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Private Equity: Barbarians at the Gate?

An analysis of the effect of private equity on the economic growth in 21 European countries from 1989-2014

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ABSTRACT

The recent collapse of Dutch department store V&D has lead to much controversy again about the effects of private equity firms on the overall market. This study examines the effect of private equity on the economic growth to provide a concrete example on the effects of private equity in line with the goal of the European Private Equity & Venture Capital Association (EVCA). Using a dataset of 21 European countries from 1989-2014, I find strong evidence that private equity investments promotes economic growth in Europe. Specifically, I find evidence that an increase in private equity investments by 1% increases the economic growth by 1.9% to 2.8%. Furthermore, the results are robust to different specifications and after controlling for endogeneity using an instrumental variable approach. This study therefore contributes to both the existing literature and the field of private equity in practice. This study is one of the first papers to use European data and to empirically examine the direct effects of private equity on economic growth. Furthermore, private equity firms and the EVCA can use the results of this paper to revise the image of the private equity industry.

JEL Classification: C34, F21, F43
Keywords: Private Equity, FDI, GDP, investments, economic growth, Europe

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1. Introduction

On December 31st 2015 a large Dutch chain of department stores, V&D, was declared bankrupt following months of uncertainty among employees and customers[1]. At first sight, this bankruptcy seems just like many of the other bankruptcies in the retail industry following the surge of internet web shops, but there is one notable difference: V&D was owned by Sun Capital Partners. Sun Capital Partners is a private equity (PE) firm located in Florida, U.S. and also holds stakes in, for example, the Dutch clothing store Scotch & Soda.

Although there is not one definition of what a PE firm is, the European Private Equity & Venture Capital Association (interchangeably called EVCA or Invest Europe) defines it as 'a form of equity investment into private companies that are not publicly traded on a stock exchange'. This usually happens through the investment in long-term, typically 10 years, closed-end funds. Investors in these funds are usually pension funds, insurance companies and high net worth individuals. Over the last few decades, PE firms have been struggling with their image of short-term minded, asset-stripping and employee-firing grasshoppers, and Sun Capital Partners is no exception. This image seems to persist from the 1980s, in which Kohlberg, Kravis, Roberts & Co (KKR) completed a leveraged buyout (LBO) of RJR Nabisco. The owners of KKR were later called 'barbarians at the gate' because of their greediness in this deal, and is nowadays a renowned example of corporate greed and PE in general. Even recently a member of the Dutch parliament, Henk Nijboer, called to battle PE excesses, although he stated that PE could be beneficial for companies[2].

The financial trouble at V&D caused Sun Capital to impose a 5.8% pay cut to V&D employees in 2015, and even in this early stage this lead to much controversy for the Dutch union FNV about the owners of V&D[3]. In a recent article in NRC Handelsblad, Sun Capital Partners were not blamed, however, for the financial distress at V&D[4]. Nonetheless, the general public and media seems to maintain the negative image of PE firms.

In fact, a recent report by Investec Fund (2013) indicates that the PE industry is indeed still struggling with its negative image since the financial crisis. The study finds that PE firms have to adapt to the new post-crisis environment to address this negative image, specifically

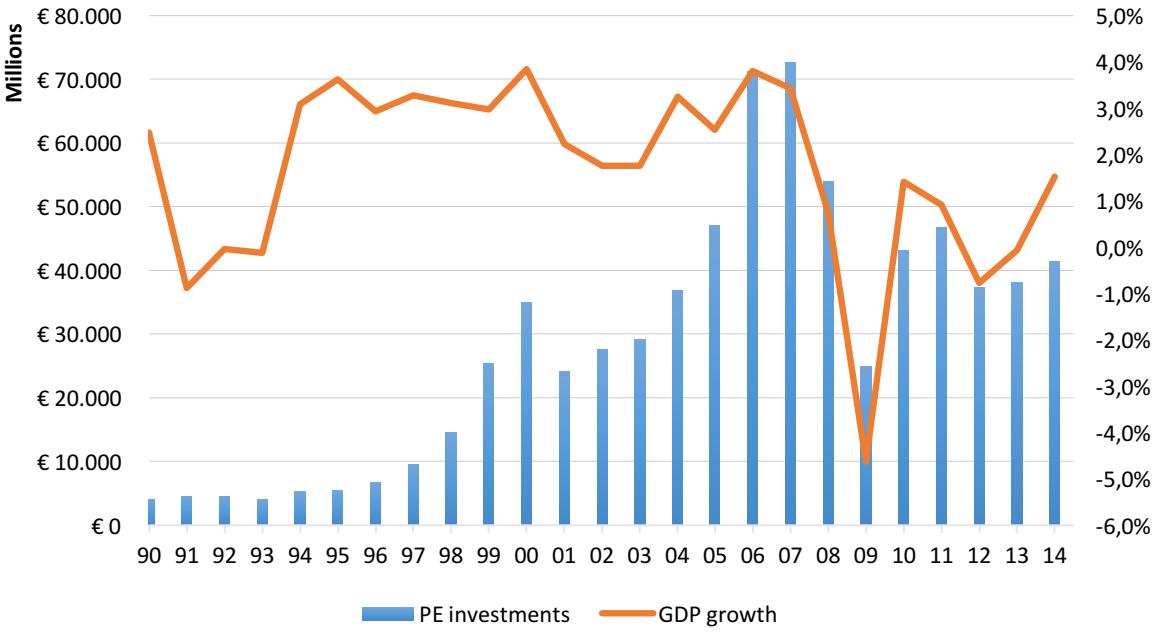
[1] V&D failliet: Dit betekent het voor medewerkers, leveranciers en klanten. (2015, December 31). *NOS*. Retrieved February 15, 2016, from http://nos.nl/artikel/2078060-v-d-failliet-dit-betekent-het-voor-medewerkers-leveranciers-en-klanten.html
[2] Jonker, S. (2015, January 26). PvdA wil 'uitwassen' private equity aanpakken. *Financieele Dagblad*. Retrieved February 15, 2016, from http://fd.nl/frontpage/economie-politiek/1090069/pvda-wil-uitwassen-private-equity-aanpakken
[3] V&D-personeel moet salaris inleveren, 50 mensen ontslagen. (2015, January 19). *NRC Handelsblad*. Retrieved February 15, 2016, from https://nrccarriere.nl/artikelen/vd-personeel-moet-salaris-inleveren-vd-ontslaat-50-mensen
[4] Rijlaarsdam, B. (2015, January 27). Blinde paniek in het warenhuis. *NRC Handelsblad*. Retrieved February 15, 2016, from http://www.nrc.nl/nieuws/2015/01/27/warenhuis-in-nood-redt-wat-er-te-redden-valt

targeting buyout firms to behave more maturely. If they do not, this could lead to more regulation and, as a result, a lower ability to raise funds from new investors (Investec Fund, 2013). Even more recently, the EVCA has expressed their concerns about the negative image of PE. PE firms are seen as maximizing the return for their investors at the expense of jobs and economic growth. Eileen Appelbaum, Senior Economist at the Center for Economic and Policy Research, agrees with this current negative image of the PE industry, but does note that PE firms are able to improve the number of jobs and the value for stakeholders (Appelbaum and Batt, 2014). She believes that PE firms can improve their image by focusing on smaller companies, distressed companies and improving operating performance, because that is where PE firms are value-adding. To revise the image of the PE industry, the EVCA focuses on 'encouraging the private equity industry to look beyond returns and recognize its role as a global influencer and agent for progress, [which] requires concrete examples and models for inspiration'[5]. This thesis attempts to provide such a concrete example of the beneficial effect of the PE industry on economic growth.

This master's thesis examines the effect of PE, partially as part of foreign direct investments (hereafter: FDI) on the economic growth in European countries. Research on the effects of PE on macroeconomic variables is limited. As can be seen in Figure 1.1, PE investments have been increasing extensively over the past two decades. The enormous increase in PE investments has caught the attention of policy makers and economists as well, wondering what the effects of PE are. The examination of the PE industry is thus relatively new. Studies have been focusing on the effects of PE on innovation, productivity, firm competition and trade. For example, Lichtenberg and Siegel (1990) were one of the first to examine the effects of PE on total factor productivity (TFP) and finds that PE firms increase the total productivity of their portfolio firms. Other studies find similar positive effects for the link between PE and innovation and PE and trade (Kortum and Lerner, 2000; Popov and Roosenboom, 2012; Samila and Sorenson, 2011; Strömberg, 2009). To date, however, little research is done on the direct effect of PE on economic growth (Strömberg, 2009). This is mostly due to data availability issues, since PE firms are not obliged to disclose data, and endogeneity issues (Strömberg, 2009). Figure 1.1 shows that there is a correlation between PE investments and economic growth in Europe. For example, during the financial crisis (2007-2009) the GDP growth stagnates in line with PE investments, whereas both indicators increase substantially after the financial crisis.

[5] http://www.investeurope.eu/Content/Microsites/symposium2014/overview.html

Figure 1.1: Private equity investments and GDP growth in Europe



Source: Invest Europe Yearbook - 2015 Yearbook and World Bank World Development Indicators Database

This topic serves both the interest of the academic private equity literature as well as the private equity industry in practice. PE firms are concerned about their negative image[6]. Research on the effects of PE is therefore very useful to PE firms who could use these results to revise their image. Even though there has been research on the effects of PE firms on macroeconomic variables before, no information is available about their effects in recent years and almost no study uses economic growth as their focus. Furthermore, these studies generally examine only U.S. data because of data availability issues. This thesis examines only European countries since especially the research on European effects is limited, and to avoid the effect that more than 50% of the database contains U.S. PE investments. Lastly, this thesis attempts to control for reverse causality issues by employing an instrumental variable approach.

The research question of this paper is: What is the effect of private equity on economic growth? This question will be answered using data on private equity investments from the Invest Europe Yearbook - 2015 for 21 European economies. In evaluating the effect of private equity on economic growth, I test one hypothesis in line with the endogenous growth theory and empirical literature which explains positive effects of PE on innovation, productivity and competition: private equity has a positive effect on economic growth in Europe. This hypothesis is tested using a Least Squares Dummy Variable Model (LSDVM) using fixed effects to control

[6] Weissink, A. (2015, April 29). 'Private equity maakt zich zorgen om imago van sprinkhanen'. *Financieele Dagblad*.

for omitted variable bias. In the first regression, I regress economic growth on private equity investments, the stock market performance, the unemployment rate and other control variables that have been shown to affect the economic growth in line with previous literature. Moreover, I test for endogeneity using two measures: (1) by regressing private equity investments on the real GDP growth rate and other control variables that have been shown to affect private equity investments in line with previous literature and (2) by means of a Hausman test. Lastly, I will control for endogeneity employing a two-stage least squares regression using venture capital investments and buyout investments as instrumental variables for private equity investments. The regressions are then examined to accept or reject the hypothesis.

The empirical results indicate strong evidence that private equity has a positive effect on the economic growth in a sample of 21 European countries. Specifically, this paper finds evidence that an increase in private equity investments by 1% increases the real economic growth rate by approximately 1.9% to 2.8%. This result is in line with the empirical literature of Meyer (2006) who finds similar results using a European dataset from 1994-2004. Furthermore, these results are robust to different specifications and endogeneity issues.

To summarize, this thesis contributes to the existing literature and the field of private equity in practice in several ways. First, it is one of the first papers to examine the direct impact of private equity investments on the economic growth. Second, it examines the impact of private equity investments on economic growth only for European countries whereas previous studies mainly used U.S. data. And lastly, it contributes to the field of private equity in practice as it attempts to answer the question whether private equity firms in general add value. The results of this thesis can be used to revise the image of private equity firms.

The remainder of this thesis is arranged as follows. Chapter 2 presents the theory on the topic and an extensive literature review on the link between private equity and various characteristics. Chapter 3 describes the data and methodology and Chapter 4 describes the empirical results. Further, Chapter 5 provides an overview of my results and links them to the previous literature and Chapter 6 concludes and summarizes the results.

2. Theory

The literature on PE has developed considerably over the last few decades, focusing on the performance of PE firms to the effect of PE on macro- and microeconomic variables like firm characteristics and productivity. This section gives a short overview of the extensive amount of literature on PE. First, I will define PE, its structure and its strategies. Second, I will elaborate on the theoretical framework that will be used and the resulting hypothesis. Finally, I will present an overview of the current literature on PE and their impact on innovation, productivity, competition and overall economic growth.

2.1 Private equity

2.1.1 What is private equity?

In the current literature, there is no single definition of PE and the jury is still out whether or not to include PE as part of FDI. Further, the terms PE and venture capital are often mixed up, whereas the latter is just one of the strategies of PE. This has to do with a difference in definitions on PE and venture capital in Europe and the United States.

According to the European Private Equity & Venture Capital Association (EVCA), private equity is defined as 'a form of equity investment into private companies that are not publicly traded on a stock exchange'[7]. This usually happens through the investment in long-term, typically 10 years, closed-end funds. The British Private Equity & Venture Capital Association (BVCA) defines PE as 'finance provided for return in an equity stake in potentially high-growth companies'[7].

Venture capital, on the other hand, is the investment of PE funds into young and high-growth companies, according to the EVCA. The first part of confusion is that people generally tend to overlook the addition of the word 'young' in the definition of venture capital. The second part of confusion is by the the way in which venture capital is treated in different regions in the world. According to the BVCA, PE and venture capital are seen as different types of investments in the United States, whereas in Europe venture capital is regarded as one strategy that PE firms typically pursue. Nonetheless, in both regions venture capital is seen as investments in the early stages of development, whereas PE typically invests in more mature companies[7].

Metrick and Yasuda (2011), although both American and publishing their book in the United States, adopt the 'European' definition of PE: a broad class of investing that includes

[7] FAQs in Private Equity. (n.d.). Retrieved April 26, 2016, from http://www.bvca.co.uk/PrivateEquityExplained/FAQsinPrivateEquity.aspx

venture capital (VC) as well as investments in leveraged buyouts (LBOs), mezzanine structures, and distressed companies. Therefore, in line with most of the literature, I will adopt the European style of defining PE in this thesis. That is, I will use the definition of the EVCA.

Furthermore, there is some debate as to whether or not to include PE investments as part of FDI or a portfolio investment in the balance of payments. UNCTAD (2008) defines FDI as 'an investment involving a long-term relationship and reflecting a lasting interest in and control by a resident entity in one economy of an enterprise resident in a different economy'. FDI is different from portfolio investments in that FDI establishes or maintains control of the enterprise receiving the investment (Bowen et al., 2012). According to the Financial Times, control is defined as having at least 10% of the voting shares in a company[8]. The debate is on whether or not PE investments, having met the 10% control threshold, involve a 'long-term' relationship since PE firms typically disinvest within 5-7 years.

Nonetheless, the current literature on PE has been gradually including PE as part of FDI. Specifically, Agmon and Messica (2009) were one of the first to include PE investments into FDI and name it Financial Foreign Direct Investments (FFDI). They define FFDI as 'investments of PE funds in emerging markets for the purpose of generating a high return-on-investment over a relatively short period (5-7 years)'. More recently, Ramamurti (2013) identified in his paper three new players to possibly play a large role in FDI over the coming years: emerging market transnational corporations, sovereign wealth funds and PE. However, he finds that although the PE industry has been thriving over the last decade, the contribution of PE to FDI is likely to be small and unsustainable.

2.1.2 Private equity strategies

In line with the EVCA, I distinguish between 5 different strategies of PE funds (Figure 2.1). Venture capital is an investment by PE firms in the early stages of development of a firm, as defined in the previous section. The other strategies include growth, buyouts, mezzanine and generalist funds. The definitions of these types of fund stage focuses will be given in line with the definitions of the EVCA since this paper uses the database of the EVCA as well.

Growth funds are defined as investments by PE firms in mature companies that are looking to expand or restructure their operations[9]. It is usually classified as a strategy that has characteristics of both venture capitalism and leveraged buyouts, although the strategy often does not use leverage to invest in companies. Furthermore, most of the PE firms using a growth strategy only take minority stakes.

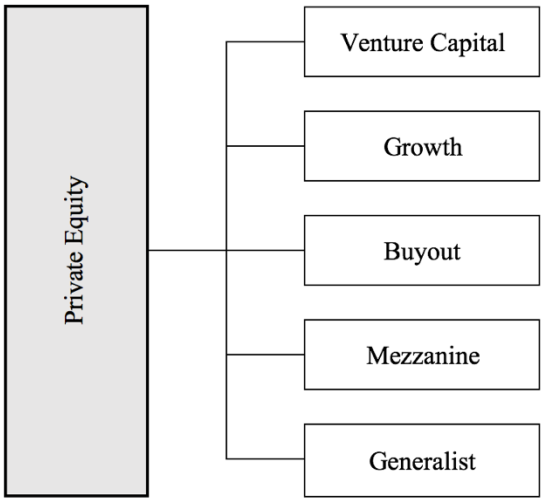
[8] Financial Times lexicon. (n.d.). Retrieved April 26, 2016, from http://lexicon.ft.com/Term?term=foreign-direct-investment
[9] Invest Europe - About Research. (n.d.). Retrieved April 26, 2016, from http://www.investeurope.eu/research/about-research/glossary/

Buyout funds, on the other hand, are funds that do take a controlling stake in established companies[9]. The most renowned example of such a strategy is the leveraged buyout (LBO). An LBO consists of the purchase of a company using only a small amount of equity and a large amount of debt. The cash flows of the target company are then used to repay the debt. LBOs have, as explained in the introduction, become a synonym for corporate greed by PE investors. The most famous private equity transaction in the world, the acquisition of RJR Nabisco by KKR in 1989, was a leveraged buyout.

Mezzanine funds generally provide subordinated debt to facilitate the financing of buyouts, and is often seen as late stage venture capital (Metrick and Yasuda, 2011). Mezzanine debt is a form of debt provided to expanding firms, but if unable to repay, the provider of the loan typically gets a share of the equity in the firm. Mezzanine is both the name of the firms investing using mezzanine debt as well as the name for debt consisting of equity and debt.

And lastly, generalist funds are funds with either a stated focus of investing in all stages of venture capital and PE investment or with a broad area of investment activity[9].

Figure 2.1: Private equity strategies



Source: Invest Europe Yearbook - 2015

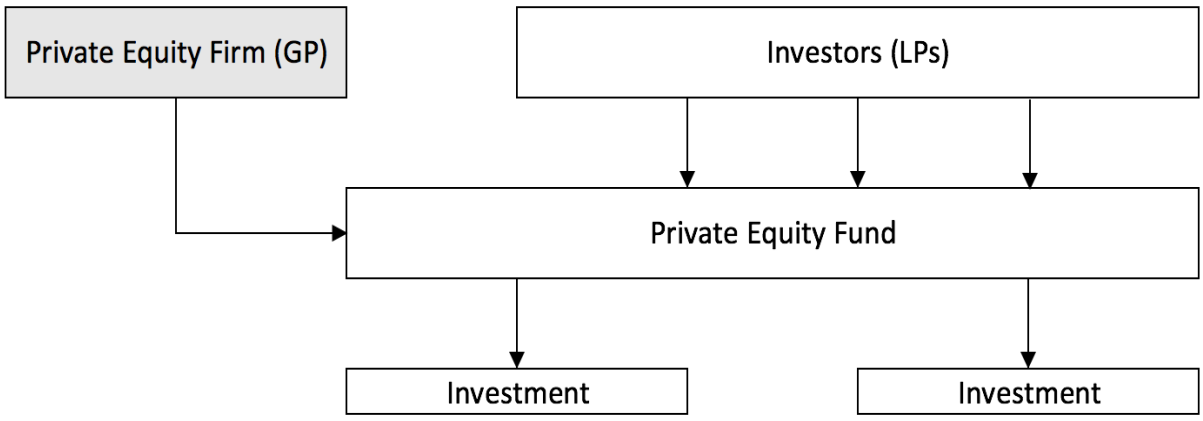
2.1.3 The structure of private equity

The structure of a typical PE fund is given in Figure 2.2. A PE firm invests some of its own capital into a PE fund, managed by a partner of that same PE firm. This partner is called a general partner (GP) and has an unlimited liability regarding the investments of the fund (Gilligan and Wright, 2014). Further, several investors invest often large amounts of capital into the PE fund as well. These investors are nowadays typically public pension funds, insurance companies, other large financial institutions and sometimes high net worth families

and individuals and are called limited partners (LPs). They are called limited partners because they are only liable for the amount that they invest in the fund. The LPs only provide capital to the PE fund and do not manage the fund. Consequently, the GP of the fund (the PE firm) will then look for suitable investments and invest the capital provided by the PE firm and the limited partners into a range of companies.

The LPs and GP sign a limited partnership agreement (LPA) in which both parties agree on, among others, the duration of the fund, the management fee to be paid to the GP and the type of companies that the GP can invest in (Gilligan and Wright, 2014). The PE fund therefore has a limited lifetime: PE firms typically cannot invest in new companies after 6 years and the fund is terminated within 10 years. PE firms typically have multiple funds open for different types of investments, with each fund manager managing different funds at the same time.

Figure 2.2: Private equity structure



Source: Gilligan and Wright (2014)

To conclude, fund managers (or the PE firm) have 4 sources of income according to Gilligan and Wright (2014): basic salary, management fees, return on investments and additional performance fees. Management fees typically consist of 1% to 3% of the invested capital per year. In addition, there usually is an additional performance fee that consists of an extra fee if a pre-determined hurdle rate has been obtained. This hurdle rate is typically 8% and the PE firm obtains 20% of any return above that rate. The return on investment is only made when the company is sold again.

2.2 Theoretical framework

In the current literature, there are two opposite growth models: neoclassical growth models and endogenous growth models. According to the neoclassical growth model, developed by Solow (1956) and Swan (1956), growth is exogenously determined. Long-run growth in these models occurs through an exogenous technological progress. Specifically, Solow used a Cobb-Douglas production function in which labor (L), capital (K) and the effectiveness of labor (A) affect the rate of economic growth (productivity (Y)):

$$Y = K^{\alpha} AL^{1-\alpha} \tag{2.1}$$

In the 1990s, Mankiw et al. (1992) came up with the addition of human capital (H) to this model to better explain real world economic growth:

$$Y = K^{\alpha} H^{\beta} AL^{1-\alpha-\beta} \tag{2.2}$$

Thus, these models treat long-run economic growth as exogenously given, indicating that economic growth is not affected by economic forces.

From the 1980s, many economists were unhappy with the exogenous growth theories to explain real world phenomena and wanted to explain growth endogenously. Romer (1986) therefore laid the foundation of endogenous growth theory with the AK-model. The AK-model is build on the following production function:

$$Y = AK \tag{2.3}$$

where A is technology and K is (human) capital. In this model, the long-run economic growth rate will be affected by economic factors (Aghion et al., 1998). A weakness of this model is that it combines both technological progress and capital accumulation in one factor.

To account for this weakness, innovation-based endogenous growth theories have emerged which separate human and physical capital from intellectual capital (Aghion et al., 1998). The first model using this separation in capital was Romer (1990). Romer's model explained that economic growth, or aggregate productivity, increases with the number of varieties in products. Romer used an Ethier (1982) production function with Dixit-Stiglitz preferences (Aghion et al., 1998):

$$Y = L^{1-\alpha} \int_0^A x(i)^{\alpha}\, di, \tag{2.4}$$

where L is constant labor supply, x(i) is the flow input of intermediate product i and A reflects the number of varieties of intermediate product i. In this model, innovation increases growth by increasing the number of varieties A in the above production function.

Another innovation-based endogenous growth model has been constructed by Grossman and Helpman (1991) and is based on Schumpeter's (1942) theory of 'creative destruction'. In contrast to Romer's (1990) model, this version focuses on the effect of innovation on the quality of products, rather than the number of varieties, which makes older products useless (Aghion et al., 1998). The production function of this model is given by:

$$Y = L^{1-\alpha} \int_0^1 A(i)^{1-\alpha} x(i)^{\alpha}\, di, \tag{2.5}$$

where product variety has now been set to unity (Aghion et al., 1998). Furthermore, each intermediate product i now has a different productivity A. Economic growth will now be obtained by innovations that improve the productivity, or quality, parameter A.

To put things in perspective, this paper analyzes the effect of PE investments on economic growth with the innovation-based endogenous growth theory. Specifically, PE investments promote economic growth in three ways as described in a report by Frontier Economics (2013). Firstly, PE investments can promote economic growth as they improve innovation. PE firms attract funds to invest in companies. These funds can be used to increase innovation by increasing the R&D fund of the firm. Furthermore, PE investments often invest in start-ups which have a tendency to be more innovative than normal (Frontier Economics, 2013). Innovation, in return, is a key determinant of economic growth in the above mentioned endogenous growth model. Therefore, PE is expected to increase economic growth through innovation.

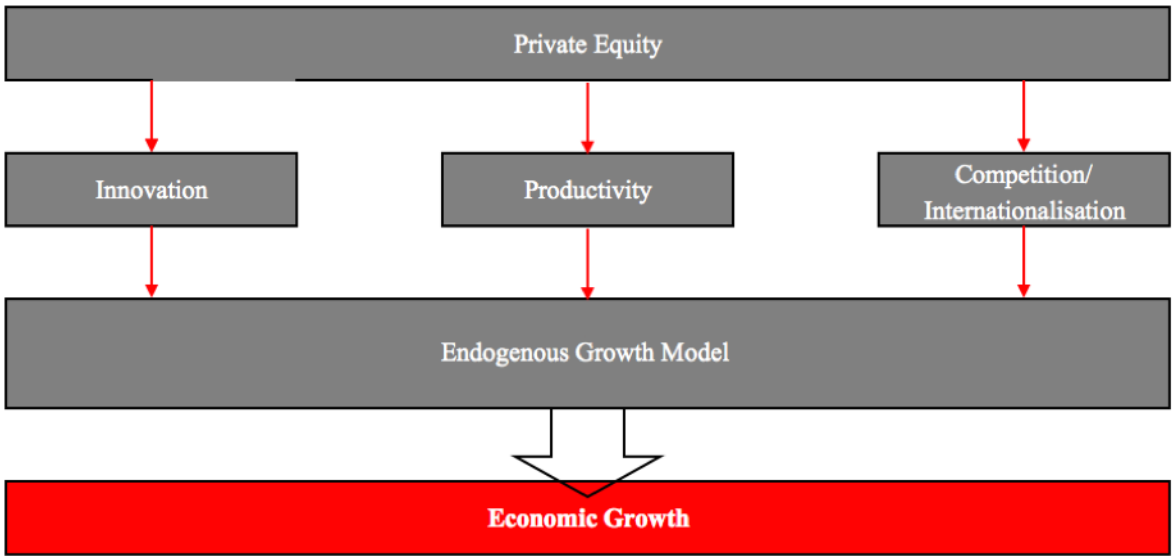
Secondly, PE investments increase productivity, for example through the accumulation of physical capital like investments in buildings and machines and innovation of new technologies. Furthermore, they can promote employment rates by creating new business for the firms in question. In the above mentioned endogenous growth model in equation 2.5, this leads to economic growth again.

Thirdly, the aforementioned increase in productivity increases the competitiveness of domestic firms. Moreover, PE can help domestic firms expand to foreign markets and improve

the external trade. The increased competitiveness of firms incentivizes firms to be more innovative and in return increases production according to the endogenous growth model.

A summary of the three ways in which PE improves economic growth can be seen in Figure 2.3.

Figure 2.3: The effect of private equity on economic growth



Source: Own work and Frontier Economics (2013)

2.3 Hypothesis

The main research question of my master's thesis will be the following:

What is the effect of private equity on the economic growth in Europe?

This research question will be answered using the following hypothesis in line with the endogenous growth theory and empirical literature which explains positive effects of PE on innovation, productivity and competition:

H1: Private equity has a positive impact on the economic growth in Europe

2.4 Literature review

Over the last few decades the literature on PE and FDI has developed into numerous topics of research, ranging from the determinants of FDI to the impact of FDI and PE on various macroeconomic variables. This literature review will first shortly examine the impact of FDI on economic growth. In line with the theoretical framework and the ways in which PE promotes growth, I will then examine the impact of PE on innovation, productivity and competition and trade. The literature review concludes with the current empirical literature on the direct effect of PE on economic growth. Note that this literature review is far from exhaustive and is limited to the most important papers in the field.

2.4.1 FDI on economic growth

The literature on the impact of FDI on economic growth is extensive, but inconclusive about their effects and the direction of the effect. The initial ideas of the effect of FDI on economic growth was developed by Brems (1970). Brems simply used the standard exogenous neoclassical growth model, also called Solow-Swan model, and argued that FDI added to the physical capital of a country by including FDI into the factors of production of the model. This in turn increases the growth in the host economy. While this concept seems simple, the theory was flawed since this model only captures short-term effects to economic growth (Neuhaus, 2006).

However, it was not until Romer (1990) and Borensztein et al. (1998) developed a new endogenous growth model in which FDI did affect economic growth in the long-term. They developed a model in which foreign direct investments increase the economic growth in a host country because domestic firms benefit from the technologies that foreign firms bring. As a result, domestic firms can produce more 'new' varieties of capital goods. Borensztein et al. (1998) found a positive effect of FDI on economic growth using a seemingly unrelated regression (SUR) with panel data of 69 countries in the world, but only when the country receiving the investments has already a certain level of human capital available. However, as noted in Neuhaus (2006), this theory neglects the immediate effect of foreign direct investments on the technology level of the domestic country, such as greenfield investments. Furthermore, they noted that no ideal instruments are available to control for endogeneity between FDI and economic growth. Attempting to control for this, they find the same results.

More recently, Nair-Reichert and Weinhold (2001) tried to control for endogeneity problems using the Mixed and Fixed Random (MFR) estimator to control for the heterogeneity of panel data. Their result indicates that imposing homogeneity assumptions in panel data may

lead to biased results. In their panel data set of 24 developing countries from 1971 to 1995, they find some evidence that the causality runs from FDI to economic growth, yet acknowledge that this relationship is not uniform across countries.

Campos and Kinoshita (2002) build on the theory of Borensztein et al. (1998) and identify the three ways in which FDI may promote economic growth. The first is that FDI boosts economic growth through the accumulation of capital. The second asserts that FDI increases the growth of a country through technology and human capital (knowledge) transfers and the third asserts that FDI directly increases the level of technology, for example by learning (i.e. how to produce faster). In line with three previous studies, Campos and Kinoshita reproduce their results with a different dataset, controlling for endogeneity and reverse causality using two-stage least squares and Granger causality tests. In their dataset of 25 transition economies in Eastern Europe, they find evidence in line with the theory that FDI increases economic growth.

Lastly, Li and Liu (2005) also examine, using a panel data of 84 countries from 1970 to 1999, the impact of FDI on economic growth. They identify two ways in which endogeneity has been covered in the current literature. The first is through the use of bilateral causality testing using, for example, Granger causality tests in line with Campos and Kinoshita (2002). Although using Granger causality tests are useful to some extent, there are more sophisticated and better approaches available to test for causality (Chowdhury and Mavrotas, 2006). The second approach uses simultaneous equation systems such as instrumental variable approaches like Borensztein et al. (1998) in which FDI and growth (or more variables) are treated as endogenous variables. Using both types of testing, Li and Liu find that FDI and economic growth have become increasingly endogenously related. This implies that they find evidence that FDI promotes economic growth and vice versa. Nonetheless, the current literature still shows ambiguous results across time and between countries (Carkovic and Levine, 2002; Choe, 2003; Hsiao and Hsiao, 2006)

2.4.2 Private equity on innovation

The current literature on the effect of PE on innovation finds in general a positive link (Strömberg, 2009). However, because PE firms are not obliged to disclose data to any database and PE is a relatively new concept in Europe, the current literature mainly examines venture capital data in U.S. samples. For example, Kortum and Lerner (2000) were one of the first to examine the effect of venture capital firms on the number of patented inventions. The number of patented inventions is a widely used proxy for innovation and still used nowadays. Using a U.S. sample of 20 manufacturing industries from 1965-1992, they find a positive effect of

venture capital firms on the number of patented inventions. In addition, they find that this effect is robust to different specifications and endogeneity issues. In fact, they find that venture capital firms were attributed for 14% of the U.S. innovative activity by 1998.

More recently, Mollica and Zingales (2007) confirm the findings of Kortum and Lerner (2000) in their study on the impact of venture capital on new business creation and the number of patents. They find that venture capital investments increases the number of businesses and the number of patents in a U.S. sample. Their results indicate that a one-unit increase in the standard deviation of venture capital investments increases the number of patents from 4% to 15%, dependent on the sample. Furthermore, a 10% increase in venture capital investments increases the number of businesses by 2.5%.

However, Hirukawa and Ueda (2011) casts doubts on the direction of causality of the previously mentioned papers. They use the same methodology as Kortum and Lerner (2000), but include data until 2001. They test two hypotheses: the VC-first hypothesis and the innovation-first hypothesis. The VC-first hypothesis states that venture capital investments stimulate innovation, whereas the innovation-first hypothesis claims that first new technology arrives and this increases the demand for venture capital. Furthermore, they use two proxies for innovation: total factor productivity growth (TFP) and the number of patents. Again using a sample of the U.S. manufacturing industry, Hirukawa and Ueda only find weak evidence of the VC-first hypothesis when using total factor productivity as a proxy for innovation. However, they find no significant evidence when using the total number of patents as a proxy, in contrast to the findings of Kortum and Lerner (2000) and Mollica and Zingales (2007). On the other hand, they find a significant effect for the innovation-first hypothesis when using TFP growth. It must be noted that they do not find evidence for reverse causality when using the number of patents.

Using firm-level data within Italy and Germany, respectively, both Engel and Keilbach (2007) and Caselli et al. (2009) confirm the findings of Hirukawa and Ueda (2011). Engel and Keilbach use a German sample and find that young venture-funded German firms have a higher number of patent applications than non-venture funded firms. Nonetheless, this result already occurs before the funding of the venture capitalist, so that the number of patent applications is not found to differ between venture funded and non-venture funded firms after venture capital firms step in. However, they do find a weakly significant difference overall.

Caselli et al. (2009) confirm these results by using the same methodology. Using 37 Italian venture funded firms and matching these with 37 similar but non-venture funded firms between 1995-2004, they find that venture capital firms select their companies based on their

innovation, but after the investment they focus on improving the profits of the firm rather than innovation. Both papers find evidence that sales increases for the firms who received venture capital financing, but the number of patent applications decreases.

Popov and Rosenboom (2012), on the other hand, confirm that venture capital has had a positive effect on the number of patented inventions for a European sample of 21 countries, but the results are ambiguous. In their paper, they have addressed the causality issues of Hirukawa and Ueda (2011), Engel and Keilbach (2007) and Caselli et al. (2009). They confirm some of the results of the firm-level evidence in the latter two papers, but also find evidence that venture capital investments increase innovation, in line with the U.S. sample of Mollica and Zingales (2007). Although they find that venture capital firms have accounted for 10.2% of the industrial innovation in Europe, this finding differs per sample and is found to be generally lower than their impact in the United States. Further, they find that venture capital firms have a greater impact on innovation in countries in Europe with lower barriers to entrepreneurship and a better environment for venture capital firms in terms of taxes.

2.4.3 Private equity on productivity

Concerning the link between PE and productivity, Strömberg (2009) finds in his literature review a positive effect. In fact, PE participation leads to a 6.9% increase in EBITDA per employee on average according to Strömberg, but this effect is larger for European firms than for U.S. firms.

Lichtenberg and Siegel (1990) were one of the first to examine the effects of PE on total factor productivity (TFP), defined as output per unit of input. Previous studies focused solely on the effect of PE on stock prices or profits, but these measures of efficiency have been found to not adequately reflect future performance (Shleifer and Vishny, 2003). Using a sample of 131 leveraged buyouts (LBOs), and in specific management buyouts (MBOs), they find that the LBOs (MBOs) in the period of 1983-1986 had a significant positive effect on TFP from 2% to 8.3% in the three years after the buyout. However, they found no significant increase for the years of 1981 and 1982.

Harris et al. (2005) extend the paper of Lichtenberg and Siegel (1990) by including more recent data and control variables, a larger sample and by applying more sophisticated techniques. Using data for the U.K. and using a GMM estimation, in contrast to Lichtenberg and Siegel using OLS estimations, Harris et al. confirm the previous findings that MBOs increase the productivity of firms. Their findings suggest that PE firms increase the labor efficiency of their portfolio firms by outsourcing. These results are confirmed more recently by

Bernstein et al. (2010) who find evidence of productivity growth due to PE investments in 20 OECD countries from 1991-2007.

In a more recent paper, however, Hirukawa and Ueda (2011) extend the paper of Kortum and Lerner (2002) concerning the impact of venture capital investments on innovation, but also focus on productivity growth. Unlike Lichtenberg and Siegel (1990) and Harris et al. (2005), they find no evidence that venture capital investments increase TFP growth in a sample of OECD countries.

The paper by Hirukawa and Ueda (2011) is the only paper not finding a significant relationship between PE investments and productivity growth. For example, accountancy firm Ernst & Young (2012) finds that PE investments improve productivity, measured as the EBITDA per employee, by 6.9% on average across all European countries. In France, the UK and Ireland, the productivity gains were the largest, increasing by more than 10% because of PE investments. They find similar results for employment growth.

Lastly, more recently Davis et al. (2014) published a paper in the renowned American Economic Review regarding the effect of PE on jobs and productivity. Specifically, they use a large sample of LBOs and include new control variables and estimation techniques to examine this impact and find a positive effect of LBOs on the TFP growth. This is largely due to target firms closing down low TFP plants and replacing them with high TFP plants, indicating that PE firms reallocate jobs more efficiently.

2.4.4 Private equity on competition and trade

Lastly, the effect of PE on competitiveness and trade in markets is examined. An increased productivity and innovation, as discussed in the previous 2 sections, could lead to increased competition and trade (Frontier Economics, 2013).

Lockett et al. (2008) were the first to examine the effect of PE on the internationalization of firms using data of the EVCA. Their main result is that venture capital investments are significantly positively related to the export intensity of portfolio firms, but this effect depends on the investment stage of the firm. More precisely, they find that venture capital investments have a greater impact on early-stage target firms than late-stage target firms. These results indicate that venture capital firms can help target firms internationalize their activities.

Lutz and George (2012) also examine the internationalization of PE portfolio firms in a theoretical paper including 18 case studies. They find that entrepreneurial spirit increases when target firms of PE investors are able to acquire slack financial resources from the venture capitalist. This implies that the entrepreneur is able to grasp more opportunities because cash is readily available to invest in opportunities that suddenly appear.

Concerning the effect on new business creation, there are two papers that have examined this effect: Samila and Sorenson (2011) and Popov and Rosenboom (2013). The first paper finds that venture capital investments increases the number of startup firms in a panel of U.S. metropolitan areas. These results are robust to different specifications and after controlling for endogeneity using a two-stage least squares approach. For example, doubling the amount of investments by venture capital firms leads to a 2.11% increase in new firms and a 1.24% higher employment. Samila and Sorenson explain this fact by mentioning two mechanisms. The first implies that would-be startups first look at the availability of capital in a certain sector before they start their firms. Second, venture capital firms that invest in certain firms may stimulate other firms in terms of inspiration and training grounds.

Confirming this piece of evidence, Popov and Rosenboom (2013) find that venture capital investments increase new business creation in a sample of 21 European firms from 1998-2008. In general, they find that new business creation is 7.1% higher in venture funded industries than in non-venture funded industries. Furthermore, they find that this effect is higher in more capital intensive industries, more R&D intensive industries, higher human capital countries and lower capital gains tax countries. These results hold when controlling for endogeneity and different robustness tests. Thus, the two papers that have examined this issue both confirm the positive effects of PE on new business creation.

2.4.5 Private equity on economic growth

While the literature on the impact of PE on various characteristics of firms is exhaustive, the direct impact of PE on economic growth is incomprehensive. To date, there are two known studies that have examined this direct effect specifically.

Strömberg (2009) examines the PE literature and indeed finds that the literature on PE investments and overall economy growth is scarce. In fact, he notes that there is no rigorous academic study analyzing this impact and that this is particularly due to reverse causality issues. That is, the literature on PE encounters the same issues as that on FDI and economic growth.

Meyer (2006) examined a set of panel data of 20 European countries between 1994 and 2004 and found a positive effect of PE investments on real economic growth. He further analyzed differences between buyouts, venture capital and early stage investments and found significantly positive effects for all three types of investments of PE firms. Meyer found no evidence of reverse causality by looking at the determinants of venture capital investments, indicating that there is no statistical relationship of economic growth on investments.

The report by Frontier Economics (2013) prepared a summary of the literature on PE investments for the EVCA (now: Invest Europe) and described the analytical framework

through which PE increases economic growth. They defined three impacts of PE investments on economic growth: (1) they increase innovation by enlarging the R&D funds of firms, (2) they increase productivity, for example through the accumulation of physical capital by new investments and (3) they increase the competitiveness by making the firm more productive. These three impacts of PE investments on economic growth are relatively similar to the framework of Campos and Kinoshita (2002) on FDI. In this review on the literature of PE investments, they do not examine the direct effect on economic growth, however. Nonetheless, they do find evidence in the literature that PE fosters economic growth by increased innovation, productivity and competitiveness.

Lastly, Aldatmaz (2013) examined a global panel dataset of 48 countries from 1990 to 2011 to examine the effect of PE investments on key variables such as employment, profitability and labor productivity. They use a panel VAR regression model to allow for dynamic interactions between the variables to control for fixed effects. Whilst acknowledging that to date there is almost no empirical study on the effects of PE on the broad industry growth, they find evidence that PE firms promote higher employment, labor productivity, profitability and capital expenditures.

3. Data and Methodology

3.1 Data and descriptive statistics

The sample consists of data from 1989 until 2014 for the 21 following European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. The starting point of 1989 is chosen since this is the first year in which data is available from the Invest Europe Yearbook – 2015 database. The data on the independent variable, PE investments, will thus be retrieved from this database. The data on PE investments is also shown separately, dividing buyout investments, venture investments and other investments.

The data on the dependent and control variables will be retrieved from various sources, in line with Barro and Lee (1994, 1996) and Meyer (2006). The dependent variable, real GDP growth, will be obtained from the World Bank World Development Indicators Database. The control variables will be obtained from various sources including the World Bank World Development Indicators Database, the OECD database, Barro and Lee (1996), the United Nations Statistics Division, UNCTAD World Investment Reports, Yahoo Finance, and Freedom House.

Table 3.1 shows the descriptive statistics of the key variables. Since the dataset contains missing values on PE investments, PE divestments and control variables for several countries, the total number of observations in the panel dataset is 546. Therefore, it is an unbalanced panel data set. The following pages provide an explanation of the variables used in this analysis. More information about the variables can be consulted in Appendix A.

3.1.1 Independent variable

In line with Meyer (2006), I will use PE investments as a percentage of the real GDP as the independent variable in this analysis. The PE investments data are obtained from the Invest Europe Yearbook - 2015 database, including data on more than 1,200 European PE firms from 22 countries covering 91% of the European PE market. It is the most comprehensive dataset of European PE investments available.

The data is obtained by PEREP_Analytics on behalf of the EVCA. They use an annual survey in which they ask more than 1,200 PE firms about their activity data regarding fundraising, investments and divestments. These figures are then aggregated by country and updated every 3 months and therefore represent a flow variable.

Table 3.1: Descriptive statistics of the key variables

Variable	Mean	Std. Dev.	Min	Max
GDP per capita growth	1.69%	2.98%	-12.16%	10.80%
Government consumption	19.88%	3.46%	10.18%	28.06%
Gross domestic investment	22.58%	3.65%	11.61%	38.40%
Openness	83.61%	36.19%	209.08%	33.97%
Schooling	3.64	1.07	1.36	6.90
Population growth	0.35%	0.53%	-1.83%	2.89%
Polity IV Score	9.60	1.37	-6.00	10.00
Regime durability	44.81	37.92	0.00	166.00
Number of telephone lines	42.91	15.37	8.22	74.76
Democracy index	1.26	0.52	1.00	5.50
Technology gap	1.22	0.25	-0.36	11.19
Stock market performance	9.55%	29.01%	-71.21%	175.45%
Unemployment rate	8.89%	4.89%	0.50%	27.20%

Specifically, the PE investments represent domestic investments in European countries, cross-border investments within Europe and European PE firms investing in portfolio companies outside Europe. Although figures on the mean percentage of ownership obtained by the PE firm do not exist in the database of the EVCA, the mean percentage of ownership in databases typically differs between 50% and 70% (Cumming, 2010). Therefore, the latter two forms of PE investments can be categorized as FDI because PE firms generally take a controlling interest (more than 10% of the equity according to the definition of the Financial Times) in a company.

The foreign private equity investments can be categorized in the balance of payments (BOP) of a country. According to the International Monetary Fund (2010), the balance of payments is defined as a 'statistical statement that systematically summarizes, for a specific time period, the economic transactions of an economy with the rest of the world'. The balance of payments is typically presented as in Figure 3.1, including the current account, capital account, financial account and reserves. The cross-border private equity investments can then be categorized in the financial account of a country, being part of the (foreign) direct investments in Figure 3.1.

Figure 3.1: The balance of payments

	Credits	Debits
Current account n.i.e.		
Goods		
Services		
Primary income		
Secondary income n.i.e.		
Balance on current account n.i.e.		
Capital account n.i.e.		
Balance on capital account n.i.e.		
Financial account n.i.e.		
Direct investment n.i.e.		
Portfolio investment n.i.e.		
Financial derivatives and ESOs n.i.e.		
Other investment n.i.e.		
Balance on financial account n.i.e.		
Balance on current, capital, and financial accounts n.i.e.		
Reserves and related items		
Reserve assets		
IMF credit and loans		
Exceptional financing		
Total reserves and related items		

Source: International Monetary Fund (2010)

Furthermore, the PE investment data are in nominal terms, so that the annual inflation rate is included as a control variable. Next to aggregated total PE investment data, the database contains information on the investments per strategy (venture capital, growth capital, buyout, mezzanine and generalist) and sector (e.g. agriculture, consumer goods and transportation).

3.1.2 Dependent variable

In line with Li and Liu (2005) and Meyer (2006) the dependent variable is the growth rate of real GDP per capita. I use the real GDP per capita in order to account for inflation, since the panel dataset runs over a period of 26 years. The real GDP per capita represents a flow variable as well, in line with the independent variable, i.e. it is measured over an interval of time. The growth rate of the real GDP per capita is a widely employed proxy for economic growth and used in, inter alia, Borensztein et al. (1998), Li and Liu (2005) and Meyer (2006). The real GDP per capita is obtained from the World Bank World Development Indicators Database and the growth rate of the real GDP per capita is obtained as follows:

$$Real\ GDP\ per\ capita\ growth: \frac{Real\ GDP\ per\ capita_t - Real\ GDP\ per\ capita_{\ t-1}}{Real\ GDP\ per\ capita_{t-1}} \qquad (3.1)$$

3.1.3 Control variables

For the regression on the real GDP growth rate, I will include the following control variables in line with Barro and Lee (1994, 1996): real GDP per capita in 1990 at 2005 constant prices, gross domestic investment as a percentage of GDP, the openness of a country, the average years

of schooling of adults aged 25 years and older, government consumption as a percentage of GDP, the growth rate of the population, the number of telephone lines per capita, the Democracy Index by Freedom House, the technology gap and two instability proxies: the number of years the country has a stable government and the Polity IV score of Systemic Peace. In addition, in line with Meyer (2006), I include the unemployment rate and the national stock market performance of all countries as control variables.

Most control variables mentioned above, except for the stock market indices and the unemployment rate, have been shown to be determinants of economic growth in Barro and Lee (1994, 1996) and other literature and are therefore included into the regression. I will not further examine most of these control variables, unless they require further elaboration.

Stock market and unemployment rate

The stock market performance and the unemployment rate are included in line with the methodology of Meyer (2006). This is in order to measure the effect of PE investments on the economic growth rate removing the effect of the stock market. As already noted in Figure 1.1, private equity investments are very cyclical and the period used for the analysis of private equity on economic growth matters. For example, if the analysis contains the period of 2002-2006, private equity markets were booming and one could likely find a positive effect of private equity investments on economic growth. Therefore, to control for the cyclicality of the economy the stock market performance is added as a control variable. In addition, in line with Meyer, the unemployment rate is added to control for variations in the business cycle. Meyer notes that stock markets are forward-looking, whereas decisions on employment are usually done with a considerable time lag and therefore may contain additional information compared to including only the stock market performance.

Democracy index

The democracy index by Freedom House is composed of a rating on the civil liberties in a country and a rating of the political rights of a country rated from 1 (most free) to 7 (least free). Freedom House initiates an annual survey by professionals and analysts of 192 countries, in which they ask, among others, individual professionals, think thanks and NGOs to assess the state of the country. It is one of the most widely used proxies for democracy in academic research and in addition has a high correlation with the other two widely employed democracy indices (Casper and Tufis, 2003).

Democracy is included as a control variable because Barro and Lee (1994) include civil liberties and political freedom as separate control variables and find that more liberty is bad for growth and more freedom is good for growth. In addition, Barro (1997) finds a significant non-linear relationship between democracy and economic growth. When a country has low civil rights, an increase in these civil rights leads to an increase in the economic development up to a certain point. After a certain point, an increase in democracy reduces economic growth. A possible interpretation could be that extreme dictatorships limit economic growth, but once a country has a certain level of political rights an increase in democracy hampers growth due to concerns about income redistributions and social programs (Barro, 1997).

Technology gap

In line with Li and Liu (2005), the technology gap is introduced as a control variable because it has been shown to be an important determinant of economic growth. The technology gap is defined as follows:

$$GAP_{jt} = \frac{\gamma max_t - \gamma_{jt}}{\gamma_{jt}} \tag{3.2}$$

where γmax_t is the real GDP per capita in the United States at time t and γ_{jt} is the real GDP per capita in country j at time t. By using the technology gap and the number of years of secondary schooling, I estimate an endogenous growth model in line with Li and Liu (2005). In their paper, they find a negative and significant effect of the technology gap on economic growth. This result indicates that a larger technology gap hampers economic growth of the country receiving the foreign direct investment.

Instability

Proxies of the instability of countries have been included in growth regressions for a long time. Barro and Lee (1994) find a negative impact of political instability on economic growth, using different measures for political instability. In their sample, they use the number of revolutions, the number of wars and wartime to proxy instability. However, because there have been no wars and revolutions in the countries of my sample, I will use different proxies in line with the previous literature. Barro (1997) uses the Rule-of-Law index as a proxy for political instability, but this index is not freely available.

In my sample, I use the number of years a country has a stable government and the Polity IV score of Systemic Peace as control variables in line with other literature (Casper and Tufis, 2003; Rodrik and Wacziarg, 2005). Furthermore, Adams and Klobodu (2016) directly examine the impact of regime durability on economic growth in 33 Sub-Saharan African countries and find a negative and significant relationship. The Polity IV index is a widely used proxy for political instability and used in different papers as well (Casper and Tufis, 2003; Goldstone et al., 2010). The Polity IV score is computed by subtracting the Autocracy score from the Democracy score. The resulting unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic). The Autocracy score measures the autocracy of a country using different indicators in an 11-point scale (0-10) and the Democracy score measures the democracy of a country using different indicators in an 11-point scale (0-10). For more information about the methodology of these indices, I refer you to Appendix A and the accompanying website of Systemic Peace[10].

For the regression on the growth rate of PE investments to look for reverse causality, I will include the following control variables in line with Bernoth et al. (2010) and Meyer (2006): the equity market capitalization as a percentage of GDP, commercial bank lending as a percentage of GDP, the inflation rate, the strength of labor unions, the unit labor costs, the corporate tax rate, the performance of national stock market indices, the exit channel and R&D expenditures. These are all variables that have been shown to affect PE investments in the paper by Bernoth et al. (2010) and are therefore included as control variables in the regression. Missing values in the control variables have been filled up by making use of linear interpolation and extrapolation if possible. This is the case for the variables R&D expenditures, unit labor costs and union labor strength. All three control variables show a clear linear trend in the data, so that missing values could be replaced. Missing values for the exit channel, stock market performance and equity market capitalization cannot be replaced due to the volatile nature of these variables. I will elaborate on some control variables in this regression below. For more information about the control variables I refer you to the paper by Bernoth et al. and Appendix A.

Commercial bank lending

Commercial bank lending is defined as the amount of domestic credit given by banks to the private sector as a percentage of the (real) GDP and has been found to be a significant

[10] http://www.systemicpeace.org

determinant of PE investments in Europe by Bernoth et al. (2010). Their results indicate that PE investments are significantly positively affected by a higher rate of commercial bank lending. Furthermore, they find that this result is more pronounced in CEE countries than in Western European countries, although the result is significant for both subsamples. The intuition behind this result is that when PE firms have more access to debt financing, which is proxied by a higher rate of commercial bank lending, they are more likely to pursue investments because PE firms often use significant amounts of debt in their transactions.

Corporate tax rate

The corporate tax rate is defined as the basic central government income tax rate. Gompers and Lerner (1998) find that corporate tax incentives play a significant role for the amount of PE investments. Their results indicate that a higher corporate tax rate significantly decreases the amount of venture capital investments. This result is intuitive as PE firms are less willing to invest in countries if they have to pay more taxes. This result is confirmed by Bernoth et al. (2010) in CEE countries, but they find an insignificant result for Western European countries. This result implies that Eastern European countries can attract more PE investments by lowering their corporate income taxes.

R&D expenditures

The current literature has found a positive and significant effect of research and development (R&D) expenditures on the amount of PE investments (Bonini and Alkan, 2012; Gompers and Lerner, 1998). The intuition is as follows. According to Gompers and Lerner, increases in the R&D expenditures and the level of the stock market often imply a growing economy. Growing economies present more opportunities to start a new business, which increases the demand for venture capitalists. This could, in return, increase the level of commitments to PE funds. Since data on R&D expenditures are missing from 1989-1995 for virtually every country, the data for these countries has been obtained by making use of a linear extrapolation of the data. Linear extrapolation could be used because the R&D expenditures followed a linear trend from 1996-2014.

Exit channel

The exit channel is in line with Meyer (2006) and defined as follows:

$$Exit\ channel = \frac{IPO\ divestments_t}{PE\ investments_{t-3}} \tag{3.3}$$

where IPO divestments is the amount of divestments of private equity firms through an initial public offering (IPO) at time t. The ability to exit the investment opportunity within 3 to 5 years is an important determinant to invest or not for a PE firm (Caselli, 2010). If a PE firm is unable to exit an investment within a short period of time, the firm is less likely to invest. This implies that a higher exit channel is associated with higher PE investments. The exit within 3 years is chosen here because of data availability. A longer time period for the exit of 4 or 5 years would significantly reduce the sample on divestments.

3.2 Methodology

This section presents the empirical methodology. In line with Li and Liu (2005) and Frontier Economics (2013), I will estimate an endogenous growth model with innovation as the most important determinant of economic growth, as outlined in the theoretical framework. For this examination, I will perform the following basic LSDVM regression:

$$GGDP_{jt} = \beta_0 + \beta_1 PE_{jt} + \beta_2 \psi_{jt} + u_{jt} \tag{3.4}$$

where $GGDP_{jt}$ is the growth rate of the real GDP in country *j* at time *t*; PE_{jt} is private equity investments in country *j* at time *t* as a percentage of the real GDP and ψ_{jt} is a matrix of control variables which have been shown to affect the GDP growth rate in line with Barro and Lee (1994, 1996) and Meyer (2006). These control variables are described in the Data section. Since this is a panel data study of 21 European countries, I expect there to be omitted variables that vary per country but not over time. Therefore, this regression will be estimated using cross-section fixed effects, to control for omitted variable bias. Appendix B shows the correlation matrix of the independent variable PE and the control variables. The table shows that there is no multicollinearity among these variables in equation 3.4.

Obstfeld (2009) notes that the major ambiguity in the finance-growth literature is whether financial development causes growth or is caused by growth, though much of the literature finds evidence for the first effect. To examine whether reverse causality is an issue for this paper, I will use the approach of Meyer (2006) and Li and Liu (2005). That is, I examine first if real economic growth affects PE investments after accounting for certain control variables using the following basic OLS regression:

$$PE_{jt} = \beta_0 + \beta_1 GGDP_{jt} + \beta_2 \chi_{jt} + u_{jt} \tag{3.5}$$

where PE_{jt} is PE investments in country *j* at time *t* as a percentage of real GDP*;* $GGDP_{jt}$ is the growth rate of the real GDP in country *j* at time *t* and χ_{jt} is a matrix of control variables. These control variables are in line with Meyer (2006) and Bernoth et al. (2010) and include, among others, the national stock market performance, the exit channel (initial public offering divestments/PE investments three years before) and general expenditures of a country to R&D expenses. Again, since this is a panel data study of 21 European countries, I expect there to be omitted variables that vary per country but not over time. Therefore, this regression will be estimated using cross-section fixed effects to control for omitted variable bias. Appendix C shows the correlation matrix of the independent variable GGDP and the control variables. The table shows that there is no multicollinearity among these variables in equation 3.5.

In addition, I will perform a second test to determine whether there is an endogenous relationship between PE investments and economic growth by performing the Durbin-Wu-Hausman test (augmented regression test) in line with Davidson and MacKinnon (1993) and Li and Liu (2005). This procedure works as follows. Suppose that there are two single equations of the following form:

$$z = a_0 + a_1 x_1 + a_2 x_2 + \varepsilon_1 \; ; \qquad y = b_0 + b_1 z + b_2 x_3 + \varepsilon_2 \tag{3.6}$$

To perform the augmented regression, I first need to obtain the residuals (res_z) of each endogenous right-hand side variable by estimating the following reduced form regression:

$$z = c_0 + c_1 x_1 + c_2 x_2 + c_3 x_3 + \varepsilon_3 \tag{3.7}$$

Then, the following augmented regression is performed including the residuals of *z*:

$$y = d_0 + d_1 z + d_2 x_3 + d_3 z\_res + \varepsilon_4 \tag{3.8}$$

If we find that the coefficient for d_3 is significantly different from zero using an F-test, the OLS estimates are not consistent and endogeneity is indicated.

If the two tests indicate endogeneity, I will attempt to control for this using the approach of Li and Liu (2005). That is, I will use a two-stage least-squares (2SLS) procedure with instrumental variables. While it is acknowledged that there are no perfect instrumental variables available (Strömberg, 2009), other attempts to control for endogeneity are not free of problems either. For example, the research done by Nair-Reichert and Weinhold (2001) using the MFR

estimator may suffer from spurious causality due to the omission of relevant variables (Li and Liu, 2005). This is the case for other studies using Granger causality tests as well, which could lead to wrong inferences of the way in which the causality flows (Caporale and Pittis, 1997).

The instrumental variables to instrument PE investments to control for possible endogeneity will be in line with Li and Liu (2005), Campos and Kinoshita (2002) and Borensztein et al. (1998). To date, there have been no empirical studies that directly examine the effect of PE investments on economic growth whilst controlling for endogeneity. Therefore, there are no (perfect) instrumental variables. All the variables on the right-hand side of the reduced form in equation 3.7 will be tested to use as instrumental variables. For example, (lagged values of) the real GDP growth rate, gross domestic investments, the number of telephone lines and all other control variables mentioned above in the Data section. Furthermore, I test venture capital investments and buyout investments as an instrument for private equity investments because it has been shown in the literature that venture capital investments are not affected by the real GDP growth rate (Meyer, 2006). Lastly, I test the financial assets held by domestic autonomous pension funds and insurance corporations as a percentage of GDP as an instrumental variable (Bernstein et al., 2010).

Before proceeding to the empirical results, I need to ensure that all the variables in the panel data set are stationary. This is needed to ensure that the provided regressions are not spurious. In line with Li and Liu (2005), I use the panel unit root test by Levin et al. (2002). The null hypothesis of this test is that the variable in question contains a unit root. The results are depicted in Table 3.2 and show that all the variables, except for the regime durability, are stationary. The nonstationarity of the regime durability variable lies in the nature of the variable. Once a regime changes, the regime durability starts from 0 again and consequently moves back to where it started in terms of the number of years of the new regime. Because all other variables are stationary, the regression results are therefore reliable and not spurious.

Table 3.2: Unit root tests for the key variables

The panel Levin-Lin-Chu unit root test with a null hypothesis that the variable in question contains a unit root is performed on all key variables below. Lag length is chosen automatically according to the Schwarz Information Criterion (SIC). All tests are done with an intercept, unless specified otherwise.

Variable	Levin et al. t-statistic	*p-value*	Observations included
GGDP	-9.377	0.000***	492
PE	-2.348	0.009***	464
GDP initial	N/A	N/A	N/A
GDI	-4.516	0.000***	505
SCH	-31.479	0.000***	448
GPOP	-3.139	0.001***	488
OPEN^	-2.973	0.002***	514
GFCE	-2.273	0.012**	515
Telephone lines	-3.172	0.001***	511
Democracy	-3.883	0.000***	279
Technology gap	-1.960	0.025**	498
Regime durability	0.188	0.574	25
Polity IV score	-16.727	0.000***	120
Stock market	-16.926	0.000***	461
Unemployment rate	-4.043	0.000***	483

Notes: (1) ^ with intercept and trend. *significant at 10%; **significant at 5%; ***significant at 1%

4. Empirical Results

This section first presents the results on the single equations and then tests for endogeneity issues. The next section addresses the endogeneity issues using two-stage least squares regressions and in the last subsection I provide robustness checks.

4.1 Single equations

Firstly, I conduct the Hausman test to examine whether fixed effects or random effects should be used for equation 3.4, even though fixed effects are usually the most appropriate thing to use when working with panel data because it captures omitted variables bias. The Hausman test tests the null hypothesis that the difference in coefficients is not systematic. Table 4.1 shows that the Hausman test strongly favors the use of fixed effects. All regressions will therefore be performed using fixed effects.

Table 4.1: Hausman test

The Hausman test tests the following null hypothesis: H0: The difference in coefficients is not systematic. It is used to determine whether the model should be estimated using fixed effects or random effects.

Test Summary	$\chi^2 - Statistic$	p-value
	108.12	0.000***

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Next, the model needs to be tested if it satisfies the Gauss-Markov conditions for performing a least squares regression. That is, the model needs to satisfy these five assumptions: (1) homoskedasticity, (2) no serial correlation, (3) the error terms are uncorrelated with the independent variables, (4) the error terms have a mean of zero and (5) there exists no multicollinearity (Verbeek, 2012). The use of a fixed effects model corrects for violations of assumption 3 and 4. Furthermore, I have shown before that the regressions do not have issues of multicollinearity. I proceed to test the assumptions 1 and 2: homoskedasticity and no serial correlation.

To test for serial correlation, I use the Wooldridge test for first-order serial correlation in panel data. The Wooldridge test tests the null hypothesis that there is no first order serial correlation. The test gives a p-value of 0.000, rejecting the null hypothesis and indicating that the panel data contains significant serial correlation (Table 4.2).

Table 4.2: Wooldridge test

The Wooldridge test tests the following null hypothesis: H0: No first-order autocorrelation.

Test Summary	F-statistic	p-value
	286.339	0.000***

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Secondly, I perform a modified Wald test for groupwise heteroskedasticity in a fixed effects regression model. This test tests the null hypothesis of homoskedasticity. Table 4.3 indicates the presence of significant heteroskedasticity.

Table 4.3: Modified Wald test

The modified Wald test tests the following null hypothesis: H0: Homoskedasticity.

Test Summary	$\chi^2 - Statistic$	p-value
	194.35	0.000***

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Thus, before I estimate equation 3.4, I need to correct for both serial correlation and heteroskedasticity. To overcome this problem, I use the method of Hoechle (2007) which corrects for heteroskedasticity and serial correlation in panel data using Driscoll and Kraay (1998) standard errors while allowing to use fixed effects. Further, I will use country fixed-effects to capture structural differences between countries as indicated by the DWH test.

The results for equation 3.4 are depicted in Table 4.4. Note that due to the use of fixed effects, an important explanatory variable needs to be removed from the equations, GDP initial per capita. The robustness section will further elaborate on this issue. Regression 4.1 shows the basic regression with the core variables that influence GDP growth in the literature. Not all core variables have the expected signs. Specifically, the number of years of secondary schooling significantly negatively affects the economic growth rate which is not consistent with the empirical literature. More interesting is the fact that regression 4.1 shows a significant and positive effect of private equity investments on economic growth after controlling for the core variables that affect economic growth. A 1% increase in private equity investments raises economic growth by approximately 2%. Specifications 4.2 and 4.3 include control variables for the infrastructure and stability of a country. The results are similar to regression 4.1 and show a positive and significant effect of private equity investments on economic growth, whilst the added control variables are insignificant. Regression 4.4 is the only specification in which private equity investments do not significantly affect economic growth, although the sign is still

positive and the coefficient is only barely insignificant at the 10% level. This regression includes the technology gap and results in a positive and significant effect on economic growth. This implies that a higher technology gap increases economic growth.

Regressions 4.5 until 4.7 all show the same picture. Private equity investments continue to have a positive and significant effect on economic growth whilst including political stability control variables and the unemployment rate and stock market performance. Of these control variables, only regime durability enters the regressions significantly. Specifically, a higher stable regime duration significantly decreases economic growth at the 5% significance level.

Table 4.4: Effect of private equity on the real GDP growth per capita

This table shows the results for a normal OLS regression with fixed effects. The dependent variable is the real GDP growth rate per capita.

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
PE/GDP	2.009	2.040	1.945	1.658	2.665	2.641	2.539	2.550
	(0.056)*	(0.048)**	(0.063)*	(0.107)	(0.015)**	(0.017)**	(0.016)**	(0.019)**
Gross domestic investment	0.213	0.209	0.207	0.250	0.227	0.234	0.223	0.217
	(0.009)***	(0.011)**	(0.011)**	(0.006)***	(0.009)***	(0.009)***	(0.017)**	(0.008)***
Years of schooling	-0.004	-0.004	-0.004	-0.005	0.002	0.002	0.003	0.003
	(0.087)*	(0.094)*	(0.075)*	(0.037)**	(0.492)	(0.585)	(0.427)	(0.456)
Population growth	-1.708	-1.678	-1.711	-1.697	-1.536	-1.520	-1.470	-1.485
	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.000)***	(0.000)***
Openness	0.010	0.011	0.010	0.022	0.049	0.051	0.051	0.050
	(0.452)	(0.429)	(0.469)	(0.128)	(0.012)**	(0.010)**	(0.011)**	(0.011)**
GFCE	-0.985	-0.973	-0.982	-1.024	-0.825	-0.813	-0.854	-0.848
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Telephone lines		0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
		(0.450)	(0.550)	(0.901)	(0.838)	(0.804)	(0.407)	(0.405)
Democracy			-0.007	-0.011	-0.008	-0.009	-0.011	-0.011
			(0.299)	(0.069)*	(0.165)	(0.162)	(0.075)*	(0.075)*
Technology gap				0.014	0.012	0.013	0.014	0.014
				(0.018)**	(0.049)*	(0.032)**	(0.058)*	(0.040)**
Regime durability					-0.015	-0.002	-0.002	-0.002
					(0.029)**	(0.032)**	(0.026)**	(0.028)**
Polity IV score						0.003	0.002	0.002
						(0.381)	(0.410)	(0.410)
Stock market performance							0.009	0.009
							(0.165)	(0.180)
Unemployment								-0.010
								(0.776)
Constant	0.175	0.167	0.183	0.170	0.159	0.122	0.157	0.104
	(0.001)***	(0.002)***	(0.001)***	(0.000)***	(0.000)***	(0.076)*	(0.014)**	(0.007)***
R-squared	0.323	0.324	0.323	0.357	0.379	0.380	0.387	0.387
Countries	21	21	21	21	21	21	20	20
Observations	478	478	478	478	478	478	454	454

Notes: (1) For these samples, the Hausman test suggests the use of fixed effects, so all models are estimated using the fixed effect method. (2) The regressions are corrected using Driscoll-Kraay standard errors. (3) p-values in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

4.2 Endogeneity

To test for endogeneity in equation 3.5, I first need to test the Gauss-Markov conditions again. The tests provide significant evidence of the presence of first-order serial correlation and heteroskedasticity again (Table 4.5 and Table 4.6).

Table 4.5: Wooldridge test

The Wooldridge Test tests the following null hypothesis: H0: No first-order autocorrelation.

Test Summary	F-statistic	p-value
	83.356	0.000***

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Table 4.6: Modified Wald test

The modified Wald test tests the following null hypothesis: H0: Homoskedasticity.

Test Summary	$\chi^2 - Statistic$	p-value
	4505.12	0.000***

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Again, I use the method of Hoechle (2007) which corrects for heteroskedasticity and serial correlation in panel data. The results for equation 3.5 are depicted in Table 4.7. In all three equations, the GDP growth has a positive and significant effect on private equity investments, which implies an endogenous relationship between economic growth and private equity investments. In line with Bernoth et al. (2010), the equity market capitalization, commercial bank lending, inflation, unit labor costs and corporate tax rate all significantly affect the amount of private equity investments. However, not all control variables have the expected sign. Both unit labor costs and corporate tax rate have a significant positive effect on private equity investments, while a negative relationship is expected. All the other variables show the expected signs.

Secondly, I perform the Durbin-Wu-Hausman (DWH) test to test for endogeneity in accordance with equations 3.6-3.8. The DWH test indicates that real GDP growth per capita and private equity investments are endogenously related to each other (Table 4.8) and confirms the results in Table 4.7. However, in line with the findings of Meyer (2006) I do not find evidence that venture capital investments and real GDP growth suffer from endogeneity (p-value of 1.000). The results are similar for buyout investments with a p-value of 1.000 and an F-statistic of 0.00 (Table 4.8).

Table 4.7: Effect of economic growth on private equity

This table shows the results for a normal OLS regression with country-specific fixed effects. The dependent variable is the private equity investments.

	4.9	4.10	4.11
Real GDP growth per capita	0.010	0.010	0.010
	(0.001)***	(0.001)***	(0.001)***
Market capitalization	0.001	0.001	0.001
	(0.004)***	(0.002)***	(0.003)***
Commercial bank lending	0.001	0.001	0.001
	(0.006)***	(0.007)***	(0.007)***
Inflation	0.014	0.015	0.013
	(0.000)***	(0.000)***	(0.001)***
Unit labor costs	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***
Corporate tax rate	0.002	0.002	0.002
	(0.022)**	(0.056)*	(0.039)**
R&D expenditure	-0.011	-0.008	-0.010
	(0.681)	(0.772)	(0.717)
Exit channel		-0.000	-0.000
		(0.147)	(0.142)
Stock market performance			-0.000
			(0.130)
Constant	-0.005	-0.005	-0.005
	(0.000)***	(0.000)***	(0.000)***
R-squared	0.330	0.336	0.339
Countries	20	20	20
Observations	407	393	392

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Table 4.8: Durbin-Wu-Hausman test

This Wald test tests the following null hypothesis: H0: Residuals are equal to zero.

Test Summary	F-statistic	*p*-value
Residuals PE investments	8.94	0.008***
Residuals VC investments	0.00	1.000
Residuals BUY investments	0.00	1.000

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

4.3 Two-stage least squares

Since the literature of private equity on economic growth is limited, there exists no perfect instrumental variable to instrument private equity investments. Li and Liu (2005) in their study on FDI suggest the use of all right-hand side variables of the reduced form (equation 3.7) as instrumental variables. This implies the use of all control variables of equation 3.4 and 3.5 as instrumental variables. In Table 4.7, I find that the following variables have a significant effect on PE investments: real GDP growth rate, market capitalization, commercial bank lending, inflation, unit labor costs and finally the corporate tax rate. Therefore, these variables are initially tested as instrumental variables including lagged variables of PE in line with the FDI literature (Borensztein et al., 1998). Furthermore, I test venture capital investments as an instrument for private equity investments because it has been shown in the literature that venture capital investments are not affected by the real GDP growth rate (Meyer, 2006). I come to the same conclusion that venture capital investments (and buyout investments) and the real GDP growth rate are not endogenously related in my sample as noted before. Lastly, I test the financial assets held by domestic autonomous pension funds and insurance corporations as a percentage of GDP as an instrumental variable. Bernstein et al. (2010) used this as an instrumental variable for private equity investments, including lagged values of private equity investments.

To test the validity of these instrumental variables, they need to satisfy two assumptions in line with Verbeek (2012):

1. Relevance
2. Exogeneity

The relevance assumption states that the instrumental variable should have a significant effect on private equity investments. I test for this assumption in two ways. First, I regress the instrumental variables on the private equity investments to see if the variables are correlated. Second, I test the significance of the excluded instruments in the first-stage regression using an F-statistic. As a rule of thumb, Stock and Watson (2011) find that an F-statistic larger than 10 in the first-stage regression suggests that the instruments used are strong and vice versa.

The exogeneity assumption states that the instrumental variables are uncorrelated with the error term. This assumption cannot be tested. In line with Verbeek (2012), I therefore assume that the instrumental variables are exogenous. A test for overidentifying restrictions, or

Hansen's J-statistic, tests whether all instrumental variables are exogenous after assuming that at least one of the instruments is already exogenous.

All the proposed instruments above have a significant effect on private equity investments. Furthermore, these instrumental variables provide an F-statistic in the first-stage regression of 21.31, which is above the rule of thumb by Stock and Watson (2011). However, the Hansen-J statistic of overidentification presents that the instruments are overidentified (p-value of 0.001 and J-statistic of 22.432). Therefore, instrumental variables are removed to satisfy the test of overidentification. The resulting instrumental variables are venture capital investments and buyout investments, both of which have been found not to be affected by endogeneity issues before (Table 4.8). When using lagged variables of PE, a common instrumental variable in the economic growth literature, all combinations of instrumental variables indicate overidentification. Therefore, lagged variables of PE are not used as instrumental variables.

The F-statistic of the first-stage regression is 6912.26, which is well above the rule of thumb of 10 by Stock and Watson (2011), implying strong and valid instruments. Furthermore, the Hansen J-statistic states that I cannot reject the null hypothesis, supporting the validity of my instruments (p-value of 0.590 and J-statistic of 0.290). Therefore, I have confirmed that these two instruments are valid and will be used throughout the paper.

The 2SLS regression is performed using HAC standard errors that are robust to heteroskedasticity and serial correlation whilst using fixed effects. The results are shown in Table 4.9. Again, regression 4.12 shows the basic regression with the core variables that influence GDP growth in the economic growth literature. Because of the high correlation between private equity investments and venture capital investments (61.25%) and buyout investments (97.61%), the results are in line with the single equations. Again the number of years of secondary schooling shows the unexpected negative sign, although the result is only significant in specifications 4.14 and 4.15. Nonetheless, this result is in line with Li and Liu (2005), finding the same unexpected outcome.

The most interesting result is the positive and significant effect of private equity investments on the economic growth in all equations. In fact, an increase in private equity investments as a percentage of GDP of 1% increases economic growth by 1.9% to 2.8%, depending on the specification. This finding is significant at the 1% significance level in all specifications. This result confirms the findings of the single equations and shows that the findings of the single equations are robust to endogeneity issues.

Furthermore, more openness to trade still positively affects economic growth in line with the single equations in specifications 4.16 to 4.19. In line with the previous literature, government consumption also negatively and significantly affects economic growth in all specifications. The results on the technology gap and regime durability remain highly significant in all specifications as well, with their respective unexpected signs. That is, a higher technology gap increases economic growth and a higher level of regime duration decreases economic growth. An interesting result arises from the stock market performance. There exists a positive and significant effect of the stock market on economic growth in both regression 4.18 and 4.19, unlike the single regressions estimated before. This result is in line with Meyer (2006). Nonetheless, the unemployment rate, the Polity IV score and the number of telephone lines per capita never enter the regressions significantly.

4.4 Robustness checks

To further examine the relationship between private equity investments and real GDP growth, I have estimated several different specifications to test the general robustness of my results.

Firstly, the definitions above of PE and real GDP growth assume that increases in private equity investments in one year lead to increases in real GDP growth in that same year, i.e. it investigates a relationship over the short-run. To investigate whether private equity investments have a long-run effect on real GDP growth as well, I include lagged variables of private equity investments as a robustness check in line with the methodology of Görg and Strobl (2002). That is, I include lagged variables of private equity investment as explanatory variables.

Secondly, due to the use of fixed effects the initial real GDP per capita had to be dropped in all of the previous regressions. Nonetheless, the initial real GDP per capita has been shown to have a strong effect on real GDP growth in previous literature. Including the initial real GDP per capita takes into account the fact that some countries are (initially) richer than others, which explains their subsequent growth pattern. Therefore, I include the initial real GDP per capita to examine whether this affects the outcomes. The results are shown in Table 4.10 and corrected for heteroskedasticity and serial correlation in accordance with the previous methodology.

Regressions 4.20-4.22 indicate the results using pooled OLS whilst using fixed effects including lagged variables of PE investments up until the third lag. The results show that all three lagged variables of PE investments are highly statistically insignificant, which suggests that there is no long-run positive effect of private equity investments on the real GDP growth rate. However, these results are not controlled for the observed reverse causality. Therefore,

regressions 4.23-4.25 indicate the results using two-stage least squares whilst using the same instrumental variables as before. The results indicate a strong statistically significant and positive sign of private equity investments on real GDP growth, indicating that private equity investments have a positive long-run effect on real GDP growth. These findings support my earlier results.

Finally, regressions 4.26 and 4.27 indicate the results including the initial real GDP per capita as control variables to see if the results change. The results suggest that the effect of private equity investments on real GDP growth remain more or less unchanged, indicating a strong positive effect of private equity investments on real GDP growth, even after controlling for endogeneity.

Table 4.9: Effect of private equity on the real GDP growth per capita

This table shows the results for the two-stage least squares (2SLS) regressions with fixed effects and HAC standard errors. The dependent variable is the real GDP growth rate per capita.

	4.12	4.13	4.14	4.15	4.16	4.17	4.18	4.19
PE/GDP	2.285	2.307	2.210	1.869	2.814	2.776	2.633	2.573
	(0.001)***	(0.000)***	(0.001)***	(0.005)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***
Gross domestic investment	0.211	0.205	0.205	0.248	0.226	0.233	0.222	0.213
	(0.002)***	(0.002)***	(0.002)***	(0.000)***	(0.001)***	(0.001)***	(0.003)***	(0.018)**
Years of schooling	-0.004	-0.004	-0.005	-0.005	0.002	0.002	0.003	0.003
	(0.101)	(0.106)	(0.071)*	(0.038)**	(0.445)	(0.532)	(0.326)	(0.352)
Population growth	-1.714	-1.683	-1.715	-1.699	-1.536	-1.520	-1.470	-1.477
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Openness	0.010	0.011	0.010	0.022	0.049	0.051	0.051	0.051
	(0.469)	(0.460)	(0.506)	(0.181)	(0.006)***	(0.007)***	(0.007)***	(0.007)***
GFCE	-0.984	-0.972	-0.981	-1.023	-0.822	-0.810	-0.853	-0.851
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Telephone lines		0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
		(0.505)	(0.636)	(0.916)	(0.878)	(0.854)	(0.527)	(0.525)
Democracy			-0.007	-0.011	-0.008	-0.009	-0.011	-0.011
			(0.276)	(0.073)*	(0.196)	(0.178)	(0.058)*	(0.059)*
Technology gap				0.014	0.012	0.013	0.014	0.015
				(0.000)***	(0.003)***	(0.003)***	(0.011)**	(0.012)**
Regime durability					-0.002	-0.002	-0.002	-0.002
					(0.000)***	(0.000)***	(0.000)***	(0.000)***
Polity IV score						0.003	0.002	0.002
						(0.462)	(0.561)	(0.565)
Stock market performance							0.009	0.009
							(0.016)**	(0.014)**
Unemployment								-0.013
								(0.840)
Countries	21	21	21	21	21	21	20	20
Observations	478	478	478	472	472	472	454	454

Notes: (1) For these samples, the Hausman test suggests the use of fixed effects, so all models are estimated using the fixed effect method. (2) The regressions are corrected using HAC standard errors. (3) p-values in parentheses. (4) Instruments used are venture capital investments and buyout investments. (5) The constant is not reported because it is not estimated in a 2SLS model with fixed effects. (6) R-squared is not reported because it does not provide any information in 2SLS. *significant at 10%; **significant at 5%; ***significant at 1%

Table 4.10: Effect of private equity on the real GDP growth per capita

This table shows the results for the robustness checks including lagged independent variables and the initial real GDP as control variable. The dependent variable is the real GDP growth rate per capita.

	4.20 OLS	4.21 OLS	4.22 OLS	4.23 2SLS	4.24 2SLS	4.25 2SLS	4.26 OLS	4.27 2SLS
PE/GDP							3.580	3.912
							(0.009)***	(0.000)***
PE/GDP (-1)	-0.431			4.261				
	(0.726)			(0.001)***				
PE/GDP (-2)		-1.082			6.239			
		(0.249)			(0.003)***			
PE/GDP (-3)			0.256			7.846		
			(0.785)			(0.028)**		
GDP initial							0.000	0.000
							(0.404)	(0.338)
Gross domestic investment	0.178	0.231	0.314	0.209	0.264	0.334	0.059	0.061
	(0.060)*	(0.009)***	(0.000)***	(0.030)**	(0.008)***	(0.001)***	(0.482)	(0.442)
Years of schooling	0.003	0.003	0.004	0.003	0.003	0.003	-0.005	-0.006
	(0.500)	(0.425)	(0.241)	(0.375)	(0.349)	(0.368)	(0.010)***	(0.013)**
Population growth	-1.48	-1.565	-1.901	-1.502	-1.712	-2.189	-0.635	-0.657
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.093)*	(0.080)*
Openness	0.046	0.048	0.053	0.056	0.069	0.075	0.021	0.022
	(0.020)**	(0.011)**	(0.004)***	(0.003)***	(0.001)***	(0.002)***	(0.001)***	(0.002)***
GFCE	-0.908	-0.892	-0.830	-0.869	-0.926	-0.911	-0.279	-0.286
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.009)***	(0.000)***
Telephone lines	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.000
	(0.352)	(0.535)	(0.375)	(0.542)	(0.682)	(0.502)	(0.129)	(0.111)
Democracy	-0.014	-0.012	-0.016	-0.011	-0.008	-0.012	-0.003	-0.003
	(0.019)**	(0.046)**	(0.015)**	(0.075)*	(0.184)	(0.110)	(0.571)	(0.749)
Technology gap	0.020	0.022	0.025	0.015	0.017	0.023	0.001	0.001
	(0.022)**	(0.020)**	(0.005)***	(0.020)**	(0.022)**	(0.006)***	(0.619)	(0.861)
Regime durability	-0.001	-0.001	-0.002	-0.002	-0.002	-0.003	-0.000	-0.000
	(0.052)*	(0.091)*	(0.022)**	(0.000)***	(0.000)***	(0.000)***	(0.006)***	(0.000)***
Polity IV score	0.003	0.003	0.001	0.003	0.002	-0.000	0.003	0.003
	(0.220)	(0.291)	(0.655)	(0.468)	(0.630)	(0.961)	(0.140)	(0.441)
Stock market performance	0.009	0.008	0.007	0.011	0.010	0.006	0.010	0.010
	(0.189)	(0.213)	(0.307)	(0.004)***	(0.007)***	(0.119)	(0.153)	(0.024)**
Unemployment	-0.076	-0.070	-0.040	-0.000	0.008	-0.009	-0.032	-0.031
	(0.097)*	(0.112)	(0.342)	(0.997)	(0.910)	(0.894)	(0.300)	(0.402)
Constant	0.167	0.144	0.154				0.035	0.036

	(0.009)***	(0.024)**	(0.023)**				(0.422)	(0.486)
R-squared	0.381	0.400	0.429	-	-	-	0.206	-
Countries	20	20	20	20	20	20	20	20
Observations	449	434	417	449	434	417	454	454

Notes: (1) The estimation method is provided below the regression number. (2) Regressions 4.20 to 4.25 are estimated using fixed effects (3) The regressions using OLS are corrected using Driscoll-Kraay standard errors (4) The regressions using 2SLS are corrected using HAC-standard errors. (5) p-values in parentheses. (6) Instruments used are venture capital investments and buyout investments. (7) The constant is not reported for 2SLS because it is not estimated in a 2SLS model with fixed effects. (8) R-squared is not reported for 2SLS because it does not provide any information in 2SLS. *significant at 10%; **significant at 5%; ***significant at 1%

5. Discussion of Results

This chapter discusses the results of my analysis and links them to the results of previous literature on the topic. This thesis investigates the research question: what is the effect of private equity on the economic growth in Europe? This question is answered using the hypothesis that private equity has a positive effect on economic growth following the endogenous growth model and previous literature.

Thus far, the empirical analysis provides strong evidence that private equity promotes economic growth. Specifically, I find strong evidence that, ceteris paribus, an increase in private equity investments as a percentage of GDP by 1% increases the real economic growth rate by approximately 1.9% to 2.8%. This result is in line with my hypothesis and the findings of Meyer (2006), who finds that an increase in private equity investments by 1% increases real economic growth by 2% for buyout investments and 3.6% for venture capital investments. Furthermore, I find that these findings are robust to reverse causality issues using an instrumental variable approach and different specifications. Specifically, an increase in private equity investments as a percentage of GDP by 1% increases the real economic growth rate by 4.3% to 7.8% in the long-run. This implies that my results confirm the general findings of Frontier Economics (2013) and Meyer (2006). In fact, Meyer does not find evidence that real GDP growth and private equity investments are endogenously related. This is due to the fact that his research uses venture capital investments as the dependent variable in the endogeneity regression. My results also indicate no evidence of reverse causality when using venture capital and buyout investments as a dependent variable, but this result changes when using total private equity investments as a dependent variable. Therefore, I have used venture capital investments and buyout investments as an instrumental variable for private equity investments. A reason for the discrepancy between my findings and those of Meyer could be the sample used. Meyer uses data from 1994-2004 and includes a booming period of private equity investments as can be seen in Figure 1.1. My sample includes the relatively infant years of the European private equity industry and the recent financial crisis. Furthermore, Meyer makes a distinction between venture capital investments and buyout investments whereas I use total private equity investments.

Some other interesting results arise from the control variables. I find no evidence that higher political instability of a country decreases economic growth. On the contrary, I find that that a higher stable regime durability as a proxy for political stability decreases economic

growth. In addition, I find no significant evidence of the Polity IV score on economic growth. Most of the literature on economic growth finds a negative and significant effect of political instability on economic growth (Barro and Lee, 1994; Easterly and Levine, 1997; Fosu, 2001; Sala-i-Martin, 1997). However, there is some literature that finds no evidence of an effect of political stability on economic growth. For example, Borensztein et al. (1998) use the number of assassinations and wars in a country as a proxy for political instability. Although the signs of the coefficients are in the same direction as the literature mentioned above, the results were not significant. Similarly, Li and Liu (2005) use the number of riots as a measure of political instability and also find insignificant results. They also note that previous literature finds strong evidence of a negative relationship between political instability and economic growth, but that there is much ambiguity about the real effects of political instability. Part of the reason why I find no evidence of an effect of political stability on the economic growth is that I use a sample of predominantly developed countries. This is because information on private equity investments in developing countries is not available. Other studies mainly use panel data of countries all over the world. Nonetheless, the effect of the Polity IV score is in line with the results of Sachs et al. (1995), although they use a different political instability index.

Moreover, the significant effect of the stock market on economic growth is in line with the expectations, but this result must be taken with caution. A number of mechanisms are at work. Intuitively, higher stock markets increase the optimism of consumers who consequently increase their spending on consumer goods. Secondly, in bull markets companies are more optimistic about the future prospects of their firm. Moreover, borrowing rates are often more attractive when the economy is booming. As a result, companies invest more in, for example, employees, machines and other factors that eventually increase GDP because of improved productivity. But this is not the entire story. In fact, Ritter (2005) finds evidence that the correlation between long-run equity returns and long-run economic growth is negative. He states that economic growth occurs through increases in productivity and increased inputs, in line with the findings by Krugman (1994). However, increases in productivity and inputs do not necessarily benefit capital owners. In fact, economic growth increases the standard of living of people, but this does not imply that share prices increase.

My results also indicate a negative effect of the population growth rate on economic growth. This finding contradicts Barro and Lee (1994) but is in line with Mankiw et al. (1992). The reasoning of Barro and Lee is that a higher population growth rate indicates that a country has a high net immigration rate or a lower mortality rate. Both factors contribute to economic growth. On the other hand, Mankiw et al. state that a higher population growth rate creates a

situation in which the available capital of a country must be spread more thinly over more people. As a result, the total factor productivity of the country decreases, which lowers economic growth. The empirical findings in this thesis therefore support the findings of Mankiw et al. and the augmented Solow growth model which predicts this finding.

Another contribution of this paper is that I find a positive and significant effect of the technology gap on economic growth. This implies that a higher technology gap increases economic growth. This result contradicts the findings of Li and Liu (2005) who find the opposite effect of the technology gap. However, my results are in line with Bende-Nabende et al. (2003) and Sjöholm (1999). Bende-Nabende et al. examine the effect of FDI on output in the less-developed countries Thailand and the Philippines and the more-developed countries Japan and Taiwan. They find evidence that, although Thailand and the Philippines are less-developed, the effect of FDI on output is more pronounced in these countries. This implies that a larger technology gap between countries increases the productivity spillovers. A similar result occurs in my sample, although further research is needed to examine whether private equity investments affect economic growth more in less-developed countries.

Finally, in line with the trade literature, my results also indicate a positive influence of (trade) openness on economic growth. This result is in line with the extensive trade-growth literature that examines this finding (Frankel and Romer, 1999; Li and Liu, 2005; Sachs et al., 1995; Sala-i-Martin, 1997). In fact, it is the main goal of the European Commission to promote trade to increase economic growth for the European Union in the coming 4 years according to the newly adopted strategy (European Commission*,* 2014*)*. My findings indicate that the strategy of the European Commission should work to promote economic growth.

Overall, the empirical findings indicate strong and robust evidence that private equity is able to promote economic growth in 21 European economies. Specifically, I find evidence that an increase in private equity investments as a percentage of GDP by 1% increases economic growth by 1.9% to 2.8%, and these results are robust to different specifications and endogeneity issues.

6. Conclusion

The recent bankruptcy of Dutch department store V&D has lead to much controversy again about the effects of private equity. The general public and media seem to have a rather pessimistic view of PE firms. Various reports indeed confirm that PE firms are struggling with a negative image and even the EVCA has expressed their concerns about the negative image of PE firms. This image seems to persist from the 1980s, in which leveraged buyouts with leverage levels up to 90% were the rule rather than the exception. Furthermore, member of the Dutch parliament Henk Nijboer frequently puts private equity on the agenda, calling to battle private equity excesses. Even PE firms themselves are worried about their image, possibly preventing them to raise funds in the future if this image persists. To battle the negative image, the EVCA calls to 'encourage the private equity industry to look beyond returns and recognize its role as a global influencer and agent for progress, which requires concrete examples and models for inspiration'. This thesis provides such a concrete example for the private equity industry.

Using a sample of 21 European countries from 1989-2014, I examine the effect of private equity on economic growth. In line with previous literature and the endogenous growth model, I test the hypothesis that private equity investments have a positive effect on the economic growth in Europe. I test this hypothesis using two measures. In the first regression, I regress economic growth on private equity investments using a Least Squares Dummy Variable Model using fixed effects to control for omitted variable bias. In the second regression, after testing for endogeneity, I employ a two-stage least squares regression using venture capital investments and buyout investments as instrumental variables for private equity investments. The results are consequently checked for their robustness to different specifications.

The empirical results indicate strong evidence that private equity has a positive effect on the economic growth in a sample of 21 European countries. Specifically, this paper finds strong evidence that an increase in private equity investments by 1% increases the real economic growth rate by approximately 1.9% to 2.8% in the short-run. This result is in line with the empirical literature of Meyer (2006) who finds similar results using a European dataset from 1994-2004. Furthermore, I find that this result is robust to different specifications and endogeneity issues. Specifically, after controlling for endogeneity using an instrumental variable approach, the significant positive effect remains strong throughout different specifications. That is, I find evidence that an increase in private equity investments by 1% increases the real economic growth rate by 4.3% to 7.8% in the long-run. The results of this

paper therefore show a clear acceptance of the first hypothesis and suggest that PE firms unilaterally increase economic growth.

This study contributes to both the existing literature and the field of PE in practice. This study is one of the first papers to use European data and to empirically examine the direct effects of PE on economic growth. Furthermore, PE firms and the EVCA can use the results of this paper to revise the image of the PE industry since it is found to contribute significantly to economic growth.

However, a number of limitations of this thesis need to be considered. The first limitation is that there are no perfect instrumental variables available to control for endogeneity. Even though both of the instrumental variables have been found not to be endogenously related to GDP growth, the exogeneity of the instruments cannot be tested. The results of 2SLS could then be inconsistent and not reliable. Nonetheless, I cannot reject the null hypothesis of overidentified restrictions, implying that my instruments are exogenous given that at least one of the instruments is exogenous.

A second limitation is the use of virtually only developed countries in Europe. Although I tried to include developing countries in Europe, including the Baltic countries and Ukraine, data on PE investments and control variables where hard to find. Therefore, these countries were excluded from the dataset. The inclusion of developing countries in this analysis could lead to vastly different results.

Finally, I have used an unbalanced panel data set due to missing observations for a number of control variables and PE investments. However, the use of an unbalanced panel data is not problematic in this case. Although there are some missing values for the Slovak Republic, the rest of the sample for the results in Table 4.4 are balanced and include all information. The results in Table 4.7 are more problematic, however, with missing observations for multiple countries and multiple variables. Nonetheless, the results for this Table are less important and double checked using a DWH test for endogeneity.

The results of this thesis present a number of topics for further research and an important policy implication. For example, the inclusion of developing countries could provide valuable insights into the effects of PE in developing countries in line with Li and Liu (2005). Due to data availability issues, this empirical analysis is not feasible today. Furthermore, further research could provide valuable insights into the relationship between the components of PE investments and economic growth. And lastly, the relationship between international PE investments as part

of FDI and economic growth has not been examined in this paper. This is due to the fact that these numbers are only recorded from 2007 onwards in the Invest Europe Yearbook - 2015. Future research on this topic would be an interesting contribution to the current literature of FDI and economic growth.

To conclude this thesis, I must note that there are still exuberances in PE, but this thesis has found a s structural and positive relationship between PE and economic growth. Therefore, an important policy implication would be to improve the image of PE in general as it proves to be a valuable alternative investment class. This thesis proves to be an important contribution to the EVCA in revising the image of the PE industry as it provides a concrete example of the beneficial effect of PE investments.

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APPENDIX A

Table A1: Variable descriptions and sources

This table shows the description and sources of the used regression variables.

Variable	Description	Source
GGDP	The real growth rate of GDP per capita, measured in market constant prices (2005).	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Private Equity (PE)	Private equity investments in EUR millions made by European private equity firms regardless of the location of the portfolio firm.	Invest Europe Yearbook - 2015 European Private Equity Activity. http://www.investeurope.eu/research/activity-data/annual-activity-statistics/
GDP initial per capita	The real GDP per capita in 1990, measured in market constant prices (2005).	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
GDI	The gross capital formation of a country as a percentage of the real GDP, measured in market constant prices (2005).	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Openness	The degree of openness of a country, given by the sum of exports and imports divided by real GDP.	Data for the imports and exports come from the Organisation for Economic Cooperation and Development (OECD). https://data.oecd.org For GDP data, see the variable 'GGDP'.
Schooling	Average years of secondary schooling for individuals aged 25 years and older.	Barro and Lee (1996). The updated files are available from the Center of International Development (CID) at Harvard University: http://www.cid.harvard.edu/ciddata/ciddata.html.
Population growth rate	The annual population growth rate.	The United Nations Statistics Division. The demographics are available through: http://unstats.un.org/unsd/demographic/products/dyb/dyb2.htm

GFCE	Government final consumption expenditure as a percentage of the real GDP.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Telephone lines	The number of fixed telephone subscriptions per capita.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Democracy	Democracy index which is an average of the rating for civil liberties and the rating for political rights on a scale of 1 (most free) to 7 (least free).	Freedom House Freedom Rating Database. https://freedomhouse.org
Technology gap	The level of GDP per capita in the European country as a percentage of the GDP per capita in the United States.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Regime durability	The number of years since the most recent regime change, defined by a three- point change in the Polity IV score over a period of three years or less, or the end of transition period defined by the lack of stable political institutions (denoted by a standardized authority score).	The Center for Systemic Peace. http://www.systemicpeace.org/inscrdata.html
Polity IV score	The Polity IV score is computed by subtracting the Autocracy score from the Democracy score. The resulting unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic).	The Center for Systemic Peace. http://www.systemicpeace.org/inscrdata.html

Stock market performance	The stock market performance of the largest national stock market index.	Yahoo Finance. http://finance.yahoo.com Data for Hungary comes from the Budapest Stock Exchange, available through http://bse.hu/ Data for Slovakia comes from the Bratislava Stock Exchange, available through http://www.bsse.sk/default.aspx Data for the Netherlands comes from Financieele Dagblad, available through http://beurs.fd.nl/noteringen/12272/aex/historie Data for Italy, Norway, Poland and Portugal come from the OECD Database, available through http://stats.oecd.org/
Unemployment rate	The total unemployment rate as a percentage of the total labor force.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Equity market capitalization	The market capitalization of listed domestic companies as a percentage of the real GDP. Market capitalization is defined as the number of outstanding shares times the share price.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Unit labor costs	Total unit labor costs in €.	OECD Database, available through http://stats.oecd.org/
Commercial bank lending	Domestic credit to private sector by banks as a percentage of the real GDP.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators
Inflation rate	The annual growth rate of the consumer price index (CPI).	OECD Database, available through http://stats.oecd.org/
Corporate tax rate	The basic central government corporate income tax rate.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators Blanks are filled in with the OECD Database, available through http://stats.oecd.org/
R&D expenses	Expenditures on research and development as a percentage of the real GDP.	World Bank World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators

Labor union strength	The number of union members as a percentage of the number of employees in a country.	OECD Database, available through http://stats.oecd.org/
Exit channel	The exit channel is defined as the divestments through an initial public offering (IPO) as a percentage of the private equity investments three years before.	Invest Europe Yearbook - 2015 European Private Equity Activity. http://www.investeurope.eu/research/activity-data/annual-activity-statistics/

APPENDIX B

Table B1: Correlation matrix equation 3.4

	PE	GDP initial	GDI	Openness	Schooling	GFCE	Population	Telephone lines	Democracy	Tech-nology gap	Regime durability	Polity IV score	Stock market	Un-Employment rate
PE	1.000													
GDP initial	0.250	1.000												
GDI	-0.216	-0.266	1.000											
Openness	-0.093	-0.486	0.144	1.000										
Schooling	0.404	0.212	-0.173	0.170	1.000									
GFCE	0.222	-0.053	-0.260	-0.032	0.227	1.000								
Population	0.173	-0.046	0.281	0.059	0.183	-0.155	1.000							
Telephone lines	0.219	0.306	-0.136	-0.293	0.313	-0.006	0.195	1.000						
Democracy	-0.228	0.190	-0.083	-0.270	-0.381	-0.076	-0.272	-0.067	1.000					
Technology gap	-0.185	-0.279	0.183	0.148	-0.413	-0.018	-0.483	-0.587	0.233	1.000				
Regime durability	0.293	0.012	-0.164	0.115	0.291	-0.419	0.396	0.367	-0.225	-0.544	1.000			
Polity IV score	0.003	-0.101	-0.159	-0.127	0.005	-0.181	-0.014	0.109	-0.044	-0.152	0.152	1.000		
Stock market	-0.077	-0.014	-0.053	-0.050	-0.029	0.011	-0.027	0.048	0.005	-0.028	-0.011	0.042	1.000	
Unemployment rate	-0.101	-0.017	-0.263	0.145	-0.225	0.185	0.298	-0.168	0.268	0.361	-0.415	-0.073	0.086	1.000

APPENDIX C

Table C1: Correlation matrix equation 3.5

	GDP growth rate	Equity market cap	Unit labor costs	Commercial bank lending	Corporate tax rate	R&D	Labor union strength	Stock market	Exit channel	Inflation rate
GDP growth rate	1.000									
Equity market cap	0.147	1.000								
Unit labor costs	-0.366	-0.097	1.000							
Commercial bank lending	-0.407	0.257	0.479	1.000						
Corporate tax rate	0.023	0.047	-0.410	-0.163	1.000					
R&D	-0.114	0.385	0.139	0.227	-0.016	1.000				
Union labor strength	0.019	0.129	-0.216	-0.138	0.067	0.557	1.000			
Stock market	0.125	0.128	-0.181	-0.168	0.088	0.014	0.095	1.000		
Exit channel	0.141	0.225	-0.188	-0.100	0.001	0.062	0.082	0.056	1.000	
Inflation rate	0.067	-0.033	-0.038	-0.064	-0.022	0.033	0.087	-0.007	0.159	1.000