immense negatively significant contributions to on-the-job training with beta coefficients of 0.00686, 0.0282, and -0.0364, respectively, with probability values of less than 1%.

Table 9: Regression Output for Higher Education and Training

	Model 1 (RE)	Model 1 (FE)	Model 2 (RE)	Model 2 (FE)	Model 3 (RE)	Model 3 (FE)
Quantity of Education	0.0120***	0.0134**	0.00313	0.00255	0.00508	0.00762
	(2.88)	(2.22)	(0.63)	(0.30)	(1.13)	(0.98)
Quality of Education	-0.00370	-0.00788	-0.0255***	-0.0274***	-0.0257***	-0.0258***
	(-0.69)	(-1.36)	(-3.38)	(-4.85)	(-2.66)	(-3.10)
On-the-job Training	0.0214***	0.0175**	0.0478***	0.0434***	0.0485***	0.0390***
	(3.69)	(2.71)	(6.90)	(4.43)	(4.97)	(3.49)
Euro*Quantity of Education			0.00686***	0.00838		
			(2.80)	(1.69)		
Euro*Quality of Education			0.0282***	0.0233**		
			(2.95)	(2.43)		
Euro*On-the-job Training			-0.0364***	-0.0419***		
			(-3.94)	(-2.92)		
Optout*Quantity of Education					0.00573**	0.00515
					(2.37)	(0.98)
Euro*Quality of Education					0.0271**	0.0218*
					(2.47)	(1.99)
Euro*On-the-job Training					-0.0332***	-0.0283*
					(-2.88)	(-2.02)
Constant	-0.109***	-0.0757*	-0.0815**	-0.0192	-0.0962***	-0.0584
	(-3.30)	(-1.77)	(-2.46)	(-0.42)	(-3.16)	(-1.34)
Observations	171	171	171	171	171	171
R^2	0.573	0.464	0.632	0.215	0.621	0.479
χ^2 STAT.	308.053		5447.482		544.692	
F- STAT.		19.514		27.241		18.781
PROB.	0.000	0.000	0.000	0.000	0.000	0.000

The explanation of the interaction terms must be approached cautiously. While a large number of high-quality graduates from secondary education boosts competitiveness and attracts VC investment, on-the-job training decreases the amount of the VC investments in these countries.

A possible explanation for the negative beta coefficient here might be related to the fact that if graduates receive a quality education from the secondary and higher education sector to train them, companies must invest more vigorously to meet their needs and expectations in terms of training.

In model 3, again, the same regular terms and the interaction effects of those terms are reported. The regular terms follow a similar pattern as the previous model. Although their impact on VC investment activity has shown some deviations from the previous model, the implications are showing the same scenario here. For quality of education, the beta coefficient lessened by 0.0003 and appreciated by 0.0007 with both probability values less than 1%. This alteration on the regular terms can be explained with the omission of Denmark and the UK. Using a new type of interaction, it shows that the impact of quality of education and on-the-job training matters to venture capitalists when deciding to invest in economies' private firms.

5.4.2 Competition and the Sophistication of Demand Conditions of the Customers as the Determinants of VC

In this section, the study attempts to check the impact of domestic and foreign competition, and how customers' expectations of products will be used as determinants of VC. Table 10 reports the associated descriptives and the correlations among the variables.

Table 10: Descriptives and the Correlation Matrix for the Goods Market

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3	4
VENMARKET	171	0.031	0.022	0.000	0.116	1.000			
QUALITY OF DEMAND CONDITIONS	171	4.798	0.482	3.880	5.832	0.660	1.000		
DOMESTIC COMPETITION	171	4.814	0.428	3.685	5.519	0.582	0.807	1.000	
FOREIGN COMPETITION	171	5.175	0.486	4.049	6.304	0.246	0.408	0.589	1.000

Following this, before proceeding to the reporting, the panel line plots and the diagnostics tests for the underlying models will be presented. Figure 4 reports the panel line plots, the independent variables, and the dependent variables used in this modeling. It can be clearly seen that there is stability among the variables reported here. Interim Tables 11 and 12 report the routine diagnostics and individual diagnostics for the models. As can be seen in Tables 11 and 12 , all the estimated models are free of autocorrelation. Also, none of the estimated models were able to reject the null hypothesis for the Wooldridge (2002) first-order autocorrelation test. The inability to reject this test allows for forming the models in an efficient way. After estimating the RE models, further tests will be applied. First, the RE model was estimated, and the cross-sectional dependence test was applied to check if the model is estimated cross-sectionally independent. The Pesaran (2004) CD test showed that RE models are cross-sectionally independent where the null hypothesis for any of the RE models failed to be rejected. The models' poolability was tested via the Breusch-Pagan (1980) LM test, and among all the models, the null hypothesis was strictly rejected, indicating that pooled OLS model cannot be used for estimation purposes.

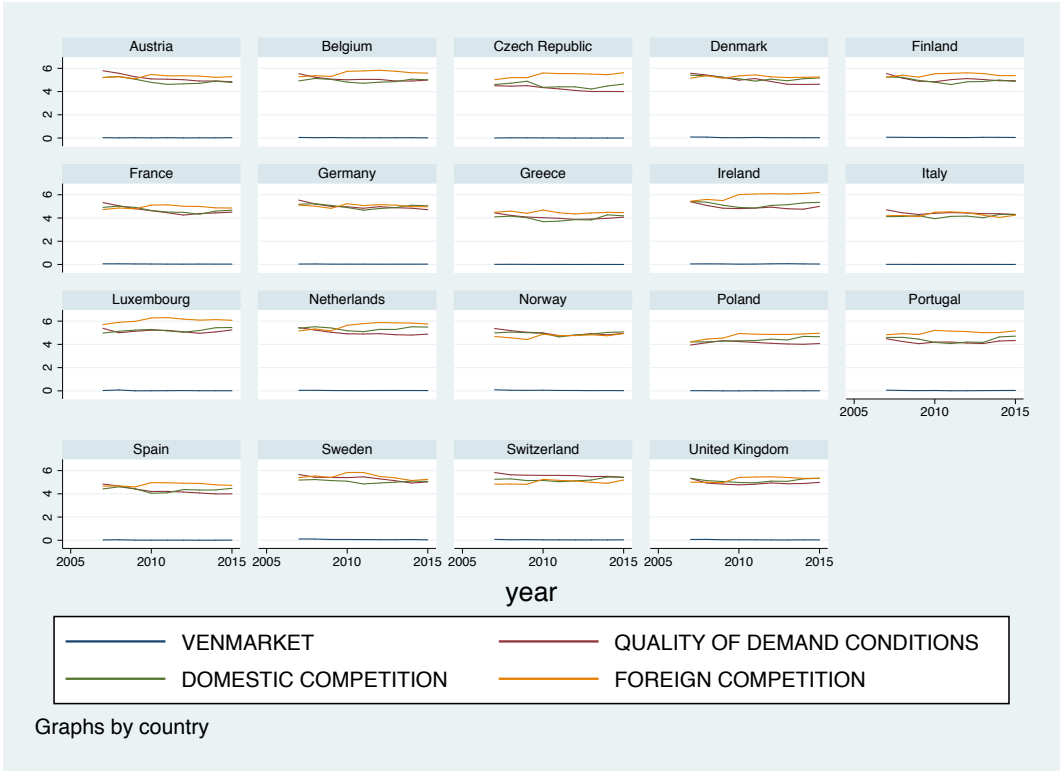

Figure 4: Panel Line Plots for Goods Market

After this procedure, it is possible to test whether the RE or FE model is more appropriate for estimation. The bootstrapped Hausman (1980) test is also applied to discern the best model to represent the link between the goods market and VC activity. To test this procedure, the associated FE models were estimated and checked against cross-sectional dependency which is also reported in Table 12. The Pesaran (2004) CD test showed that the hypothesis was firmly rejected for all models. After determining that the FE and RE models are cross-section free, the bootstrapped Hausman test was applied to check if an efficient model could be selected. The test statistics reported in this section show that for all the models, the bootstrapped Hausman test could not be mutually rejected for all models. Models 1, 2, and 3 give the associated test statistics of 4.70, 5.64, and 6.02, and associated probability values of 0.9449, 0.9747, and 0.9661, respectively. This finding clearly indicates that the best possible model for estimation purposes is the RE model.

Table 11: AR(1) and Model selection diagnostics for Goods Market Regressions

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	2.530	0.1291	1.461	0.2424	1.754	0.2019
Hausman Test	4.70	0.9449	5.64	0.9747	6.02	0.9661

Table 12: Other Diagnostics for the Goods Market Regressions

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	185.15	-	182.97	-	150.15	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.070	-1.649	-2.011	-2.016	-1.829	-1.880
Pesaran CD Test p-value	1.7153	1.9009	1.9557	1.9562	1.9326	1.9399

Table 13 reports the regression output for both the RE and FE models to assess the relationship between the competition and sophistication of demand by the customers present in a specific market. The FE model is only reported for illustration purposes, because the RE models were proven most efficient for estimates, according to the Hausman test.

Model 1 shows that all the employed variables brought positive estimates, but unfortunately, these figures failed to find statistically significant estimates for VC funding in Europe. These findings are also mutually significant when the FE version of model 1 is taken into account.

While finding the insignificant estimates in model 1, it is possible to observe significant relationships in model 2. The regular term, which represents non-euro users

in the sample, shows that quality of demand conditions provided high positively significant estimates ($\beta = 0.0272, p < 0.01$), while for the other regular terms, statistically significant relationships could not be constructed. This finding shows that non-euro users' perceptions about the market affect VC investment activity decisions. Furthermore, this explanation shows that higher sophisticated goods and services required by the customers will supply higher amounts of VC funding to the associated region.

The regular term's significance is only achieved with the quality of demand conditions interim, while all variables employed as interaction terms show some significant relationship with VC investment activity. While achieving a significant relationship with quality of demand conditions, the interaction terms show that competitive environment and sophisticated demand have a highly significant relationship. Meanwhile, quality of demand conditions shows a negative highly significant relationship ($\beta = -0.0358$, p-value < 0.01), and domestic competition and foreign competition show a highly significant positive relationship ($\beta = 0.0195$, probability < 0.01 and $\beta = 0.0129$, probability < 0.05, respectively). These findings indicate that all of the interaction variables have some potential effect on VC investment potential in a particular economy. The sign change observed at quality of demand conditions shows that if customers start to require more sophisticated goods and services, this will show venture capitalists that their perceptions of companies are high, which can only be supplied by larger companies that exist within the economy. This will lead venture capitalists to target other economies that did not reach this level of sophistication, such as non-euro users or other countries not investigated in this study.

Table 13: Regression output for the Goods Market

	MODEL 1 (RE)	MODEL 1 (FE)	MODEL 2 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 3 (FE)
QUALITY OF DEMAND CONDITIONS	0.00843	-0.00120	0.0272***	0.0235**	0.0253***	0.0235**
	(1.22)	(-0.12)	(4.15)	(2.61)	(3.49)	(2.24)
DOMESTIC COMPETITION	0.00576	0.00101	-0.00763	0.00498	-0.00548	0.00732
	(0.78)	(0.12)	(-0.71)	(0.39)	(-0.53)	(0.53)
FOREIGN COMPETITION	0.00840	0.0139	0.00131	0.0149	0.00365	0.0201
	(1.21)	(1.15)	(0.21)	(1.17)	(0.65)	(1.62)
EURO*QUALITY OF DEMAND CONDITIONS			-0.0358***	-0.0434***		
			(-3.57)	(-4.44)		
EURO*DOMESTIC COMPETITION			0.0195***	0.000768		
			(2.61)	(0.06)		
EURO*FOREIGN COMPETITION			0.0129**	-0.0109		
			(2.40)	(-0.90)		
OPTOUT*QUALITY OF DEMAND CONDITIONS					-0.0258**	-0.0312**
					(-2.13)	(-2.19)
OPTOUT*DOMESTIC COMPETITION					0.0163*	-0.00575
					(1.83)	(-0.41)
EURO* FOREIGN COMPETITION					0.00759	-0.0146
					(1.19)	(-1.19)
CONSTANT	-0.0655	-0.0195	-0.0450	0.00292	-0.0622	-0.0147
	(-1.32)	(-0.25)	(-0.88)	(0.05)	(-1.22)	(-0.19)
OBSERVATIONS	171	171	171	171	171	171
R^2	0.443	0.278	0.555	0.084	0.527	0.028
χ^2	116.056		235.914		355.357	
F-STAT.		12.640		39.785		8406.003
PROB.	0.000	0.000	0.000	0.000	0.000	0.000

t statistics in parentheses
all the models clustered according to sample countries to eliminate heteroscedasticity problem
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While achieving a negative correlation between VC investment and quality of demand conditions, the interaction variable for domestic competition and foreign competition also matters to venture capitalists. Achieving a higher significance on domestic competition indicates that venture capitalists are more interested in domestic competition than foreign competition. In the case of domestic competition, a beta

coefficient of 0.0195 is observed, where the results are in favor of higher competition in the market, boosting the performance of entrepreneurial activity in Europe. Although foreign competition is again significant, the overall effect of this variable shows a less significant effect on VC investments in Europe. The competitive environment indeed shows a favorable impact from countries who adopted the euro. This gives some indication that euro adoption and competition work hand-in-hand, boosting the performance of VC activity in Europe. However, the regular variables failed to present any statistically significant relationship.

The third model gives some similar results that are in line with the findings of model 2, which demonstrated a statistically significant relationship with quality of demand conditions both on the regular term and the interaction variable. However, statistically significant associations were only established with interactions from domestic competition. While this version of the model partly mimics the previous model in terms of its findings, it reported some changes in the overall model. Quality of demand conditions demonstrated a positive highly significant association with VC investment activity, while compared with the previous model, its impact on VC investment activity was slightly diminished. Quality of demand conditions were reduced by 0.0019 on beta coefficient reports and an associated beta of 0.0253 with a probability value of less than 5%. In terms of the interaction terms of quality of demand conditions, a positive improvement was observed while keeping the highly statistically significant value of 1%. With an improvement of 0.0100, this value shows that quality of demand conditions is likely to have a negative affect negatively ($\beta = -0.0258, \text{p-value} < 0.05$). In addition, domestic competition has a statistically significant positive effect on VC activity; however, compared with the previous

model, the significant effect of this variable was somewhat diminished ($\beta = -0.0163$, p-value < 0.10). These findings show that the two opt-out countries employed in the interaction terms severely affect VC investment activity, and domestic and foreign competition that depends on euro usage affects VC investment activity when determining their investment portfolio.

5.4.3 Labor Market Conditions as the Determinants of VC

In this section, the study tries to present the effect of the labor market on VC investment activity. Flexibility of the labor market (FLEXIBILITY) and the efficient use of talent in the labor market (EFFICIENCY) were employed. The interaction variables for the euro and opt-out will also be reported to test the market effect on VC investment activity in Europe.

Table 14 reports the descriptives and associated correlation coefficients for the model. A mid-range positive correlation can be observed among the independent variables. A slightly positive and mid-range positive correlation is also documented for the dependent variables for the flexibility index and efficiency index, respectively. The mean value of the independent variables show that the independent variables have relatively low values concerning these indexes, which are based on a 1–7 scale. This clearly shows that, on average, the European labor market is not as competitive as it should be.

Table 14: Descriptives and Correlation Matrix for the Labor Market

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3
VENMARKET	171	0.031	0.022	0.000	0.116	1.000		
FLEXIBILITY INDEX	171	4.444	0.625	3.371	6.030	0.293	1.000	
EFFICIENCY INDEX	171	4.766	0.612	3.023	5.884	0.645	0.632	1.000

Figure 5 also plots the dependent and independent variables used in this study. A close interaction of the independent variables can be observed, especially for countries using the euro and opt-out countries. It can also be observed that these values follow mid-range values as the indexes are based on a 1–7 scale.

Tables 15 and 16 show the joint and individual diagnostic tests for the efficient model estimation. All of the models to be estimated, whether estimating FE or RE, show that they are free of autocorrelation. The Wooldridge (2002) first-order autocorrelation test shows that none of the models' null hypotheses of the test failed to be rejected, and they were highly insignificant with a level greater than 10%. As the RE model will be the starting point, the estimated RE models for all the leading models show that they are not poolable; thus, there is no need to do a regression with a pooled OLS model. This is efficiently demonstrated with the Breusch-Pagan (1980) LM test, where for all the RE models, the null hypothesis is firmly rejected with a 1% significance level. Also checked was if cross-sectional dependence was present in the model, where it failed to document any kind of cross-sectional dependence in the RE models. The Pesaran (2004) CD test showed that the null hypothesis failed to be rejected for all the RE models, proving that RE models are efficient. In the meantime, FE models were estimated to determine which model was more efficient for estimating the association between the labor market and VC investment activity. After estimating the FE model, the estimated FE models were also checked to see if they were free of CD dependence. The Pesaran (2004) test showed that all FE models were mutually non-significant. Thus, it can be concluded that FE models do not bear any conditions to satisfy cross-sectional dependence. To determine which estimation technique was less biased to document the association (i.e., RE or FE) and to discern the best possible model, the

Hausman (1980) test was applied. In the previous sections, it was documented that RE models were more efficient for all the models estimated, but in this section, a mixture of results is presented.

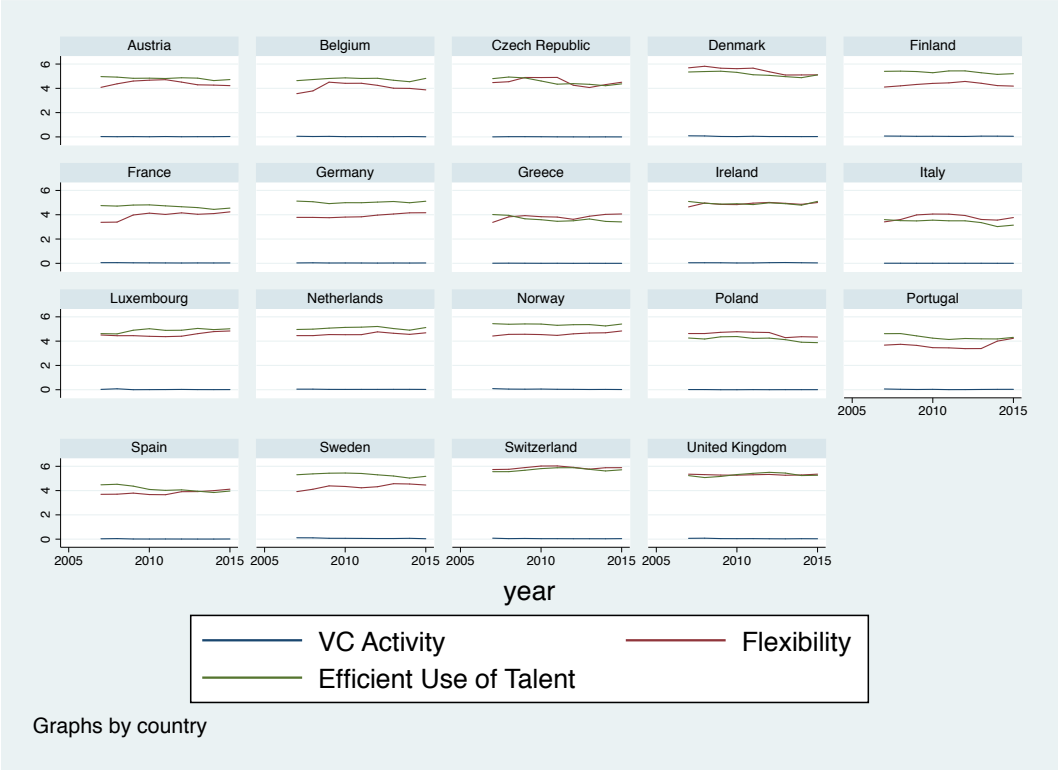

Figure 5: Panel Line Plots for the Labor Market

Table 15: AR and Model Selection Diagnostics for Labor Market

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	2.247	0.1512	2.153	0.1596	1.922	0.1826
Hausman Test	23.57	0.0088	15.57	0.2119	19.71	0.0728

For model 1, Hausman (1980) χ^2 resulted in a test statistic of 23.57 with a probability level of 0.0088, showing that the FE model should be chosen instead of the RE model. Meanwhile, having statistically insignificant χ^2 test statistics of 15.57 and 19.71, respectively, shows that the FE model is inefficient, and the FE model can be selected. To summarize these findings, the estimation model for model 1 is FE, and the rest of the models are assumed to be RE models due to our findings from the Hausman test.

Table 16: Other Diagnostics for the Labor Market

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	102.07	-	85.43	-	68.51	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.538	-1.469	-1.897	-1.805	-2.068	-1.996
Pesaran CD Test p-value	1.8761	1.8583	1.9421	1.9289	1.9614	1.9541

Table 17 reports the estimation output for all models, including the FE and RE models. Other than the efficient models, all of the models are reported for estimation purposes. Throughout the efficient models, it can be observed that efficient use of talent is the

only significant factor. The presence of the interaction terms for models 2 and 3 clearly affects the model selection and the effect of the variables that is presented in the regression output. Because the FE model was determined to be efficient, it can only measure the time effect of the variables present in the data but not cross-sections. Under this assumption, the efficient use of talent index shows a statistically significant negative contribution to VC activity ($\beta = -0.0168, p - value < 0.05$). For the rest of the models, efficient use of talent has some positively significant attributes for VC activity. For example, for model 2, it is slightly significant ($p - value < 0.10$) with a beta coefficient of 0.0238. In addition to this, for the model, the efficient use of talent positively improved with high statistical significance ($\beta = 0.0334$, p-value< 0.01).

As mentioned earlier, for all the models, there is a consensus that efficient use of talent produced statistically significant results throughout. For last two models, it is assumed that it also captures the effect of being a euro adopter and an opt-out country, but for the first model, it considers the whole sample as the determinants. When it did not discriminate according to the currency used, it reached the adverse effect that the efficient use of talent loses its significance as time progresses.

This also determines that each country's focus on the use of talent depends on the economic and cultural policies adopted by the associated country. The amount of payment and productivity ratio, and the ability to retain and attract a talented foreign workforce also matter for better productivity. However, because the country-specific effect is omitted in this output, these factors cannot be employed in this model. Although for model 1, low explanatory power clearly shows that this estimation output can be ruled out.

Table 17: Regression Output for Labor Market

	MODEL 1 (RE)	MODEL 1 (FE)	MODEL 2 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 3 (FE)
FLEXIBILITY	0.00552	0.0109	-0.00770	-0.00191	-0.0184	-0.0168
	(0.95)	(1.57)	(-0.55)	(-0.10)	(-1.51)	(-0.82)
EFFICIENT USE OF TALENT	0.0104	-0.0168**	0.0238*	-0.00282	0.0334***	0.000406
	(1.62)	(-2.61)	(1.78)	(-0.19)	(2.79)	(0.03)
EURO*FLEXIBILITY			0.0202	0.0172		
			(1.42)	(0.85)		
EURO*EFFICIENT USE OF TALENT			-0.0193	-0.0200		
			(-1.32)	(-1.12)		
OPTOUT*FLEXIBILITY					0.0313**	0.0344
					(2.38)	(1.59)
OPTOUT*EFFICIENT USE OF TALENT					-0.0291**	-0.0203
					(-2.18)	(-1.28)
CONSTANT	-0.0255	0.0833**	-0.0270	0.0871**	-0.0281	0.0846**
	(-1.62)	(2.35)	(-1.20)	(2.31)	(-1.51)	(2.51)
OBSERVATIONS	171	171	171	171	171	171
R^2	0.4763	0.0003	0.5356	0.0256	0.5899	0.0000
X^2 STAT.	184.6209		154.9993		182.9331	
F- STAT.		16.1579		13.6982		11.1883
PROB.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses

All models are clustered to countries. In addition to this, for Model 1 the efficient estimation model is proved to be Fixed Effect Model, and for the rest of the models it is proved to be Random Effect Model is efficient

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While ruling out country effect for model 1, the country-specific effect could be captured by using RE estimation for model 2 and model 3. The positive statistically significant finding at the regular term shows that the efficient use of talent matters. A simple explanation is that if countries are able to provide favorable conditions for a talented workforce, this will lead to increased productivity by the workforce. Favorable conditions might include: rewarding talent within the country with no discrimination; promoting a diversified workplace that is free of ethical violations, such as cultural equality, equal pay for men and women, and transparent hiring practices. In addition to this being a highly significant regular term, model 3 outlines that the effect of the two countries that were involved in the regular term for model 2 determines the effect of the labor force on VC investment activity. For the regular term of efficient use of talent, if the countries make more improvements, this will potentially affect these countries more positively.

Finally, checking the interaction terms will bring some explanations for the currency market-based approach to the findings. For the interaction variables in model 2, there was no statistically significant relationship documented, while in model 3, it was documented that both the flexibility index and the efficient use of talent index were statistically significant. Observing a positively significant association ($\beta=0.0313$, p-value<0.05) with the flexibility index indicates that venture capitalists care about flexible working conditions, such as taxation imposed on labor, ease of recruitment and redundancy labor practices, and similar associated flexible conditions in the labor market, as flexibility increases in the euro adopters and opt-out countries. In the meantime, it is also observed that efficiency of talent use is statistically significant for the interaction term while having a negative impact on VC investment

activity (β=-0.0203, p-value<0.05). This value is quite contradictory since it has positive significance in the regular term. This clearly indicates that an ethical approach in the labor market decreases overall VC activity.

These countries have reached a specific level of socioeconomics, and improvements in these factors at a higher level might create an extra burden for the economy. This clearly gains more importance in the EU, where freedom of movement enables any European citizen to freely move from one country to another. However, recent developments in the EU have enabled citizens to focus more on the money-driven benefits, which are documented by the flexibility of the labor market.

5.4.4 Financial Market Development as the Determinant of VC Investments

This section will try to assess if financial development has an influence on VC investments within Europe. The two indexes used for financial development are the financial market efficiency index and the trustworthiness and confidence index. The associated descriptives and the correlation coefficients are reported in Table 17. A mid-range correlation is shown between individual variables and the dependent variable, and there is a high correlation between the independent variables. The descriptives also documented that the financial markets are well-developed for the markets, which can be observed by the mean value of the independent variables.

Table 18: Descriptives and Correlation Matrix for Financial Market Development

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3
VENMARKET	171	0.031	0.022	0.000	0.116	1.000		
FLEXIBILITY INDEX	171	4.376	0.706	2.566	5.814	0.662	1.000	
EFFICIENCY INDEX	171	5.079	0.715	2.976	6.525	0.562	0.821	1.000

Figure 6 depicts independent and dependent variables that are used in this part of the thesis throughout 2007–2015. It can be observed that both indexes suffered a lot after the 2008 crisis, especially countries like Greece, Ireland, Spain, and the UK. The results show that the financial system throughout Europe suffered severely during the research period.

The tables below report the diagnostics test for the regression output for estimation purposes. Table 18 outlines the basic common diagnostics for the FE and RE models for the estimated models. Before estimating the model, a check was done to see if there was autocorrelation in the model. The results obtained from the Wooldridge (2002) AR test show that the null hypothesis of the test could not be rejected. After the RE models are estimated, it is possible to check the poolability of the models. Before proceeding with checking the poolability of the models, the models were also checked for any kind of dependency on the cross sections. The Pesaran (2004) CD test for the RE models found that the null hypothesis could not be rejected for any of the models. Thus, the cross-sectional dependency was not valid for any of the RE models. The next step is to check whether an association can be demonstrated with the pooled OLS model. To test the applicability of this assumption, the Breusch-Pagan (1980) LM test was applied. This test favors the pooled OLS model if the null hypothesis is accepted. However, the results contradict this assumption, where the test was significantly rejected with 1% for all models.

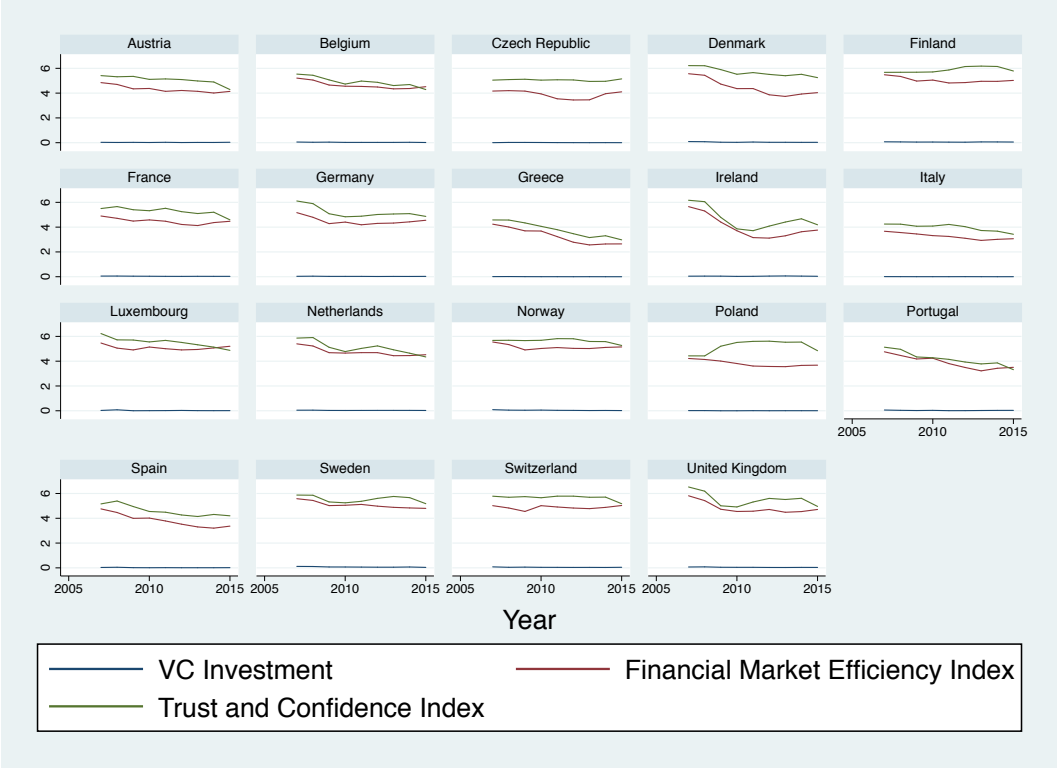

Figure 6: Panel Line Plots for Financial Development

It is also checked if the models have any kind of dependency on the cross sections. The Pesaran (2004) CD test for the RE models finds that null hypothesis cannot be rejected for any of the models. This promotes the cross-section dependency not valid for any of the RE models. The next step is to check if the association can be demonstrated with Pooled OLS model. To test the applicability of this assumption Breusch Pagan (1980) LM test is applied. This test favors Pooled OLS model if the null hypothesis accepted but the results contradict with this assumption where the test is significantly rejected with 1 percent for all the models.

With the poolability assumption rejected, the FE models are also estimated and checked for cross-sectional dependency. Again, the cross-sectional dependence assumption was rejected for the model by not rejecting the null hypothesis of the Pesaran (2004) test. The last test applied is the bootstrapped Hausman test to check

for the most favorable model. The bootstrapped Hausman (1980) test showed that for all the models, the RE models were more efficient than the FE models.

Table 19: AR(1) and Model Selection Diagnostics for Financial Development

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	2.529	0.1292	1.390	0.2537	1.886	0.1866
Hausman Test	9.47	0.4880	18.51	0.1010	12.99	0.3695

Table 20: Other Diagnostics tests for Financial Development

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	151.51	-	122.32	-	90.25	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.225	-1.093	-1.546	-1.915	-1.318	-1.791
Pesaran CD Test p-value	1.7794	1.7258	1.8779	1.9446	1.8126	1.9266

Table 21 shows the regression output for all the models estimated (RE and FE models). First, all the models will be investigated according to their regular terms, and then the interaction terms will be investigated accordingly. Throughout the efficient models, we can see that only FINMARKET EFFICIENCY promoted a slightly statistically significant positive impact on VC funding in model 2 ($\beta=0.0109$, p-value<0.10).

This indicates that in terms of the regular term, countries receive more investments if the financial market develops more.

While this is true for the efficient models, for the inefficient models, like the FE models, it could be possible to find some significant results for the regular term for models 2 and 3. These models show that trustworthiness and confidence and financial market efficiency are equally important for VC investment activity, while bearing in mind that FE models consider time effects of the estimates in depth, instead of the cross-sections presented in the model. In addition to these, the models' explanatory power is quite low, with models 2 and 3 showing an overall R-squared of 9% and 3%, respectively.

The concept of financial market efficiency was only achieved in model 2, where it represents all the non-euro users in the sample. This finding suggests that it is positively correlated with VC investment activity, while some conclusions in model 3 could not be documented. Also, it might be possible to document for both models 2 and 3 that the trustworthiness and confidence variable mutually suggests high statistical significance (p-value$<$0.01) and positive beta coefficients of 0.0136 and 0.0198, respectively, for models 2 and 3.

This shows that increasing the amount of this index will lead to a pile up of VC investments for both non-euro users and the non–opt-out sample. The findings here again indicate that two countries make a great impact on how the results might be documented. The interaction between model 2 and model 3 shows that if the countries transferred from the regular term to the interaction term, it would severely affect the regular term, which is documented in Table 20

Table 21: Regression Output for Financial Development

	MODEL 1 (RE)	MODEL 1 (FE)	MODEL 2 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 3 (FE)
FINMARKET EFFICIENCY	0.00376	-0.00471	0.0109*	0.00790*	0.00991	0.0142
	(0.53)	(-0.55)	(1.65)	(2.04)	(1.50)	(1.13)
TRUST AND CONFIDENCE TO FINANCIAL MARKETS	0.00233	0.00256	-0.00246	0.0136***	-0.000699	0.0198***
	(0.86)	(0.60)	(-0.51)	(2.92)	(-0.18)	(3.21)
EURO*FINMARKET EFFICIENCY			-0.0178**	-0.0236***		
			(-2.51)	(-3.89)		
EURO*TRUST AND CONFIDENCE TO FINANCIAL MARKETS			0.0125**	-0.00607		
			(2.30)	(-1.05)		
OPTOUT*FINMARKET EFFICIENCY					-0.00829	-0.0175
					(-1.05)	(-1.11)
OPTOUT*TRUST AND CONFIDENCE TO FINANCIAL MARKETS					0.00591	-0.0190**
					(1.05)	(-2.33)
CONSTANT	0.0166	0.0578*	0.0198	0.0282	0.00900	0.0110
	(0.55)	(1.99)	(0.69)	(1.60)	(0.30)	(0.42)
OBS.	171	171	171	171	171	171
R^2	0.336	0.098	0.371	0.091	0.402	0.030
χ^2 STAT.	93.490		167.090		147.922	
F- STAT.		12.006		19.718		12.293
PROB.	0.000	0.000	0.000	0.000	0.000	0.000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While having these results for the regular terms of the interaction terms, it can also be documented that there is a different relationship at the interaction term. Because the first model did not require an interaction term, it will not be investigated here. For the efficient models, a statistically significant relationship could be achieved with model 2 only. Both interaction terms (FINMARKET INTERACTION and Trustworthiness and Confidence in Financial Markets) show mid-range statistically significant results. In terms of financial markets, efficiency shows a negative association with VC where it produces a beta coefficient of -0.0178 and a p-value less than 5%. This indicates that financial market efficiency is actually a deteriorating factor for VC investment activity within these high-income countries, which contradicts the finding at the regular term.

An interim positive statistically significant association is found between trustworthiness and confidence and VC. The beta coefficient of 0.0125 with an associated probability value of less than 5% shows that trustworthiness and confidence might be closely correlated with investment activity. This can be related to the financial crisis observed during the sample period. The sub-prime mortgage crisis and the euro-debt crisis can be quite interrelated with trust in the markets, especially for the countries who chose to adopt the Euro.

The efficient RE regressions show these results, but in the meantime, inefficient FE regressions show similar stories with a bit of a difference. For model 2, instead of achieving mutual significance with all of the interaction terms, the FE model only outlines that financial market efficiency is the only statistically significant factor with high statistical significance of less than 1%. In the meantime, model 3 could not find any statistical significance in the RE model, but the FE model produced a negative association between trustworthiness and confidence and VC investment activity. The reason for this can be explained via the model's assumption that FE models do not consider the cross-sections but instead the time effects of the panel data.

5.4.5 Market Size as the Determinant of the VC

This section will investigate how the magnitude of the domestic and foreign markets affects VC investment activity within Europe. Table 21 summarizes the descriptives and the correlation coefficients used in this study. It can be clearly observed that the independent variables are highly correlated with each other, but there is a negative association between the dependent variable and the independent variables.

Table 22: Descriptives and Correlation Matrix for Market Size

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3
VENMARKET	171	0.031	0.022	0.000	0.116	1.000		
DOMESTIC MARKET SIZE	171	4.551	0.784	2.505	5.869	-0.097	1.000	
FOREIGN MARKET SIZE	171	5.397	0.539	4.134	6.562	-0.159	0.809	1.000

Before discussing the results, the variables will be plotted across time to see their associations, and the relevant diagnostics will be investigated in the coming sections. Figure 7 below plots the independent variables across time. It can be observed that the independent variables generally follow a constant trend across time except for some fluctuations among a few countries, such as the euro-debt crisis player Greece and smaller countries like Luxembourg, etc. It can also be observed that the spread between foreign market and domestic market size is subject to high comparisons with the other countries in the sample. Except for Greece, it is also observed that the domestic market size was unable to exceed the foreign market size, but during 2007 and the peak of the Eurozone debt crisis, these two values were nearly identical.

Tables 22 and 23 report the diagnostic tests for the following models before they are estimated with the RE versus the FE models. To assess the impact of market size on VC investment activity in Europe, the RE model is estimated and checked for poolability. Before checking the poolability of the model, cross-sectional dependency of the models must be checked. The models were assumed to be cross-sectionally dependent, which was proved by the Pesaran (2004) CD test. After the RE models are estimated, they can be checked for poolability. The Breusch-Pagan (1980) LM $\bar{\chi}^2$ statistic shows that for all the RE models, the null hypothesis was rejected with high significance.

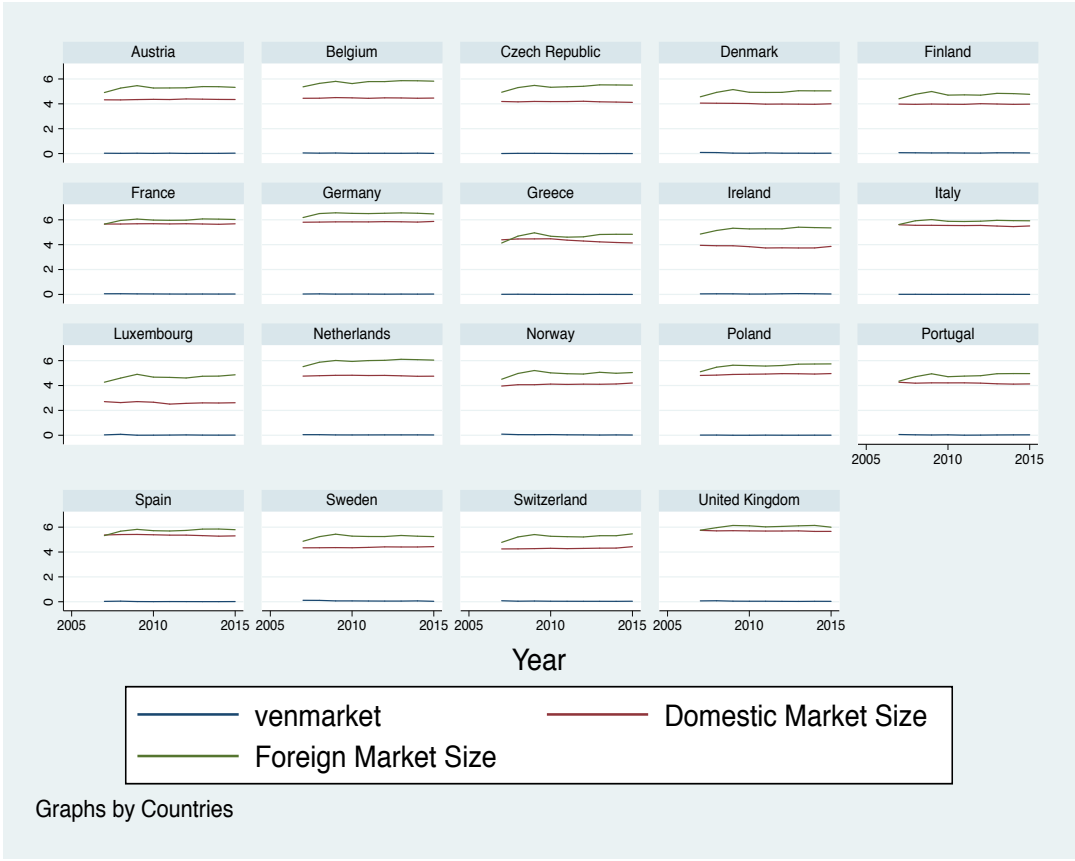

Figure 7: Panel Line Plots for the Market size

These tests show that the RE model proved to be the best applicable model, up until further tests were proposed. In addition to this, our models also tested if the FE models better represented the estimated models. In order to prove this, the FE models were also estimated and checked for cross-sectional dependence. Table 23 documents that cross-sectional dependence was not a valid assumption for the model.

Table 23: AR(1) and Model Selection Diagnostic for Market Size

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	3.113	0.0946	2.326	0.1446	2.903	0.1056
Hausman Test	2.14	0.9951	1.31	0.9999	1.90	0.9995

The last procedure tested whether the consistent or the efficient model was more efficient for the individual models to be estimated. For all the models, it was proven that RE models are more efficient in contrast to the FE model. The χ^2 statistics received for models 1, 2, and 3 were 2.14, 2.326, and 2.903, respectively, with highly insignificant probability values.

Table 24: Other Diagnostic Tests for Market Size

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	363.34	-	351.46	-	362.18	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.251	-1.458	-1.839	-1.992	-1.360	-1.613
Pesaran CD Test p-value	1.7891	1.8551	1.9341	1.9536	1.8261	1.8933

Table 25 shows all the models for both the FE and the RE models for representation purposes. Except for model 1, the rest of the models consider interaction terms within the regression. The first model does not discriminate the model in terms of classification, while second and third models discriminate variables using the interaction terms, such as adoption of the euro, and euro and opt-out countries for models 2 and 3, respectively.

Table 25: Regression Output for Market Size

	Model 1 (RE)	Model 1 (FE)	Model 2 (RE)	Model 2 (FE)	Model 3 (RE)	Model 3 (FE)
DOMESTICMARKETSIZE	-0.0120	-0.0447	0.0163	-0.0172	-0.00457	-0.0842
	(-1.13)	(-1.57)	(1.02)	(-0.24)	(-0.24)	(-1.39)
FOREIGNMARKETSIZE	0.0107	0.00519	-0.0113	-0.0113	0.00550	0.00776
	(0.80)	(0.28)	(-0.68)	(-0.46)	(0.36)	(0.41)
EURO*DOMESTIC MARKET SIZE			-0.0334*	-0.0209		
			(-1.93)	(-0.28)		
EURO*FOREIGN MARKET SIZE			0.0266*	0.0281		
			(1.94)	(1.51)		
OPTOUT*DOMESTIC MARKET SIZE					-0.00867	0.0565
					(-0.38)	(0.84)
OPTOUT*FOREIGN MARKET SIZE					0.00697	0.00210
					(0.41)	(0.13)
CONSTANT	0.0497	0.226	0.0429	0.154	0.0453	0.192
	(1.35)	(1.32)	(1.32)	(0.94)	(1.15)	(1.17)
OBSERVATIONS	171	171	171	171	171	171
R^2	0.1586	0.0428	0.2125	0.0005	0.1574	0.0006
χ^2 STAT.	112.3151		111.9964		141.5599	
F- STAT.		7.0177		9.2907		6.0305
PROB.	0.0000	0.0002	0.0000	0.0000	0.0000	0.0004

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In terms of regular terms, it could not be documented that the market size in both the domestic market and the foreign market has any statistically significant association. This assumption is valid for both the efficient RE and the consistent FE models. The only significant relationship could be achieved with model 2, where it is documented that there was only a slight statistically significant relationship documented for both interaction variables (p-value<0.10). This effect can only be measured in the RE estimation of model 2. The positive association of domestic market size (β=-0.0334) and the negative association of foreign market size (β=0.0266) show us that the size of the market has a close association with the countries that adopted the euro. If the

size of the market increases, venture capitalists are likely to divert their investments to other countries that have adopted the euro. For the foreign market, the same conclusion with a reversed approach was found, where if the foreign market increases, the VC investment switches countries. To conclude, the effect of market size throughout the models can only be constructed with the euro countries, and market size appreciation has a negative impact on the amount of VC investment received by euro users.

5.4.6 Innovation and Sophistication as Determinants of VC

The previous sections documented how economies are able to efficiently determine VC investment attraction in European countries. In addition, it was outlined that VC investments are driven by companies' innovative capacities. In this section, companies' innovative capacities will be measured using two variables: business sophistication index and innovation index. Table 25 shows the associated correlation coefficients and the associated descriptives for the variables used in this study.

Table 26: Descriptives and Correlation Matrix for Innovation Drives Variables

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3
VENMARKET	171	0.031	0.022	0.000	0.116	1.000		
BUSINESS SOPHISTICATION INDEX	171	5.078	0.558	3.744	5.935	0.580	1.000	
INNOVATION INDEX	171	4.550	0.791	2.979	5.787	0.620	0.906	1.000

In the previous sections, on average, the independent variables associated correlation coefficients with the dependent variable were positive, but the association with the independent variable was below the mid-range. On average, high values can be observed for the independent variables, meaning that the innovative capacities of these

economies are quite high. Thus, they can be classified as innovation-driven economies.

The following graph (Figure 8) represents both dependent and independent variables through time. It shows that innovation factors have been determined as high for all countries, except Greece and Spain. This will boost our expectations where VC is the innovative money, as asserted by many scholars. Interim countries that share lower innovative factors also share some mutual history. In particular is what they faced during the European debt crisis, while the other members did not show any potential decrease in innovation factors during the crisis.

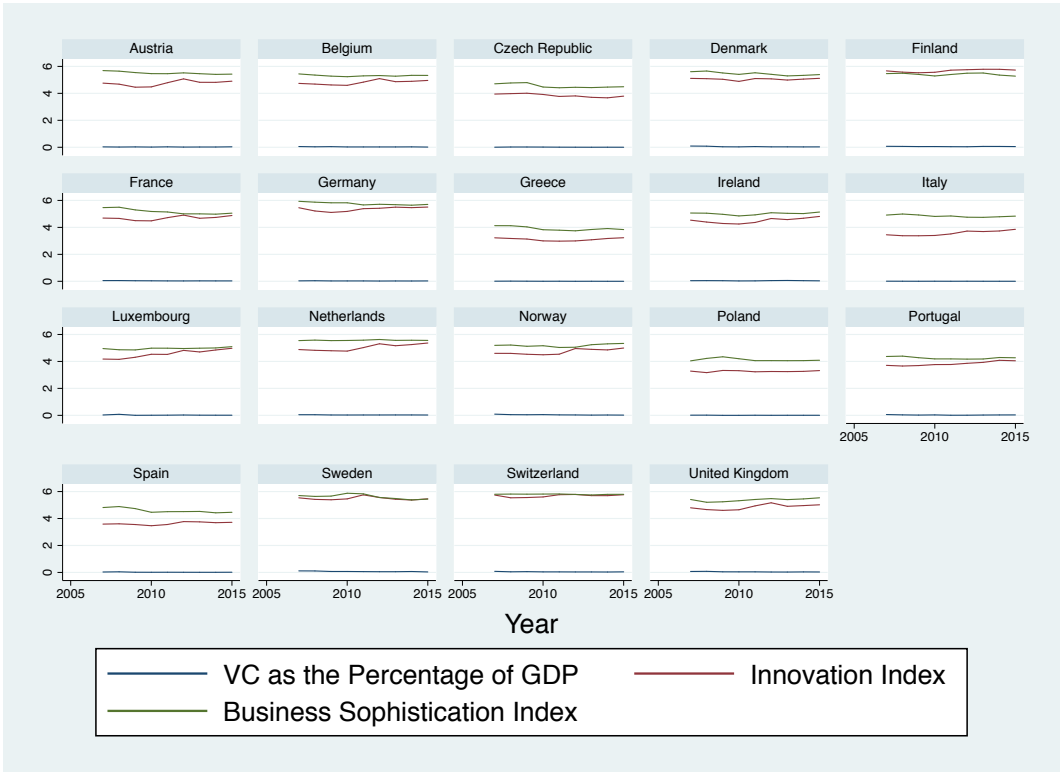

Figure 8: Panel Line Plots for Innovation Drives Variables

The summary of statistics shows potentially high figures, which are in line with the previous findings on innovation as a boosting factor for VC involvement. However,

without observing the regression output, it is impossible to reach a conclusion about these figures. To observe the best possible model, it is necessary to construct a link to VC. In this part of the thesis, the diagnostics will be checked before proceeding with the model.

Tables 26 and 27 show the specific models' diagnostic tests and the mutual diagnostic test for the models. Before proceeding with the model estimation, the first-order serial correlation was checked via the Wooldridge (2002) test. It documented that none of the models (neither FE nor RE) had a serial correlation, as reported in Table 26.

Table 27: AR(1) and Model Selection Diagnostics for Innovation Drives Variables

	Model 1 (RE and FE)		Model 2 (RE and FE)		Model 3 (RE and FE)	
	Test Statistics	Associated p-value	Test Statistics	Associated p-value	Test Statistics	Associated p-value
Wooldridge Test	3.075	0.0965	2.844	0.1090	3.237	0.0888
Hausman Test	8.31	0.5983	10.34	0.5860	7.94	0.7896

All models were also tested for cross-sectional dependence. Pesaran (2004) test statistics could not be rejected for all the models, with the conclusion that our models are cross-sectionally independent. The model diagnostics in Tables 26 and 27 report only the RE and FE models. However, to check if the model can be estimated with the pooled OLS model, the RE models were first estimated using the Breusch-Pagan (1980) LM test. The test statistics of $\bar{\chi}^2$ show that the models can be mutually rejected for the poolability hypothesis. Thus, it can be concluded that RE is more efficient than

pooled OLS and be compared with other types of estimation, which are reported. After estimation of the FE models, a test was conducted to choose between efficient and consistent models. The bootstrapped Hausman (1978) test showed that the FE model could not be selected as superior to the RE models in any case, as indicated by the χ^2 statistics of this test, which failed to be rejected in all scenarios.

Table 28: Other Diagnostics for Innovation Drives Variables

	Model 1		Model 2		Model 3	
	RE Model	FE Model	RE Model	FE Model	RE Model	FE Model
Breusch Pagan LM test for Random Effects	95.44	-	60.01	-	73.08	-
Breusch Pagan LM Test for Random Effects p-value	0.0000	-	0.0000	-	0.0000	-
Pesaran CD Test	-1.704	-1.419	-1.772	-1.693	-1.706	-1.596
Pesaran CD Test p-value	1.9116	1.8440	1.9236	1.9096	1.9121	1.8895

Table 28 shows the regression output for the estimated models. In this table, both consistent and efficient models are represented. It is essential to point out that in all cases, the efficient model (RE model) is superior to the consistent model (FE model). However, for the efficient models, it can be concluded that only the first model had a statistically significant effect on VC. The innovation index variable positively and profoundly statistically affected VC investments within Europe when no discrimination was made among the sample countries ($\beta=0.0244$, p-value<0.01), while no statistically significant relationship could be found between the business sophistication index and VC investment activity. In the interim, some statistical relationship could also be constructed with the regular innovation index variable in model 3. The positive beta coefficient of 0.0228 is slightly lower compared to the first

model, but the magnitude of significance is likely to decrease in the meantime where the probability value is less than 10%.

Table 29: Regression Output for Innovation Drives Variables

	MODEL 1 (RE)	MODEL 1 (FE)	MODEL 2 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 3 (FE)
INNOVATION INDEX	0.0244***	0.00639	0.0170	-0.0334**	0.0228*	-0.0269
	(3.93)	(0.63)	(1.32)	(-2.18)	(1.68)	(-1.52)
BUSINESS SOPHISTICATION INDEX	-0.0120	-0.0105	-0.00370	0.0258	-0.00975	0.00649
	(-1.52)	(-0.79)	(-0.29)	(1.13)	(-0.70)	(0.32)
EURO*INNOVATION INDEX			0.00779	0.0409***		
			(0.54)	(2.90)		
EURO* BUSINESS SOPHISTICATION INDEX			-0.00849	-0.0408		
			(-0.63)	(-1.45)		
EURO* INNOVATION INDEX					0.00124	0.0379*
					(0.08)	(2.06)
OPTOUT*BUSINESS SOPHISTICATION INDEX					-0.00179	-0.0179
					(-0.12)	(-0.65)
CONSTANT	0.0000191	0.0737	-0.00328	0.0852	-0.00151	0.0795
	(0.00)	(1.08)	(-0.16)	(1.38)	(-0.08)	(1.11)
OBS.	171	171	171	171	171	171
R^2	0.6210	0.1690	0.6250	0.0184	0.6220	0.0074
χ^2 STAT.	108.9470		193.4519		138.0895	
F- STAT.		12.1612		16.8054		10.4829
PROB.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The efficient models' interaction variables reported in models 2 and 3 could not find any significant relationship between the independent variables and VC investment activity.

In the other scenarios of the consistent models (FE), some significant relationships were found in the models with the interaction terms (model 2 and model 3), while no significant associations with the independent variables were found where only the

regular term is presented (model 1). While model 2 found a statistically significant relationship with the regular term of the innovation index and VC, this could not be achieved with the later model. Model 2 also documents that the innovation index variable is highly statistically significant with mutual change in the sign ($\beta=0.0409, \text{probability}<0.01$). In model 3, it can be also observed that the innovation index interaction variable is slightly significant with a decrease in the overall impact on VC with a beta coefficient of 0.0379 and a probability value of less than 10%. These estimations cannot be relied on due to two facts. First, the bootstrapped Hausman test was in favor of the RE models; and second, the explanatory power of the models is quite short for an efficient determination of VC investment activity with an overall R^2 of 1.84% and 0.74%, respectively, for models 2 and 3.

The findings in this section outline that overall, innovation has a generally positive impact on VC investments within Europe. In addition, a positive contribution to receive VC investment within Europe was made by countries that met the ERM criteria within the EU but did not achieve innovation. Mutually, it was documented that high-income European countries are not affected by the sophistication magnitude of the businesses.

5.5 Conclusion

This section of the study tried to test individually the effects of efficiency and innovation drivers of competitive economies as determinants of VC investment throughout high-income European countries. Since the earliest studies assessing the determinants of VC on the aggregate level, scholars have chosen to assess via RE models and FE models. This study found that with the exception of one regression, no FE models could better explain the regressions used in this model. This study differs

from the existing literature in that no previous study has tried to examine the monetary unions and the ERM criteria, while this part of the thesis partly considers and divides the sample countries according to that criteria.

Overall, this study found mixed results according to the criteria applied. For the general model, it can be observed that education variables (quantity of education and on-the-job training) and the innovation index were the primary driving forces of VC investment throughout our sample. Some additional effects, both enhancements and detractions, for VC via the various variables used were found in interim observations. For countries that did not choose to adopt the common currency (euro), some enhancement effect from the labor market's ability to efficiently use the labor force and the presence of sophisticated demands from residents within the economy were observed. However, there was a counterargument to those observed results, with the quality of secondary and higher education leading to a decrease of VC investment in the local economy. Euro-adopting countries were affected more by the variables used in this study. It was documented that education, competition, financial markets and institutions, and market size are the leading determinants for attracting VC investment in the sample countries.

For countries that adopted the euro, the quantity and quality of education had some strengthening effect while the on-the-job training variable decreased the attraction of VC investment. Competition is one of the critical areas for VC investment for countries using the euro; while higher sophisticated demands for goods and services repelled VC investment, domestic competition and foreign competition attracted VC investments. The financial markets also had some mixed conclusions for venture capitalists. While the financial markets had some repelling effects on VC,

trustworthiness and confidence had a significant promoting impact for the euro adopters. Lastly, market size showed that it has significant implications for countries. It was observed that if the market size increases, this leads to VC fleeing from one country to another, from smaller markets to larger ones. Finding negative and positive associations with domestic and foreign market size supports this hypothesis mutually.

The last type of regression differentiated countries by euro usage and satisfying ERM criteria, and some conclusions were implicated. It showed that two countries, especially Denmark and the UK, have a significant impact on the determinants of VC. The addition of these countries into interaction or regular terms significantly changed how the results were interpreted. Compared with the results of euro adopters versus non-adopter countries, it can be seen that education variables follow the same path with the interaction terms while inverted terms were observed for statistically significant variables for the regular terms. Also, with the goods market, it precisely formed similar characteristics with the discriminating factor of euro usage, but the foreign competition variable failed to keep its significance in the interaction terms. In addition, labor market variables, such as the efficient use of talent variable, showed some positive effect for the regular term but showed the reverse for the interaction term. In contrast, switching two countries from the previous model did not affect any significant changes in the regular term, but it became significant in the interaction term. Finally, it could only be documented that innovation is the driving force for the regular term, but no relationship to the interaction term could be documented in this study's results.

In conclusion, this study tried to assess the impact of market enhancers and innovation enhancers on VC determinants. The findings suggest that 19 European high-income

countries show different determinants on the three criteria mentioned in this study. For the overall sample, education and innovation were documented as significant driving forces, but according to the specifications listed here, the determinants are subject to change. In the sample considered in this study, it was documented that not only does forming a single market with a single currency have a significant impact on the attractiveness of VC investments. To attract VC to individual states, euro users have to extensively increase their investments in education, implement better competition policies, raise trustworthiness and confidence levels in the financial markets, and adopt better workplace practices to attract VC investment to the countries. It should be kept in mind that this study focusses on individual aggregates of the sections. In addition to Denmark and the UK having a significant effect on VC investment activity, their impact cannot be overlooked due to the high volume of VC in these countries. Further studies might touch upon the interior specifications of VC policies in these two countries, particularly since one of the critical members (UK) has started negotiations to exit the EU.

Chapter 6

TESTING HUMAN CAPITAL AND INNOVATION ECOSYSTEM AS THE BASIS OF VC DETERMINANTS IN HIGH-INCOME EUROPEAN STATES

6.1 Introduction

From early civilizations, education has been a fundamental concept for the advancement of economies. Attaining knowledge and applying it to real-life has changed history. It is an undisputed fact that education and innovation walk hand-in-hand, but mutually, so do a healthy and educated workforce.

It is a general consensus that as health improves, individuals' production capabilities are likely to increase (Arora, 2001; Banerjee & Iyer, 2005; D. E. Bloom & Canning, 2000; Mattke et al., 2007). Also, with a healthier workforce in the future, their knowledge attainment and its application to innovative activities will increase. For example, some scholars showed that R&D expenditure increased due to schooling and led to economic growth via innovation activities (Benos & Zotou, 2014; Hanushek, 2007; Papageorgiou, 2003).

In addition, some scholars showed that if primary schooling increases, it will lead to increased levels of post-secondary schooling (Barro, 2011; Hanushek & Kimko,

2000). These findings suggest that human capital is an essential driver of innovation. Thus, a triangular relationship may exist between VC, innovation, and human capital.

Innovation has also been documented by many scholars in different forms, such as innovation's effect on VC or innovation as one of the determinants boosting VC (Chemmanur, Loutskina, & Tian, 2014; Engel & Keilbach, 2007; Faria & Barbosa, 2014; Félix et al., 2013; Gompers & Lerner, 1998, 2001, 2004; Groh & Wallmeroth, 2016; Hirukawa & Ueda, 2011; Jeng & Wells, 2000; Obrimah, 2015; Romain & van Pottelsberghe de la Potterie, 2003, 2004; Stuck & Weingarten, 2005). In addition to general assessments, studies on patents, R&D expenditure, and innovation indexes have also been conducted. Unfortunately, no study has investigated the innovation ecosystem where other variables are directly related to the innovation background.

The current research will consider the effect of human capital and the innovation ecosystem, and its effect on VC in high-income countries located on the European continent. In addition, monetary integration differences via interaction variables will be made. In addition to the general sample, this study used the interaction of Eurozone countries and ERM satisfying countries to assess the differences between Eurozone countries, ERM members, and other European high-income countries.

6.2 Theoretical Framework

For the data of VC investments spanning 2007–2015, the RE model is used to represent this study's findings. The RE model is expected to have superior performance while conducting this research compared to the FE model. RE captures the country-specific effect on the regression where FE models are lacking in that sense. Also, RE models have only been occasionally employed in the literature to measure

VC investment determinants (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016).

In addition to this, using generalized least squares models provides more efficient results when the small sample size, in which the number of observations is smaller than the cross sections, is considered (Baltagi, 2012; Félix et al., 2013; Groh & Wallmeroth, 2016; Jeng & Wells, 2000; Romain & van Pottelsberghe de la Potterie, 2004).

Following these assumptions, the following criteria will be considered, and the results of both the RE and FE models will be reported. The expected result is that the RE model will be more appropriate for this study. However, to support this fact, this study will employ the robust Hausman test to prove the significance of either model.

First, the human capital variables and their possible effect on the dependent variable are tested:

$$VENMARKET = \beta_0 + \beta_1 HEAPRIM_{it} + B_2 HET_{it} + \beta_3 DUMMY_{YEAR} + a_i + u_{it} \quad (1)$$

where VENMARKET represents the VC investments as a percentage of GDP at market prices, HEAPRIM is the aggregated index of the health infrastructure and primary education system, and HET represents the secondary and tertiary education system and training in the workplace. Lastly, DUMMY will represent the year dummy variables. The remaining terms, a_i and u_{it}, show the models' error terms for explicit country and time effects.

Equation 2 below exactly mimics Equation 1 with the addition of the interaction variables to test:

$$VENMARKET = \beta_0 + \beta_1 HEAPRIM_{it} + B_2 HET_{it} + \beta_3 EHEAPRIM + \beta_4 EHET_{it} + \beta_5 DUMMY_{YEAR} + a_i + u_{it} \quad (2)$$

where the remaining variables EHEAPRIM and EHET are the interaction dummies of the original variables, HEAPRIM and HET, where if the country has already adopted the euro, the value will take the results of multiplication by 1 and the original variable at the regression. This will enable the possibility to test the effect of HEAPRIM and HET variables for the euro adopter states and the remaining sample.

Equation 3 presented below will have some alterations to Equation 2, where instead of the euro interaction, it will report the opt-out plus euro countries. Invest Europe (2015) states that among the non-euro adopting countries, two countries, Denmark and the UK, are the recipients of most VC investment.

At the same time, these two countries could satisfy the ERM criteria to adopt the euro, but they chose not to. Due to this fact, it is possible that these countries might have more determination power among the non-euro users. By combining these two countries with the euro users, it could be tested to see if there are any differences between countries who satisfied the ERM criteria or not:

$$VENMARKET = \beta_0 + \beta_1 HEAPRIM_{it} + B_2 HET_{it} + \beta_3 OHEAPRIM + \beta_4 OHET + \beta_5 DUMMY_{YEAR} + a_i + u_{it} \quad (3)$$

where the only change in Equation 3 is that instead of EURO interaction variables, they are replaced with the opt-out interaction variables, where if the country has

satisfied the ERM criteria, original variables of HEAPRIM and HET will be multiplied by 1, and for the other cases, zero to form OHEAPRIM and OHET, respectively.

Previous models have tried to model the impact of human capital variables, and the following models will try to investigate the relationship between the innovation ecosystem and VC investments.

$$VENMARKET = \beta_0 + \beta_1 TCHRDY_{it} + B_2 FMRKT_{\mathrm{it}} + \beta_3 \mathrm{BSN}_{\mathrm{it}} + \beta_4 INNO_{it} + \beta_5 DUMMY_{YEAR} + a_i + u_{it} \quad (4)$$

Where TCHRDY is the aggregated technological adoption index, FMRKT is the foreign market index, BSN is the business sophistication index, and lastly, INNO is the innovation index for the associated country.

Also, this model will be tested with the interaction variables for states that adopted the euro and countries that are not using the euro as their official currency. Equation 5 below shows the mimicked version of Equation 1, and at the same time, the addition of the interaction variables:

$$VENMARKET = \beta_0 + \beta_1 TCHRDY_{it} + B_2 FMRKT_{\mathrm{it}} + \beta_3 \mathrm{BSN}_{\mathrm{it}} + \beta_4 INNO_{it} + \beta_5 ETCHRDY_{it} + \beta_6 EFMRKT_{it} + \beta_7 EBSN_{it} + \beta_8 EINNO_{it} + \beta_9 DUMMY_{YEAR} + a_i + u_{it} \quad (5)$$

where the remaining variables, ETCHRDY, EFMRKT, EBSN, and EINNO. are the interaction dummies of the original variables of ETCHRDY, EFMRKT, EBSN, and EINNO, where if the country has already adopted the euro, the value will take the results of multiplication by 1 and the original variable at the regression. This will

enable the possibility to test the effect of the HEAPRIM and HET variables for the euro adopter states and the remaining sample.

Equation 6 represented below will have some alterations to Equation 5 where instead of the euro interaction, it will report the opt-out plus euro countries. Invest Europe (2015) states that among the non-euro adopting countries, two countries, Denmark and the UK, are the recipients of most VC investment.

At the same time, these two countries could satisfy the ERM criteria to adopt the euro, but they chose not to. Due to this fact, it is possible that these countries might have more determination power among the non-euro users. By combining these two countries with the euro users, it could be tested to see if there are any differences between countries who satisfied the ERM criteria or not.

$$VENMARKET = \beta_0 + \beta_1 TCHRDY_{it} + B_2 FMRKT_{\mathrm{it}} + \beta_3 \mathrm{BSN}_{\mathrm{it}} + \beta_4 INNO_{it} + \beta_5 OTCHRDY_{it} + \beta_6 OFMRKT_{it} + \beta_7 OBSN_{it} + \beta_8 OINNO_{it} + \beta_9 DUMMY_{YEAR} + a_i + u_{it} \quad (6)$$

6.3 Data, Sample Selection and Methodology

This part will be divided into three subsections. The first section will consider which dependent variables and independent variables to use. The second part will discuss how the sample countries were selected. Lastly, the methodology will be discussed in the remaining section.

6.3.1 Data

The data used in this part of the thesis was obtained from various resources and covers the period of 2007–2015. Aggregate VC data was obtained from the Invest Europe database (2016), and to check the validity of the data, it was cross-checked against the data from the Eurostat database (2016). For the independent variables, this research relied on the variables reported in the World Economic Forum's Executive Opinion Survey (Browne, Di Batista, Geiger, & Verin, 2016). The Executive Opinion Survey is an aggregated index to measure the competitiveness of the economies. This research relied on to assess impact of both the human capital variables and innovation ecosystem individually on VC investments.

For human capital, two independent variables have been employed, HEAPRIM and HET, where both indexes are scaled between 1 and 7. HEAPRIM is the aggregated index of health conditions within the country and the primary education infrastructure (HEAPRIM), while HET is the aggregated index of secondary and tertiary education, and training received in the workplace.

For the innovation ecosystem, a total of four independent variables were employed. This study relied on the technological adoption index, the foreign market index (total value of the export of goods and services measured with the purchasing parity index [PPP] normalized at the 1–7 scale), business sophistication index, and innovation index.

6.3.2 Sample Selection

This research is based on the European continent with an intentional focus on EU member states and the EFTA members. The initial sample consisted of 32 countries

where 28 were EU member states and the remaining four were EFTA countries. For the selection of the sample countries, we followed several selection criteria.

Firstly, to be chosen as sample members, countries had to be high-income countries with the constraints of being either EU members or EFTA members during the period of study. With this criterion in place, the initial sample of EU members decreased from 28 to 21, but the number of EFTA countries remained at four. According to these criteria, Croatia was omitted because its accession into the EU occurred in 2013.

Secondly, the countries VC data of individual countries had to be readily available in the Invest Europe (2015) database. The Invest Europe (2015) database reports investment data on either an aggregated or individual basis. Due to this reason, this study focuses on individual states. With this criterion in place, the final sample includes 17 EU member states (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden, and the UK) and two EFTA countries (Norway and Switzerland).

6.3.3 Methodology

All the models represented in Equations 1–3 will be reported as FE and RE models, but it is essential to determine which model is more appropriate; thus, following the rule of thumb will be employed. Félix et al. (2013) suggested that to use RE models, the country-specific residuals should not be associated with the independent regressors. Although both regressions will be reported in this study, there is a general consensus that RE models better represent panel data models compared to FE models, due to their ability to capture effects within the independent variable instead of the constant term (Félix et al., 2013; Groh & Wallmeroth, 2016; Romain & van Pottelsberghe de la Potterie, 2004).

In addition to employing variables, time effects are also employed in this study. Employing time FE also allows us to eliminate the cross-section problem. Additionally, the model is estimated using serial correlation, which might be present while estimating the model (Arellano, 2003; H. White, 1980; Wooldridge, 2013).

Before testing the relevance of each model, cross-sectional dependence testing will be performed. It has been proven by many researchers that cross-sectional dependence testing will not produce adequate results for micro-panel studies where the micro-panels have more than 200 cross sections (Baltagi, 2012; Baltagi et al., 2012; Pesaran, 2004; Pesaran et al., 2008).

Due to the problems of cross-sectional dependence testing for the variables, this study relies on regression for cross-sectional dependence, and uses the Pesaran (2004) CD test due to several drawbacks of other tests. The Pesaran (2004) CD test considers the following case that if the number of cross-sections is larger than the number of periods it will promote better results. It is this study's intention to obtain efficient and robust results.

Pesaran (2004) proposes the following model where statistics are estimated as:

$$CD = \sqrt{\frac{2T}{N(N-1)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)} \qquad (5)$$

where it is similar to test but instead of using the squared version of the residual correlations, Pesaran (2004) uses the serial correlations that will not decrease the power of the test if N≥T. The following equation shows the null and alternative hypothesis for the Pesaran (2004) CD test:

$$H_o: u_{it} = \sigma_i \epsilon_{it} \quad (6)$$

$$H_A: u_{it} \neq \sigma_i \epsilon_{it} \quad (7)$$

where H_o, H_A represent cross-sectional dependence and cross-sectional independence, respectively.

Although the RE model is more efficient in the literature, for consistency, the RE model should also be tested here to see if it is the more efficient model. First of all, we use the Hausman (1978) test:

$$\chi^2 = (\beta_{na} - \beta_{nb})'(V_{na} - V_{nb})^{-1}(\beta_{na} - \beta_{nb}) \quad (8)$$

where β_{na}, β_{n2}, V_{na}, and V_{na} is the coefficient vector of the dependable estimator, coefficient vector of the efficient estimator, the covariance matrix of the dependable estimator, and covariance matrix of the dependable estimator, respectively. During the process of estimating the models, the model will be clustered according to the countries using the bootstrapped version of the model.

The covariance of the matrix will be bootstrapped to eliminate the effect of biased standard errors that might be due to the presence of heteroscedasticity (Cameron & Trivedi, 2005, p. 717). If the null hypothesis of the Hausman test (1978) fails to be rejected, the RE model will prove to be appropriate.

Following the Hausman (1978) test, the RE model will also be tested to see if it can be represented by the simple pooled OLS estimator. In order to check this possibility, an augmented version of the Breusch-Pagan (1980) LM test will be used, which was modified by Baltagi and Li (1990), in which they incorporated the possibility to conduct the test in the presence of unbalanced panel data. The model is shown as follows:

$$y_{it} = \alpha + x_{it}\beta + v_i \qquad (9)$$

Baltagi and Li (1990) can be calculated as:

$$\lambda_{LM} = \begin{cases} \frac{nT}{2(T-1)}\left\{\frac{\sum_i(\sum_t v_{it})^2}{\sum_i\sum_t v_{it}^2} - 1\right\}^2, & \hat{\sigma}_u^2 \geq 0 \\ 0 & , \ \hat{\sigma}_u^2 \leq 0 \end{cases} \qquad (10)$$

The null hypothesis for this statistics test is to test the variance of the error component of the model. If the variance is different from zero, this proves that the RE model is appropriate, and in the case of a reverse scenario, the model must be estimated with the pooled OLS model.

6.4 Empirical Results

This section will be divided into two subsections. First, this study will try to show the effect of human capital on VC investment activity. In the second section, this study tries to show how the innovation ecosystem mutually affects the independent variable.

6.4.1 Human Capital Index as the determinant of the VC Investment Activity for the High-Income European States

In this section, the study attempts to document the effect of human capital on VC investments for high-income European countries. The correlation coefficients and the descriptives of the human capital index and the dependent variable are outlined below. It would be prudent to mention that the dependent variable is reported in percentage form and the remaining variables are normalized values on a scale of 1–7

Table 30: Descriptives and Associated Coefficients of Human Capital Index

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum	1	2	3
VENMARKET	171	0.0307	0.0224	0.0000	0.1158	1.0000		
HEAPRIM	171	6.2978	0.2327	5.8081	6.8865	0.3720	1.0000	
HET	171	5.3223	0.4719	4.3507	6.2654	0.5666	0.8032	1.0000

The reported statistics show the interactions between the explanatory variables and the dependent variable construct. The statistical findings show no negative association between the variables with an additional moderate correlation between independent variables and the explanatory variables, but the correlation increases between the independent variables. One of this study's first observations was that it is possible to construct a relationship between these variables.

The panel line plots also document how these variables are plotted against time for each individual member of the study's panel. The vast gap is between independent variables, and the dependent variable is due to normalization of the independent variables that are quoted in the index.

With the help of Figure 9, it can be concluded that health and primary education are much more sophisticated compared to the higher education system. For some countries, the gap between these two variables tends to be greater compared to others. For example, for countries that suffered heavily during the credit crunch, the gap is much more comprehensive compared to their other counterparts.

Before proceeding with the regression results, the proposed models should be tested to ensure that they are free of first-order autocorrelation and poolability issues. Many scholars have stated that RE models surpass FE models in estimation power. In order to test the models, this study used the Breusch-Pagan (1980) LM test, and for the autocorrelation testing, the Wooldridge (2002) first-order autocorrelation test was employed.

Table 30 below shows the first-order autocorrelation tests and the poolability test that were conducted for the models. To test these results, the models in Equations 1, 2, and 3 were estimated using the RE estimation method.

It has already been reported that autocorrelation and poolability are not a problem for this study's models. Mutual acceptance of the null hypothesis of the Wooldridge (2002) test shows that the proposed models are free of autocorrelation problems, and mutually rejection of the Breusch-Pagan (1980) LM test shows that there is no need to estimate the models using the pooled OLS method.

Table 31 reports the estimation results and includes both RE and FE models. However, to discriminate between the results, the models were tested using the bootstrapped version of the Hausman (1978) test. In all the cases, the RE effect models were found to be superior to their FE counterparts. In line with these results, it can be concluded that there is no need to focus on FE models because the effect is mostly absorbed at the coefficient of the term.

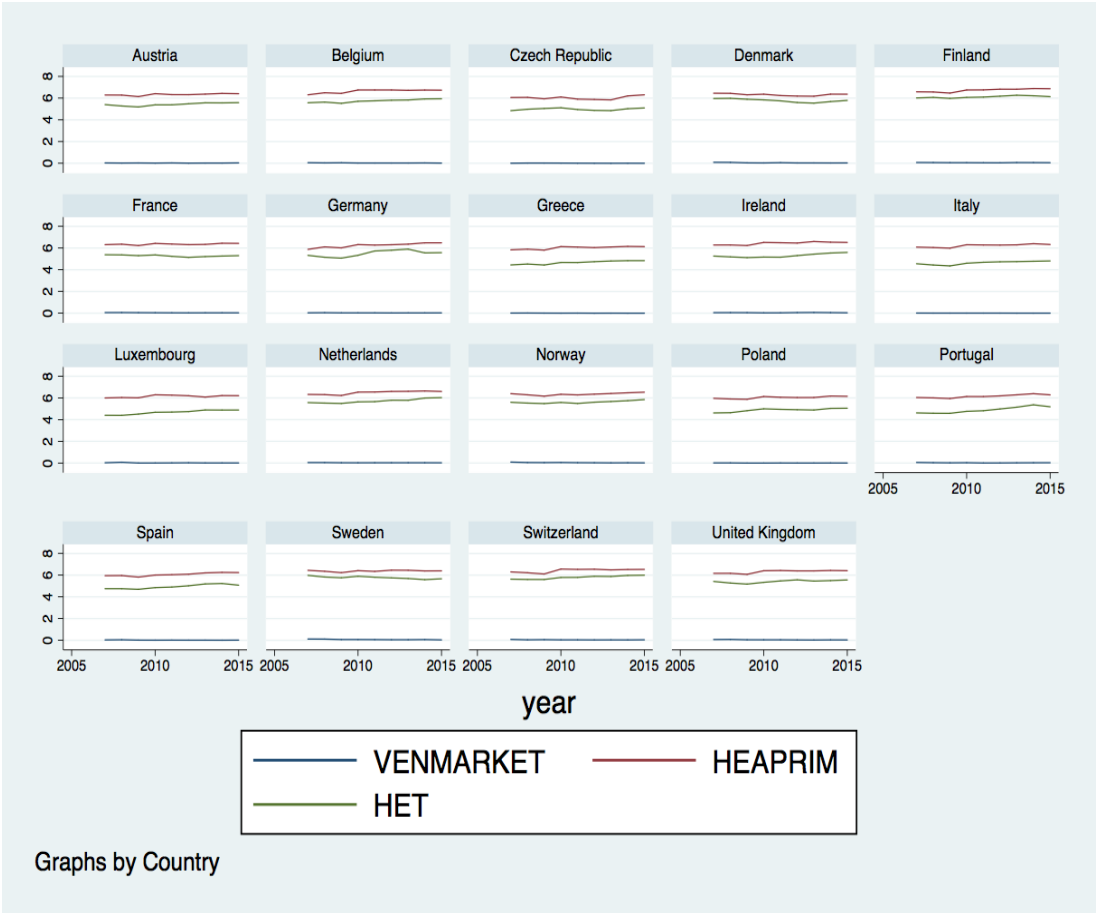

Figure 9: Panel Line Plots of VC and Human Capital Variables

A close look at model 1 shows that when the whole sample of the countries is considered, better secondary, higher education, and workplace training tends to significantly affect the sector with 1% significance and a beta coefficient of 0.0228. However, no significant relationship was found with the health and primary education system (HET) for model 1. The remaining models (2 and 3) show the effect of both the regular and the interactions terms. While model 2 tries to capture the differences between euro usage within the sample countries, in the other case, model 3 tries to discriminate between countries that satisfied ERM criteria versus those that did not.

Table 31: AR(1) and Poolability Diagnostics for Human Capital Index Determinants.

	WOOLDRIDGE (2002) AR(1) TEST	WOOLDRIDGE (2002) AR (1) P-VALUE	B&P (1980) LM TEST	B&P (1980) LM TEST P-VALUE
MODEL 1	2.527	0.1294	160.49	0.0000
MODEL 2	2.553	0.1275	106.93	0.0000
MODEL 3	2.259	0.1501	104.73	0.0000

Model 2 shows that three of the independent variables were significant. While two variables (HET and EHEAPRIM) show a positive association, the remaining term, EHET, shows a negative association with the results. The only insignificant value found in these results is the HEAPRIM term. Meanwhile, when considering the HET term, it had a more significant impact on the countries that did not adopt the euro as their official currency ($\beta=0.0507$, p-value<0.01).

While in the interaction terms, health and primary education (EHEAPRIM) show decisive significance with countries that adopted the euro as their official currency with a beta coefficient of 0.0339 and a p-value of less than 10%. This indicates that any changes in the health and education systems will positively contribute to the euro-adopting countries. Meanwhile, the higher education system shows a significant beta coefficient of -0.0405 with a p-value of less than 5%, which is beyond the expectations for this model.

Table 32: Regression Results of Human Capital Index

	MODEL 1 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 4 (FE)	MODEL 5 (RE)	MODEL 6 (FE)
HEAPRIM	0.0130	0.0143	-0.00998	-0.0279**	-0.0189	-0.0286***
	(0.95)	(0.92)	(-0.58)	(-2.30)	(-1.13)	(-2.91)
HET	0.0228***	0.0164*	0.0507***	0.0436**	0.0606***	0.0497**
	(2.75)	(1.77)	(3.46)	(2.45)	(4.12)	(2.62)
EHEAPRIM			0.0339**	0.0625***		
			(2.33)	(5.52)		
EHET			-0.0405**	-0.0411*		
			(-2.39)	(-1.90)		
OHEAPRIM					0.0399***	0.0596***
					(2.85)	(5.07)
OHET					-0.0468***	-0.0447*
					(-2.80)	(-2.08)
CONSTANT	-0.152**	-0.126	-0.156***	-0.118*	-0.154***	-0.135**
	(-2.57)	(-1.63)	(-2.90)	(-2.03)	(-2.72)	(-2.27)
OBSERVATION	171	171	171	171	171	171
R^2	0.588	0.570	0.661	0.008	0.659	0.010
χ^2 STAT.	209.753		722.554		460.463	
F-DIST		15.022		56.226		24.377
PROB.	0.000	0.000	0.000	0.000	0.000	0.000
H-TEST	4.23	4.23	10.50	10.50	6.01	6.01
H-TEST PROB.	0.9363	0.9363	0.5724	0.5724	0.9157	0.9157
CD-TEST	-1.601	-1.450	-1.434	-1.425	-1.500	-1.434
CD-TEST PROB.	1.8907	1.8531	1.8456	1.8514	1.8665	1.8483

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Model 3 is a modified version of the previous model (Model 2). The main difference is that two states (Denmark and the UK) are taken into the interaction term, which was not the case in the previous model. The findings in this model mimic model 2, with more power at the significant independent variables. These findings show that all of the explanatory variables were used in the model, but HEAPRIM provided a significant relationship both positively and negatively. The regular HET term provided a positive impact on VC investments throughout these states (β=0.0606, p-value<0.01). For the interaction terms, some different results emerged compared with the regular terms. Previously, the HEAPRIM term did not exert a

significant relationship, but the interaction term counterpart, OHEAPRIM, became a highly significant positive relationship ($\beta=0.0399$, p-value<0.01). Also, while a positive significant relationship was observed for the HET, for the interaction term EHET, a negative association with an explained variable was observed.

Compared with the previous model of the independent variables, the effect significantly increased due to our selection criteria. Countries that satisfied ERM criteria decreased the number of the regular terms' sample size and increased the number of the interaction terms' sample size. This also affected the significance level in terms of both its impact and on a statistical basis.

6.4.2 The Innovation Ecosystem as the Basis of VC Investment Activity for High-Income European States.

In this section, the innovation ecosystem variables are employed as potential determinants of VC investments in the developed economies throughout the European continent. Tables 32 and 33 represent the descriptive statistics and the associated correlation coefficients. The findings of the correlation matrix show that, with the exception of FMRKT, all of the variables had a mid-range association.

Table 33: Descriptive Statistics for the Innovation Ecosystem

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
VENMARKET	171	0.0307	0.0224	0.0000	0.1158
TCHRDY	171	5.3977	0.6848	3.2937	6.4192
FMRKT	171	5.3971	0.5388	4.1340	6.5622
BSN	171	5.0776	0.5575	3.7443	5.9346
INNO	171	4.5505	0.7906	2.9788	5.7865

The remaining association also documented a positive relationship among the independent variables. Compared with the previous association, the independent

variables had a higher correlation among them. The panel data line is also given in Figure 10 to promote the association between innovation and the remaining variables.

Table 34: Associated Correlation Coefficients for the Innovation Ecosystem

VARIABLE	VENMARKET	TCHRDY	FMRKT	BSN	INNO
VENMARKET	1.0000	-	-	-	-
TCHRDY	0.4326	1.0000	-	-	-
FMRKT	-0.1588	0.0811	1.0000	-	-
BSN	0.5801	0.7021	0.2768	1.0000	-
INNO	0.6203	0.8110	0.0828	0.9055	1.0000

The panel data plots give some idea of how the sample countries differ in terms of the innovation ecosystem. The summary that can be extracted from the plots documents that after suffering the credit crunch, there was a tendency for the countries' innovation ecosystems to become more diverse compared to their initial levels. This is mainly proven in the economies that were unstable during this period, such as Greece, Ireland, and Spain.

Before the regression results are reported, the associated autocorrelations and the poolability results will be reported. It is essential to check these results to ensure the models are free of autocorrelation, and that they can be reported with the pooled OLS method. Table 34 reports the findings for these results. First, the Wooldridge (2002) AR(1) test was employed, and a consensus was reached that the models did not have an autocorrelation issue. Second, the Breusch-Pagan (1980) test was performed, which also confirmed that it is impossible to report this study's findings using the pooled OLS method. In line with these results, this thesis will now proceed with reporting on both the RE and FE models.

Three types of models are reported as both RE and FE estimation methods. The bootstrap version of the Hausman (1978) test identified the RE models as the best possible models to represent the constructs because the test failed to reject the null hypothesis.

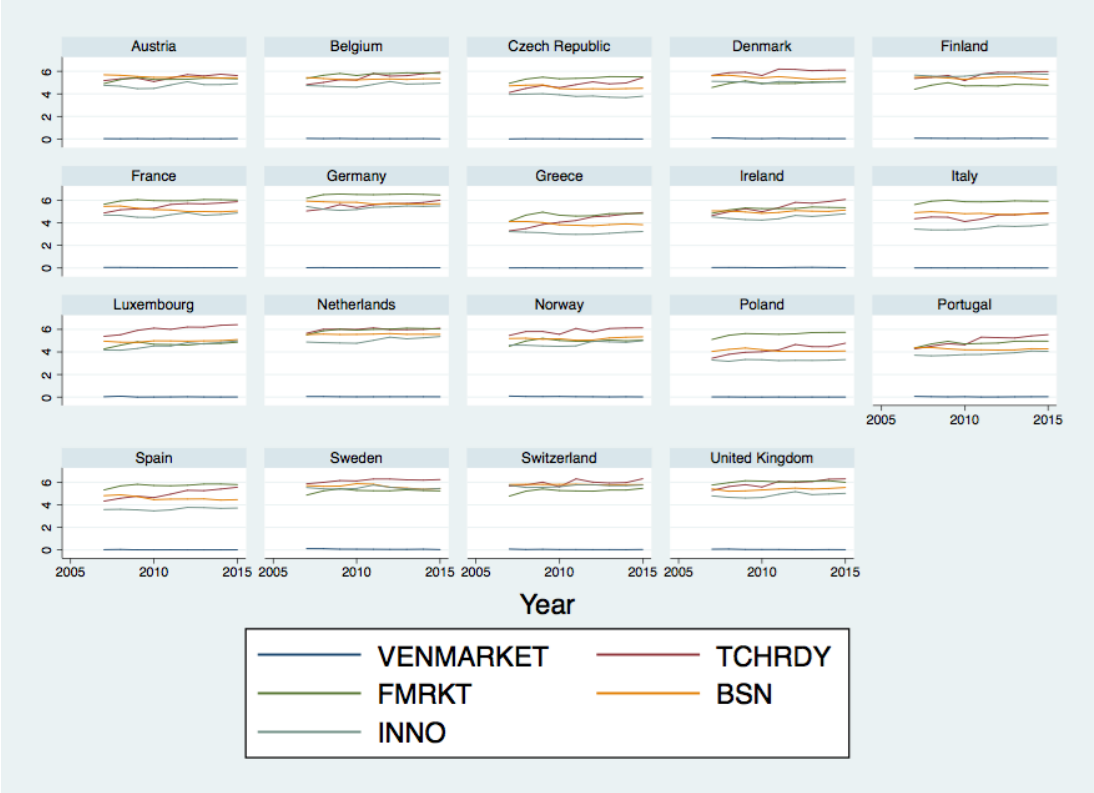

Figure 10: Innovation Ecosystem Variables Panel Data Line Plots

Table 35: AR(1) and Poolability test for the Innovation Ecosystem

	Wooldridge (2002) AR1 Test	Wooldridge (2002) AR1 p-value	B&P (1980) LM Test	B&P (1980) LM Test p-value
Model 1	3.027	0.0990	85.27	0.0000
Model 2	2.029	0.1715	53.67	0.0000
Model 3	3.032	0.0987	63.43	0.0000

The regression output displayed in Table 35 provides the results for the models. As mentioned earlier, the bootstrapped Hausman (1978) test indicated that the RE models showed no systematic differences in the coefficients. This finding supports forgoing the FE models and switching the focus to the RE models.

Model 1 considers the overall sample of high-income countries, and the findings are quite interesting. There is a positive and slightly significant effect of TCHRDY, which outlines that if a country's infrastructure is ready to absorb new technology, this will have a positive impact on VC investment activity ($\beta = 0.0131$, p-value< 0.10). In addition, a highly significant relationship was also found with INNO, clearly indicating that innovation has some impact on the level of VC investment activity. These findings confirm that innovative countries are likely to attract VC investment. Apart from TCHRDY and INNO, no other variables were able to construct a significant relationship, which clearly shows that sophisticated business techniques and exports do not have an impact on VC.

The second RE model discriminates between euro-adopted states and non-euro states, and it shows some alterations compared to the prior model. For countries that have not adopted the euro, TCHRDY and FMRKT had a significant impact on VC. TCHRDY formed a significant positive interaction, where both the impact and significance of the terms had a greater impact compared with the previous model ($\beta = 0.0187$, p-value< 0.05). This result was expected, as more readiness to adopt technology will lead to attracting VC investment activity. The other independent variable, FMRKT, showed a significant negative relationship with VC investment activity with a beta coefficient of -0.0130 and a p-value smaller than 5%. This finding

suggests that if the amount of exports is increased in non-euro adopted state, it will negatively affect VC investment activity.

The interaction terms reveal that there is a difference between countries that chose to adopt the euro. While in the regular terms, TCHRDY and FRMRKT were significant, the interaction terms show a different story. Like its counterpart, EFRMRKT had a significant effect on VC investments for the euro users, but the reverse impact was documented ($\beta = 0.0190$, p-value<0.01). For these countries, venture capitalists explicitly target these economies, and using the same currency will eliminate or reduce the transaction costs. Other significant variables reported by this model were EBSN and EINNO, where a significant negative association was found with EBSN, while the reverse is documented for EINNO. EBSN had a beta coefficient of -0.0338 and a significance level of less than 5%, which outlines the following result: if sophisticated business techniques are largely employed, this will negatively impact VC investments in these countries. Lastly, INNO made a significantly positive contribution to VC investment activity for these countries, which is in line with the expectation that the amount of cutting-edge technology attracts venture capitalists to invest in countries with a high innovation infrastructure ($\beta = 0.0267$, p-value<0.01).

Model 5 discriminates between the ERM satisfying states and those that do not. The findings of this model are similar to model 3. This model's interaction variables consider countries that have already satisfied the ERM criteria. The main difference is the addition of the two opt-out countries (Denmark and the UK) to the interaction variable terms, which led to some differences in the results of this model.

Table 36: Regression Output of Innovation Ecosystem

	MODEL 1 (RE)	MODEL 2 (FE)	MODEL 3 (RE)	MODEL 4 (FE)	MODEL 5 (RE)	MODEL 6 (FE)
TCHRDY	0.0131*	0.0106	0.0187**	0.0161	0.0221***	0.0186
	(1.83)	(1.14)	(2.57)	(1.49)	(3.43)	(1.71)
FMRKT	-0.0007	-0.0009	-0.0130**	-0.0325**	-0.0130*	-0.0263
	(-0.15)	(-0.05)	(-2.01)	(-2.11)	(-1.77)	(-1.59)
BSN	-0.0150	-0.0123	0.0085	0.0257	0.0020	0.0070
	(-1.62)	(-0.95)	(0.50)	(1.10)	(0.12)	(0.32)
INNO	0.0185***	0.0074	-0.0021	-0.0430**	0.0010	-0.0314
	(2.75)	(0.72)	(-0.21)	(-2.39)	(0.11)	(-1.54)
ETCHRDY			-0.0106	-0.0136		
			(-1.24)	(-1.42)		
EFMRKT			0.0190***	0.0436***		
			(2.91)	(2.92)		
EBSN			-0.0338**	-0.0352		
			(-2.35)	(-1.20)		
EINNO			0.0267***	0.0510***		
			(2.78)	(4.05)		
OTCHRDY					-0.0130	-0.0119
					(-1.62)	(-1.23)
OFMRKT					0.0153*	0.0246
					(1.77)	(1.31)
OBSN					-0.0225	-0.0175
					(-1.26)	(-0.62)
OINNO					0.0218**	0.0452**
					(2.13)	(2.76)
CONSTANT	-0.0182	0.0314	-0.0053	0.0686	-0.0053	0.0637
	(-0.77)	(0.25)	(-0.22)	(0.56)	(-0.21)	(0.50)
OBSERVATIONS	171	171	171	171	171	171
R^2	0.653	0.509	0.674	0.035	0.669	0.000
χ^2 STAT.	138.809		1351.178		1470.381	
F- STAT.		11.485		89.923		52.591
PROB.	0.000	0.000	0.000	0.000	0.000	0.000
H-TEST	2.8200	2.8200	19.24	19.24	5.62	5.62
H-TEST P-VALUE	0.9967	0.9967	0.2566	0.2566	0.9917	0.9917
PESARAN CSD	-1.6880	-1.602	-1.855	2.037	-1.677	-1.712
CSD P-VALUE	1.9085	1.8909	1.9364	1.9583	1.9065	1.9132

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Comparing the regular terms to the previous model (model 3), a consensus was reached over TCHRDY and FMRKT, where they led to a positive and negative impact

on VC investment activity, respectively. The impact of TCHRDY on VC increased enormously ($\beta=0.0221$, p-value<0.01), while the significant impact of the FMRKT variable stayed the same, but its statistical significance decreased ($\beta=-0.0130$, p-value<0.10). These findings suggest that certain countries such as Denmark and the UK affect the regular terms, especially with the adoption of technology, and removing them from the regular term resulted in the findings reached in this part of the model.

For the interaction terms of this model, the following scenario was observed. For countries that satisfied the ERM criteria, OFMRKT and OINNO had a significant impact on VC investment activity. Both variables showed positive effects, but their significance over VC investment activity decreased both statistically and in terms of their impact on OFMRKT ($\beta = 0.0153$, p-value < 0.10) and OINNO ($\beta = 0.0218$, p-value < 0.05).

6.5 Conclusion

This part of the thesis attempted to assess the impact of human capital and innovation ecosystems on VC investment activity for high-income European states during the period of 2007–2015. As previous studies have tried to assess the determinants of VC using FE and RE models, the same approach was used in this research. Although both estimation methods (FE and RE) were reported in this study's findings, the bootstrapped Hausman (1978) test outlined that the RE model was superior over FE model in all cases. Thus, the findings were summarized according to the efficient estimator RE model. To adequately test the impact of the explanatory variables, along with the general sample, the criteria of being an Economic and Monetary Union (EMU) member or an opt-out country were also used.

In the first section of this chapter, by employing a human capital index, this research tried to explain the effect of health and primary education with the HEAPRIM variable, and the effect of secondary education, tertiary education, and training in the workplace were tested with the HET variable.

The overall sample results showed that the effect of secondary and higher education, and workplace training were crucial, and an upward trend in this variable will likely lead to the ability of firms to attract the VC. This can be clearly linked with the indirect effect of schooling and education. Any potential increase in secondary and tertiary education will lead to an increase in output and make economies more innovative, which is the main contribution to VC (Benos & Zotou, 2014; Hanushek, 2007; Keller, 2006; Papageorgiou, 2003; Sterlacchini, 2008).

Compared to the overall sample, the other settings discussed on this topic tell a different story. The results from the three models concluded that secondary education, tertiary education, and workplace training have a significant impact on VC investment activity. However, primary education and health infrastructures only had an impact on EMU members and opt-out countries. For EMU members and opt-out countries, the findings suggest that these economies' infrastructures for the two different educational levels have different impacts on VC investment activity. Their advances in secondary and tertiary education, and training in the workplace lead to more costly investments for venture capitalists, which can also be linked with extra costs that investee firms might bear due to the relationship between on-the-job training and wages (Acemoglu, 1997; Acemoglu & Pischke, 1999a, 1999b; Bassanini et al., 2007; Booth et al., 2003; Pischke, 2001).

However, the primary education and health infrastructures had a positive association with VC activity, indicating that if states focus more on the future workforce and the health infrastructure, it can potentially lead to economic growth, and at the same time, increases in VC. This indirect effect is in line with the indirect effect where young human capital are likely to increase the potential economic growth of future entrepreneurs (Barro, 2001a; Keller, 2006; Papageorgiou, 2003).

Last, the human capital index had a positive interaction for secondary education, post-secondary education, and workplace training with VC investment. This finding showed that improvements in the higher education system can attract venture capitalists to invest in these countries. This also highlighted that the knowledge transfer generally provided by universities and the workplace is lacking in these economies. Taking this into account, development will lead to better entrepreneurial knowledge, and venture capitalists' tendency to check management qualifications during the negotiation process is essential (Lockett, Murray, & Wright, 2002).

The innovation ecosystem, however, proved to be a sufficient explanation for VC investment activity in high-income European countries. These findings had some mixed results, which must be interpreted cautiously. The differences between the overall sample, EMU members, and opt-out countries explain the mixed effects.

The evidence from the findings documented that innovation ecosystems have some actual effect on VC activity. The evidence suggested that the effect of some variables changed according to the setting. Technological readiness had a constructive effect on the general sample plus states that are not EMU members and opt-out countries. EMU members and opt-out countries already have high technological readiness, so the

impact was insignificant in those settings. The constructive impact of technological readiness can depend on two factors. The first is if the existing companies within the economy can easily adopt available technologies, and the second is if ICT is already available in the country. The findings suggest that venture capitalists value technological readiness, and it can be connected with a spillover effect, whereby non-R&D–related procedures can be absorbed by the companies with whom they interact (Blalock & Gertler, 2008; Borensztein et al., 1998; Comin & Mulani, 2006; Olsson et al., 2010).

While the innovation index was found to be an active determinant, this finding is only partly in line with the existing literature. The innovation index exerted a positive effect on the overall sample, but in terms of the other settings, it only had a positive impact on EMU members and EMU members plus opt-out countries. As mentioned above, the findings are partly in line with the recent literature. For example, Groh and Wallmeroth (2016) found that in both emerging markets and developed markets, the innovation variable had a positive interaction. Thus, in their study, both underdeveloped and developed markets had a positive association with innovation. In contrast, this research was unable to construct any positive relationships with non-EMU and non–opt-out countries.

Exports had a constructive effect on VC investment activity for EMU members and opt-out countries, whereas for the other countries, it had a destructive effect. However, no evidence could be found for the general sample. This finding is again partly in line with the findings in the literature. Again, the findings are partly harmonious with Groh and Walmeroth (2016), who found a positive interaction between exports and high-income countries throughout the world. In addition, the findings for business

sophistication were only relevant for EMU members. Furthermore, it was found that if sophisticated business techniques are used within an economy, new startups' ability to cope with this progress limits the effectiveness of small start-ups. Finally, being in a low transaction cost zone had a postive effect on this finding.

To summarize, it can be concluded that the different settings used in this study, which involved including EMU members and the opt-out countries, bore different results for the economies. This leads to the conclusion that specific currency usage is vital for human capital and innovation ecosystems to have an impact on VC investment activity. For future research, it is recommended that researchers focus more on human capital and innovation systems to fill this gap in the literature and deepen our understanding.

Chapter 7

CONCLUSION

This thesis challenged establishing a relationship between VC investments and primary education, efficiency, human capital, and innovation for European countries. Also, this thesis tried to assess the impact of being EMU and opt-out members to address a topic not visited in the literature on VC. The findings of the three chapters are summarized in the following.

Chapter 4 attempted to construct linkages between VC and factor-driven economic variables during the period of 2007–2015 for 22 European states. Using both RE and FE models, this research tested whether factor-driven variables affect the VC. The study assessed institutional quality (public and private), infrastructure, macroeconomic conditions, and the primary education infrastructure as critical determinants of VC. The findings suggest that the institutional framework, infrastructure, and primary education had strengthening effects on VC investments in Europe. However, the institutional infrastructure is more dependent on the private sector.

Chapter 5 focused on the impact of efficiency enhancers and innovations on VC investments for high-income countries during the period of 2007–2015. Three forms of regression were reported in this chapter, and efforts were made to discriminate the effect of the variables between EMU, opt-out, and the rest of the countries. The rest

of the countries specifications changed when the EMU plus opt-out members were considered.

When the whole sample was taken under consideration, the secondary and post-secondary education systems had a strengthening effect on VC investment for high-income European states, where the quantity of education and the amount of training in the workplace aided the strengthening of VC investments. In addition, it was also documented that innovation made a positive contribution to the overall sample. However, much more sophisticated findings were found when different settings were applied in the model.

The findings suggest that some factors have a strengthening effect, and some have a destructive effect on VC investments for EMU members and the remaining states. This strengthening effect was documented for quality and quantity of education, competition (domestic and foreign), trustworthiness and confidence, and exports. However, the destructive effect was documented for workplace training, quality of demand conditions, the efficiency of financial markets, and domestic market size. While for countries that are not members of the Eurozone, a reverse relationship was documented for the variables of workplace training, quality of demand conditions, efficiency of financial markets, and quality of education, whereas the other variables were insignificant in this case.

For the sample that consisted of countries that satisfied ERM criteria, findings similar to the EMU sample were found. It was observed that some of the variables followed the same pathway as the EMU findings while others did not. The findings suggested no changes in the quality and quantity of education, quality of demand conditions, and

domestic competition. However, the impact of the labor market is in place in this sample with both strengthening and weakening contributions of flexibility of the labor market and efficient use of talent, respectively.

Furthermore, the findings for the non-ERM countries were exactly the same as the non-EMU countries, except for innovation becoming a driving force and efficiency of the financial market, which were not significant in this case.

The findings in this chapter summarized that significant differences exist between monetary integration and VC attractiveness for high-income European states. It was documented that there is a general reverse relationship between the Eurozone and non-Eurozone context. Policymakers must take these differences into account to attract more VC to their economies.

In Chapter 6, this thesis attempted to identify the effect of human capital and innovation ecosystems on VC activity for 19 high-income European states. Four different specifications were tested throughout three models. The findings are subject to change according to which specifications are tested.

The human capital system focused on the health infrastructure and the whole education system. For all of the states under consideration, it was found that the post-secondary educational system had a clearly positive effect on the overall sample. However, another specification described a different story again. For the Eurozone and ERM country sample, primary education and the health infrastructure brought strengthening effects, while a destructive effect was observed with the post-secondary educational system for the ERM countries in the other case. In the regular terms regarding the non-

Eurozone and non-ERM countries, the only positive association was found with the post-secondary educational system.

These findings suggest that in order to increase VC attractiveness, countries have to focus on different policies. Mutually, Eurozone and ERM countries must focus on supporting primary education and the healthcare system to bolster their attractiveness, while the remaining countries must focus on the infrastructure of their post-secondary educational systems.

For the innovation ecosystem, it was tested for its applicability. The applicability of innovation on VC has been the interest of many scholars (Gompers & Lerner, 2004; Groh & Wallmeroth, 2016; Hirukawa & Ueda, 2011; Obrimah, 2015; Pierrakis & Saridakis, 2017; Ueda & Hirukawa, 2008 and many others). However, the innovation ecosystem has not been sufficiently or efficiently tested in these papers.

The overall sample results support that both technological readiness and innovation have a strengthening effect on VC, while these results are shared between the regular terms and interactions. The non-EMU and non-ERM countries follow the same pathway that innovation exerts a positive impact but not with technological readiness. In the meantime, this can be seen for the remaining countries. Additionally, these interacting regressions brought out two variables, which for the whole sample, were not factors. One was exports and the other was business sophistication. The observed effect of exports proved to be harmful for EMU and ERM countries, while the reverse was found for the remaining countries. Furthermore, business sophistication had a destructive effect only for Eurozone countries.

The policy implications must be considered from two perspectives. The mutual approach of EMU and ERM countries indicates that if innovation activities and the amount of exports within the respective economies increase, it will boost VC investment activity. It is not easy to control exports, but a general policy of innovative-backed growth might boost VC investment attractiveness for these countries. For the remaining countries, the results indicated that VC investments are likely to be promoted via technological readiness and exports. A more focused approach by governments to aid existing firms and startups will lead to easier technology adoption easier and the implementation of more technology that is already available in the economy.

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