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General Introduction

1. The nature of private equity transactions

Private equity is a source of investment capital from high net worth individuals and institutions for the purpose of investing and acquiring equity ownership in companies. Partners at private equity firms raise and manage funds with the objective of yielding favorable returns for their shareholder clients, typically with an investment horizon between four and seven years[1]. These funds can be used to purchase shares of private companies or public companies that eventually become delisted from public stock exchanges undergoing private transactions. Private equity is usually characterized by active ownership and builds businesses by strengthening management expertise, delivering operational improvements and helping companies access new markets. These characteristics distinguish private equity from other traditional investment in stocks and bonds as well as other alternative types of assets such as hedge funds (Metrick and Yasuda, 2011).

Given that all portfolio companies of private equity funds are private companies, much less publicly available information exists for an analysis compared with that available for public companies that must publish regular financial reports. This is the reason why information asymmetry can be greater for private equity investments. On the other hand, given that private equity firms are usually actively involved in the governance of the portfolio companies, they can reduce possible information asymmetry. Private equity firms also play an active role in helping the companies in their portfolio providing advising services. This PE firm feature also contrasts with investments in public companies. 'Except for large blockholders who gain seats on the boards of public companies, public company investors' ability to influence the management is severely limited. In contrast, private equity investors often condition their investments on contractual provisions, such as board seats, veto rights, and various contingent control rights, that enable them to influence the actions of the management while they hold their investments' (Metrick and Yasuda, 2011).

[1] http://www.investopedia.com

The supply of capital for private equity is provided by banks, corporations, pension funds and other investors. The growing amount of investments realized by private equity investors has created a considerable interest in assessing whether these transactions have a positive impact on economic performance. There is growing concern about the effect of private equity deals on governance issues, productivity, and employment in the acquired companies.

The private equity industry is usually divided into venture capital (VC) and leveraged buyouts (LBO). Venture capital is typically defined as the investment by professional investors of long-term, unquoted, risk equity finance in new firms where the primary reward is an eventual capital gain, supplemented by dividend yield (Wright and Robbie, 1998). Venture capital is focused on young, entrepreneurial companies providing finance for start-ups with high growth potential, primarily in technology-related segments of the economy. Private equity investors are usually closely involved in determining target companies' strategies, hiring key employees and searching for further financial resources (Botazzi et al., 2008). For startups with limited access to capital markets, venture capital is an essential source of financing.

In a leveraged buyout, a company is acquired by a specialized investment firm using a relatively small portion of equity and a relatively large portion of outside debt financing (Kaplan and Stromberg, 2009). In a typical leveraged buyout transaction, the private equity firm buys majority control of an existing firm. This arrangement is distinct from venture capital firms that typically invest in young or emerging companies and usually do not obtain majority control.

Risk is typically high for private equity investors, but the returns of private equity investments is considerably high since the companies obtained PE investment outperform the industry (e.g., Kaplan and Schoar, 2005).

Since the 1970s, the private equity market has strengthened readily. The European private equity industry, primarily venture capital and leveraged buyouts investments, has grown tremendously over the last decade. In 2016, total fundraising reached €73.8bn, the highest level for Europe since 2008 and a 37% increase from 2015. The total amount of equity invested in European companies in 2016 remained stable at €52.5bn compared with 2015. About a third of this amount was invested cross-border. The number of companies

receiving investment decreased by 8% to just under 6,000 and 83% were SME[2]s[3]. Venture capital investment increased by 2% to €4.3bn compared with 2015. ICT (communications, computer and electronics) was the largest sector at 44% of the total venture capital investment by amount, followed by biotech and healthcare (27%) and consumer goods and services (9%). Buyout investment decreased in 2016 compared to 2015 by 3% to €36.5bn. Most investment was concentrated in the consumer goods and services sector (32%), business products and services (22%), ICT (16%), and biotech and healthcare (10%)[4].

In 2016, globally, approximately 20% of private equity-backed buyout deals in terms of aggregate deal value represented public-to-private transactions (PTP)[5]. The European Private Equity and Venture Capital Association defines a public-to-private deal as 'a transaction involving an offer for the entire share capital of a listed target company by a new company and the subsequent re-registration of that listed target company as a private company. The shareholders of new company usually comprise members of the target company's management and private equity providers. Additional financing for the offer is normally provided by other debt providers.' Renneboog and Simons (2008) note that virtually all PTP transactions are financed by borrowing substantially beyond the industry average and are thus leveraged buyouts (LBO).

Recent research documents considerable interest among academics and financial professionals in the impact of the private equity (PE) industry on the economic development (e.g., The Global Economic Impact of Private Equity Report 2008). A growing body of research studies the performance of PE-backed companies, the restructuring process caused by the involvement of PE investors, and shows conflicting results concerning the impact of PE on the development of the targeted companies and different stakeholders. For instance, Stromberg (2007) notes two opposing opinions regarding the impact of PE on the financial results and corporate structure of acquired companies. The first gives a positive appraisal to the PE-backed organizational structure, arguing that PE investors create value by improving management incentives and by contributing to financial and operational expertise of their portfolio companies. A negative point of view suggests that leverage characteristics of PE transactions prevent investment and increase the risk of future bankruptcy (e.g., Zahra and Fescina, 1991; Stromberg, 2007).

[2] Small and medium enterprises
[3] https://www.investeurope.eu/media/651727/invest-europe-2016-european-private-equity-activity-final.pdf
[4] https://www.investeurope.eu/research/activity-data/annual-activity-statistics/investments-(2016)
[5] https://www.preqin.com/docs/press/Buyout-Deals-2016.pdf

A criticism of the PE industry and buyouts was raised, especially by the media and politicians. For instance, the European parliament noted several accusations against PE firms: asset stripping and profiting from the reselling of assets within short periods of time (asset flipping), instigating restructuring within firms that negatively impacts employment and employee remuneration, and using leverage and off-shore holding companies to reduce tax charges. These account for, or significantly contribute to, investment performance of PE firms (PSE Group of the European Parliament, 2007). However, this criticism ignores a large body of systematic studies proving the contribution of private equity to economic and financial performance.

2. The performance and governance effects of PE investments

Most scholars agree that private equity investments enhance the financial performance of acquired companies (Desbrières and Schatt, 2002; Cumming et al., 2007; Kaplan and Stromberg, 2009). These transactions may involve taking a listed corporation private (public to private transactions or PTPs), divisional buyouts where a division of a corporation is acquired (DBOs) or private-to-private transactions where entire private firms are bought. In general, the studies use both shareholder and accounting returns and show that buyouts generate significant financial returns. This section covers the reasons behind PE-backed firms' performance. One discussion has centered on the extent to which better performance is related to active monitoring by PE firms and governance mechanisms or whether the success of PE-backed companies is due to wealth transfers from other stakeholders.

Some scholars argue that one source of wealth gained from PE transactions is the transfer of wealth from bondholders and other stakeholders. A targeted firm can transfer wealth from bondholders to stockholders by an unexpected increase in the risk of investment projects, via large increases in dividend payments, or by an unexpected issue of debt of higher seniority (Renneboog and Simons, 2008). In a going private transaction that is usually realized through an LBO, this mechanism can lead to substantial bondholder wealth

expropriation. Warga and Welch (1993) find that bondholders lose approximately 5% of the average equity holder gain after an LBO announcement.

Aside from bondholders, some other stakeholders can also be impacted by restructuring in post-LBO periods. In particular, employees may be fired or see their wages revised after transactions implying change of ownership (Shleifer and Summers, 1988). Renneboog and Simons (2008) note that this is the case, especially for hostile takeovers, but Kaplan (1989[a]) finds some evidence of a decrease in employment in MBO transactions in the UK (median change is equal to 0.9%). At the same time, Kaplan (1989[a]) notes that the slight decreases in employment in the post-buyout period can be caused by divestitures. For a subsample of the companies that do not experience post-buyout divestitures the employment rate even slightly increases, but the industry-adjusted change in employment is still negative. Interestingly, in studying French data on LBOs,[6] Boucly et al. (2011) document a growth in employment (net of comparable firms). Concerning the wage reduction, Amess and Wright (2007) use a sample of 1,350 LBOs in the UK and find that wage growth of the targeted companies is lower than in the non-LBO firms from the control sample (the evidence is stronger for the MBIs than for MBOs). Thus, the hypothesis that the profitability of the LBO-backed firms is due to transfers from stakeholders is partially confirmed.

Tax benefits resulting from PE transactions may represent an important advantage for targeted companies. Kaplan (1989[b]) shows two ways in which a buyout-backed company can benefit from tax reductions. First, the debt used to finance an LBO leads to high interest payments that reduce taxable income. Thus, the amount of the debt payments associated with the buyout multiplied by the tax rate gives the value of benefit from increased interest deductions. Another way to take advantage of tax benefits available after buyout decision is to increase the tax basis of the acquired company. The acquired company can review the value of its assets and use the sum of the value of the purchased equity. Consequently, a higher tax basis will generate higher depreciation deductions. Kaplan (1989[b]) finds that the upper bond estimate of the value tax benefits can reach 143% of the premium paid to pre-buyout shareholders.

[6] The sample contains data on all types of LBOs, rather than only PTP transactions; most of the targets in the sample are privately held firms.

Kaplan (1989[b]) also analyses the relationship between the tax deduction and the premium paid to take a company private. According to the author's hypothesis, the shareholders can anticipate the buyout announcement and, thus, the tax benefits available for potential buyers. Hence, these anticipations should be incorporated into the amount paid to purchase the targeted company. The analysis of the regression where the dependent variable is the market-adjusted premium shows that the coefficient of the tax deductions is highly significant that confirms the researcher's hypothesis[7].

Some scholars also note the risk-increasing effects of PE transactions. For instance, increases in debt levels could induce a higher risk of financial distress and bankruptcy (e.g., Kaplan and Stein, 1993), harming other shareholders and debtholders. PE investors may transfer value from the 'financial system' as a whole, as increases in bankruptcy rates may negatively affect financial institutions providing transaction financing (Tykvova and Borell, 2012).

In contrast with the above criticisms, some scholars have stressed the positive effects of PE. For instance, Jensen (1986; 1989) argues that LBO governance model is an effective solution to agency problems. Several mechanisms applied by PE investors in LBO operations allow agency costs in the acquired companies to be reduced: the realignment of the managers' incentives with the shareholders' interests, the reduction of free cash flows and the tighter control.

The corporate governance problem is concerned with creating incentive and control devices to ensure managers use firms' resources in the interests of their owners and pursue value maximization (Wright et al., 2009). The diffuse ownership structure of the public corporation, while allowing risk to be efficiently allocated, is not conducive to the effective monitoring of managers, because free-riding can occur (Jensen and Meckling, 1976; Fama and Jensen, 1983). The incentive realignment hypothesis states that the reunification of ownership and control in the post-buyout firm will improve managerial incentives.

The better realignment of managerial behavior with shareholders' interests is usually provided by the rewarding system applied by private equity firms. This system implies that the possession of a part of the equity by managers should act as an effective tool that

[7] Kaplan (1989[b]) notes, however, that a public company does not need to go private to apply the mechanisms allowing to obtain the tax benefits.

stimulates managers toward increased effort and less consumption of private benefits[8]. This hypothesis is supported by numerous empirical findings. For instance, Kaplan (1989[a]) finds that the top management's share in the company's equity increases after the MBO decision[9]. Likewise, Halpern et al. (1999) show that firms involved in PTP LBOs have significantly higher managerial share ownership than those involved in traditional acquisitions of listed corporations. Baker and Wruck (1990) also document that larger equity stakes increase the incentives of managers.

The free cash flow (FCF) hypothesis shows another way of reducing agency costs, especially in the case of public-to-private transactions. FCF is cash flow exceeding that required to fund projects with a positive net present value. FCF is most likely to be found in mature, cash-rich firms with few growth options (Wright et al., 2009). Where there are agency problems, non-equity owning managers have an incentive to use FCF either to expand the firm beyond its optimal size from a value maximization perspective by investing in negative NPV projects or to build cash balances that remain unused. According to Jensen (1986), managers of the public corporations have substantial freedom in distributing operating cash generated by the company. They can direct the money in useless projects instead of paying out dividends[10]. After a PTP, which in most cases is realized as an LBO (Stromberg, 2007), the high leverage forces the managers to direct the money to pay the debt. High leverage, thus serves as a substitute for equity in a buyout and commits management to pay out future FCFs in servicing the debt rather than investing in sub-optimal projects. Shareholders will thus benefit from it, since the managers will thereby use money more effectively. The free cash flow theory thus complements the realignment incentives hypothesis.

Finally, researchers argue that PE investors possess higher monitoring capabilities. When ownership is concentrated, the shareholders have more incentives to invest in monitoring, which can create value by resolving the free-rider problem. Renneboog and Simons (2008) note that the control function of the owners may not only be intensive but also of higher quality given that the PE sponsors usually have significant experience in restructuring companies. In support of this point of view, Cornelli and Karakas (2015) find

[8] Jensen and Meckling (1976) introduce the concept of private benefits or non-pecuniary costs, i.e., the expenses that the managers allow themselves while the shareholders bear these costs.

[9] The author finds that the equity stake held by the managers increases during post-buyout by a median of 16.03%.

[10] Jensen (1986) mentions the 'empire building' phenomena, when the managers retain the financial resources to grow their firms beyond an optimal size.

that PE sponsors sitting on the corporate boards of the acquired companies ameliorate the governance mechanisms. They document that the proportion of the PE representatives on the boards of the acquired companies is higher for more difficult cases (e.g., during CEO turnover), thus suggesting that PE managers provide necessary monitoring services.

Thus, within a strategic entrepreneurship perspective, PE firms may provide complementary resources and capabilities that may be missing from the management team and some PE firms may be much more skilled in how they implement monitoring and advisory devices as they are more effective at learning from experience to create distinctive organizational capabilities (Wright et al., 2009). Jensen (1989) argued that with emphasis on corporate governance, concentrated ownership by active owners, strong managerial incentives, and efficient capital structure the LBO governance form was superior to the public corporation with disperse shareholders and weaker governance. Despite the increased PE investments and the potential importance of private equity investments for the economy, researchers only have a limited understanding of private equity's impact on the governance of acquired companies. This gap in the literature is largely due to the difficulties in obtaining systematic private equity data. In recent years, however, there has been a growing number of both empirical and theoretical studies on the topic of private equity contributing to a better understanding of the private equity governance model.

Substantial attention is paid to public-to-private transactions (PTP), where a public company is acquired using LBO mechanisms. A leveraged buyout of a public corporation causes considerable modifications of the capital structure and the mode of governance (Kaplan and Stromberg, 2009). One of the main differences between the public companies and private equity backed firms is the concentration of ownership. The ownership of the public companies is dispersed and the boards monitor the management of the company on behalf of the owners (Cornelli and Karakas, 2015). Thus, the owners of the public companies can suffer from the lack of sufficient monitoring and impossibility to govern directly the working process of the company. This can lead to the reduction of shareholder value.

In the companies that were acquired by the private equity groups, the ownership is concentrated in the hands of few shareholders who are closely involved in running the company. This can create various advantages: better monitoring, better alignment with the shareholders' interests, higher incentives for the managers, reduction of the wasting

corporate resources due to the lower managers' discretion, and saving on other costs related, for instance, to the stock markets' listing costs. Thus, a growing body of literature on LBO considers the LBO mechanisms as a solution to the agency costs' problems in the public companies' governance structure.

Scholars stress the role of the corporate boards as a main instrument of corporate governance and ask whether the corporate boards are more effective during the post-buyout period. Accordingly, the literature is also focused on the sustainability of the organizational changes initiated after an LBO transaction, i.e., whether the LBO-organizational form represents a long-term structure or a short-term arrangement (e.g., Kaplan, 1991)[11]. In this context, an important question that emerges is whether the post-LBO organizational form will become the dominate form of corporate governance that as was predicted by Jensen (1989).

Summarizing the discussions about the impact of private equity, we believe that private equity involvement provides effective instruments that can ameliorate corporate governance. PE-backed organizational form is particularly effective in reducing agency and free cash flow problems. Private equity investments are associated with performance gains, and these gains are not only due to transfers from other stakeholders.

3. The determinants of venture capital development

As discussed in the previous section, private equity investors are activist, hands-on investors whose goal is to maximize financial returns. PE investments are associated with improved governance practice at the investee firms, including more efficient boards and higher earnings quality.

The private equity industry consists of buyout funds that invest in existing companies and venture capital funds, which invest in seed and start-up businesses. The European private equity and venture capital industry has proven its contribution to economic growth and job creation by providing a source of stable investment capital to companies (EVCA's

[11] Kaplan (1991) finds that the median of the post LBO period is equal to 6.8 years. The author also notes that staying power of the LBO does not imply the period prior to an LBO exit but the viability of the governance scheme initiated by the LBO transaction even after an LBO exit.

Public Policy priorities). This is why policymakers and private equity and venture capital representatives have encouraged an ongoing dialogue with an objective of enhancing the regulatory framework for private equity development. Particular attention is paid to the venture capital development, since venture capitalists have a key role in the financing of innovative entrepreneurial companies (EVCA public policy priorities). An important question is on the factors that can stimulate the development of VC investments.

Since venture capital is an American invention[12] (Hege et al, 2009), most of the literature on the VC industry has focused on the success of the US VC market, highlighting the factors that are associated with the development of Silicon Valley (Gompers and Lerner, 1998; Hege et al, 2009; Armour and Cumming, 2006). More specifically, Armour and Cumming wonder whether the success of Silicon Valley is only explained by the particular specificities of US entrepreneurial culture, and thus is unlikely to be replicated, or whether some financial, economic or legal measures (e.g., pension funds regulation, tax subsidies, increasing funds supply) influence the development of the VC investments in the US. In other words, can policymakers, in principal, elaborate the instruments to replicate Silicon Valley's success and to stimulate VC markets in other regions (for example, in Europe) or is the VC industry a purely American economic phenomenon. Given that the factors underlying the development of the VC market in the US may not be similarly useful in other economic systems, a rigorous assessment of the VC determinants' influence is thus needed (Da Rin et al, 2006).

The debates concerning the nature of the VC development's determinants identified an important question for policymakers, i.e., what are the most appropriate instruments to develop a VC market? These instruments may be direct mechanisms focused on the increase in governmental support for the VC market or indirect mechanisms that aim to improve the opportunities for investors and/or entrepreneurs to realize the benefits from the VC market. These indirect mechanisms can include, for example, better investor protection or some measures aimed at improving the general characteristics of the social and economic environment and the quality of public institutions.

[12] Moreover, US continues to represent the world's largest VC market.

4. The thesis structure

This PhD thesis primarily addresses the effects of private equity on governance (Chapter 1 and 2) and the determinants of the private equity investments (Chapter 3). We describe the differences in corporate governance that private equity investors introduce (in the context of CEO turnover), and study how the characteristics of private equity investors impact the governance aspects in the acquired companies. The purpose of this PhD thesis is to identify what is distinctive about private equity governance mechanism, which justifies an analysis within the field of corporate finance.

Chapters 1 and 2 of this thesis focus on CEO turnover in the companies acquired by private equity firms. Indeed, the most commonly discussed responsibility of the corporate board is to monitor and replace, if necessary, the company's CEO (Coughlan and Schmidt, 1985). Therefore, one way to evaluate the board's effectiveness is to look at the quality of these decisions. Many scholars have documented (primarily, in large public corporations) a positive relationship between CEO turnover and poor firm performance (Coughlan and Schmidt, 1985; Weisbach, 1988; Murphy and Zimmerman, 1993; Huson et al, 2001; Kaplan and Minton, 2012). In addition, Denis and Denis (1995) document that firm performance generally improves following CEO turnover, especially a forced turnover. The standard interpretation of this relationship is that it measures the board's monitoring ability; when performance is poor, the board is more likely to replace an underperforming CEO (Hermalin and Weisbach, 2003). While numerous papers have increased our understanding of the performance and governance factors that influence CEO turnover, the question remains as to what the right amount of turnover and sensitivity of turnover to performance should be. While some proponents consider high CEO turnover and high CEO turnover-performance sensitivity as a sign of an efficient corporate board (e.g., Huson at al., 2001), other scholars (e.g., Gao et al., 2013; Cornelli and Karakas, 2015) argue that CEO turnover in public firms is sometimes too high and too sensitive to poor performance. However, the question remains – too high relative to what?

Chapter 1 of our thesis provides a comparison of CEO turnover in the companies taken private by private equity firms and public companies. This chapter thus analyzes how different governance structures influence CEO firing and hiring decisions. We test two alternative hypotheses about CEO turnover-performance sensitivity. The control hypothesis

implies that a concentrated ownership structure and less severe agency problems in PE-backed companies provide stronger shareholder monitoring; consequently, CEO turnover-performance sensitivity is higher in the companies taken private by PE firms comparing with those that remain public. This hypothesis thus suggests that internal control mechanisms in public companies are less capable of replacing an underperforming CEO. A possible explanation is that public firms suffer from information asymmetry and shareholder dispersion, while more independent and more powerful corporate boards installed by PE sponsors improve the quality of governance mechanisms. This hypothesis coincides with Weisbach (1998), who argues that more outside-dominated boards strengthen the relation between financial performance and the probability of CEO turnover.

However, we develop an alternative 'PE sophistication' hypothesis that implies lower performance-turnover sensitivity in PE-backed companies. The arguments for this hypothesis are based on the idea that PE sponsors have longer-term objectives towards the targeted companies than shareholders of public companies. The PE-backed companies' CEOs are thus given a longer horizon and can be sure not to be penalized for short-term performance. Another argument is that direct monitoring permits PE-backed firms' boards to rely more on inside information instead of basing firing decisions on accounting performance. Finally, the CEOs of the PE-backed companies are insulated from the pressure of possibly myopic shareholders.

Subsequent empirical tests confirmed the 'control' hypothesis. We found in particular significantly higher turnover-performance sensitivity in PE-backed companies compared with those that remain public. To further explain this difference between CEO turnover-performance sensitivity in public and PE-targeted firms, we hypothesize and find support for the idea that PE-backed companies are more likely to hire their CEO externally than public companies are.

The findings of Chapter 1 contribute to the debate over whether corporate governance in PE-backed companies characterized by active monitoring and, most commonly, by debt discipline implies less forgiveness for financial underperformance compared with governance in public companies characterized by dispersed ownership and more severe agency costs. We show that PE-backed companies are more active in replacing poorly performing CEOs compared with public companies; there is greater turnover risk for

CEOs of PE-targeted companies. We add to this literature evidence that PE-backed companies are more likely to replace the incumbent CEO by an outsider.

Chapter 2 further investigates the question of CEO turnover by investigating the characteristics of PE firms that can impact the CEO turnover-performance sensitivity in their portfolio companies. In this chapter, the sample contains only the companies taken private by PE firms and deals where the PE firm takes the majority stake (≥50%). The average PE firm share in our sample is approximately 90%. We can thus conclude that the new shareholders are endowed by a considerable control over the boards of acquired companies.

In Chapter 2, we hypothesize that in the companies taken private by PE firms, the impact of firm performance on CEO turnover depends on the investor's degree of specialization. We argue that PE firms with a higher industrial specialization (relative to their competitors) have a deeper knowledge of the industry. In so doing, we derive two alternative hypotheses about the direct impact of the PE firms' industrial specialization on the probability of CEO turnover in the acquired companies.

First, we suppose that specialization can help PE firms gain a competitive advantage, since it can give them a greater understanding about an average company's probability of success in a particular industry (i.e., reduced information asymmetries), and more in-depth knowledge of companies in that industry (i.e., reduced uncertainty) (Cressy et al., 2007). In terms of governance, more specialized PE firms may thus bring more expertise ability than can serve as a complement to CEO quality. Consequently, the CEO's role becomes less significant, and CEO turnover will be lower in companies acquired by more specialized PE firms.

Alternatively, some studies on the governance impact of PE firms demonstrate an aggressive intervention in restructuring the companies they finance and a high rate of CEO replacement. Moreover, more specialized PE firms may have a larger portfolio of managers that are likely to replace the CEOs at the targeted companies. Specialized focus also implies that PE firms observe more easily the CEO's features required for a particular industry. The alternative hypothesis thus suggests a positive relation between CEO turnover and the industry specialization of PE firms.

We also develop the idea of an indirect effect of the PE firm's industrial specialization on the CEO turnover-performance sensitivity. Specifically, we hypothesize that industry specialization could reduce the cost payed by the PE firm for identifying the true reason of the lower firm performance and isolating the effects that could cause low financial performance but are beyond the CEO's control. We suppose that for a non-specialized PE firm the cost of gathering such information is higher, and the board will opt for the short-term discipline. However, if the specialization helps the investor to reduce the costs of gathering information, then she will choose the reliance on the longer period. Consequently, the dependence of CEO turnover on short-term firm performance in PE-backed companies should decrease with a PE firm's industry specialization.

We found no significant evidence that PE firms' specialization impacts the relation between targeted company's financial performance and the probability of CEO turnover. We report, however, that the PE firm's level of industrial specialization reduces the probability of CEO replacement in the acquired company.

Our findings support the idea of Cornelli and Karakas (2015), who found a lower turnover rate in the companies taken private in the post-buyout period and suggested that this result might be because LBO sponsors give CEOs a longer horizon. The documented evidence provides an important link between the previous empirical results concerning the CEO turnovers after LBOs, and introduces a new variable (industrial specialization of the PE firm) that plays a role in the governance of the companies they finance. Our results show that the nature of post-buyout governance reorganization in the top management discipline depends on the industrial specialization of the PE firm.

Summarizing the results of Chapters 1 and 2, we can conclude that (i) PE-backed companies exert more active monitoring and are more likely to dismiss a CEO than public firms (Chapter 1) (ii) PE-backed companies with more specialized investors are less likely to dismiss their CEOs than other PE-backed companies (Chapter 2). From a theory perspective, the findings that the CEO turnover rate and CEO turnover-performance sensitivity are higher in PE-backed companies compared with public firms (Chapter 1) seem to support the 'control hypothesis', i.e., the contention that the concentrated illiquid ownership structure of PE-backed companies provides stronger shareholder monitoring and tighter control for poor performance than the dispersed ownership structure of public firms. On the other hand, for companies with similar concentrated ownership structures (i.e., our sample of PE-backed

companies in Chapter 2), our results rather support the inside information hypothesis of boards advanced by Cornelli and Karakas (2015). This theory suggests that sophisticated investors are more likely than less sophisticated investors to use 'soft' (inside) information about firm's operations and the CEO's competence play in the decision to fire the CEO and are less likely to base their decision on 'hard' information in the form of the firm's performance relative to its peers. Accordingly, our findings that the industrial specialization of the PE firm reduces the probability of CEO replacement among PE-backed companies suggest that more specialized PE firms are better at isolating 'hard' information in the form of accounting statistics and rely more on 'soft' information obtained from direct monitoring.

Finally, Chapter 3 is related to the debate on the determinants of venture capital development. We try to assess how particular mechanisms of governmental support to innovation impact VC investments, and whether the institutional environment moderates the relationship between governmental R&D and VC investments. An important debate for policymakers is on the type of intervention that is more appropriate to foster VC investments: either direct mechanisms that increase governmental support to the VC market or indirect mechanisms that aim to improve the offer of VC and/or the demand of entrepreneurs for VC financing. These indirect mechanisms can include, for example, better investor protection or some measures aimed to improve the general characteristics of the social and economic environment and the quality of the public institutions.

The European Private Equity and Venture Capital Association (EVCA) argues that improving the conditions for innovative activity is a crucial measure for stimulating the VC market (EVCA's Public Policy Priorities). The increase of R&D expenditures (including the part financed by governments) is in turn considered a measure stimulating the innovative environment. At the same time, academics and VC professionals mention the importance of the institutional environment in determining the venture capital activity and private equity industry as a whole (The Global Economic Impact of Private Equity Report 2008; Lerner et al., 2011). Building on these issues Chapter 3 outlines several hypotheses concerning the impact of governmental R&D, the institutional environment and their interaction on VC investments.

First, we tested whether the arrival of technological opportunities (proxied by various measures of governmental R&D expenditures) have a positive impact on the level of VC investments across European countries. We then examined the impact of several institutional

factors on VC investments and found a significant influence of this institutional environment on early-stage venture capital investments. Finally, we tested the moderating effect of the institutional environment on the relationship between governmental R&D spending and VC investments.

Our results show that higher level of governmental R&D expenditures lead to a higher level of VC investments. This is consistent for both early stage and total VC investments. This result contrasts with Da Rin et al. (2006), who found no evidence that public R&D has an impact on VC investments.

We found also that higher quality of formal institutions is associated with a higher level of early stage VC activity. This is consistent with Li and Zahra (2011) who found a significantly positive impact of formal institutions on the total number and total amount of VC investments.

The hypothesis about a positive moderation effect of institutional variables on the relationship between governmental R&D expenditures and VC investments was rejected. In fact, the relation between R&D expenditures and VC activity is negatively influenced by a better institutional environment. A possible interpretation of this result is that in the presence of highly developed formal institutions the technological opportunities measured by governmental R&D expenditures have no stimulating effect on venture capital development. In other words, a sufficiently advanced institutional environment makes direct governmental intervention less necessary to stimulate the VC market. Venture capital investments coupled with a proper institutional environment represent an effective mechanism to finance technology-oriented projects, while other supplementary financing in the form of public R&D may crowd-out venture capital. This interpretation is only suggestive, however.

Our findings are in line with the theory that formal institutional rules can produce economic outcomes (North, 1990). Our results suggest that policymakers should give priority to the institutional norms in order to promote VC activity. Our study covers European countries where institutions are well developed, and we found that the factors that have a positive direct impact on VC investments (R&D expenditures and quality of institutions) negatively impact VC investments when they are considered in interaction. This result might be particularly interesting for emerging countries that aim to implement policies that stimulate the VC market. Policymakers in these countries should focus on the

development of the institutional framework rather than on direct intervention through governmental support to innovation.

References

Amess, K., Wright, M., 2007. 'The wage and employment effects of leveraged buyouts in the UK'. International Journal of the Economics of Business, 14(2), 179-195.

Armour, J., Cumming, D., 2006. 'The legislative road to Silicon Valley'. Oxford Economic Papers, 58(4), 596-635.

Baker, G. P., Wruck, K. H., 1989. 'Organizational changes and value creation in leveraged buyouts: The case of the OM Scott & Sons Company'. Journal of Financial Economics, 25(2), 163-190.

Bottazzi, L., Da Rin, M., Hellmann, T., 2008. 'Who are the active investors?: Evidence from venture capital'. Journal of Financial Economics, 89(3), 488-512.

Boucly, Q., Sraer, D., Thesmar, D., 2011. 'Growth lbos'. Journal of Financial Economics, 102(2), 432-453.

Cornelli, F., Karakaş, O., 2015. 'CEO turnover in LBOs: The role of boards'. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2269124

Coughlan, A. T., Schmidt, R. M., 1985. 'Executive compensation, management turnover, and firm performance: An empirical investigation'. Journal of Accounting and Economics, 7(1-3), 43-66.

Cressy, R., Munari, F., & Malipiero, A., 2007. 'Playing to their strengths? Evidence that specialization in the private equity industry confers competitive advantage'. Journal of Corporate Finance, 13(4), 647-669.

Cumming, D., Siegel, D. S., Wright, M., 2007. 'Private equity, leveraged buyouts and governance'. Journal of Corporate Finance, 13(4), 439-460.

Da Rin, M., Nicodano, G., Sembenelli, A., 2006. 'Public policy and the creation of active venture capital markets'. Journal of Public Economics, 90(8), 1699-1723.

Desbrières, P., Schatt, A., 2002. 'L'incidence des LBO sur la politique d'investissement et la gestion opérationnelle des firmes acquises: le cas français'. Finance Contrôle et Stratégie, 5(4), 79-106.

EVCA public policy priorities.
http://www.gvpartners.com/web/pdf/EVCA_Policy_Paper.pdf

Fama, E. F., Jensen, M. C., 1983. 'Separation of ownership and control'. The journal of law and Economics, 26(2), 301-325.

Gao, H., Harford, J., Li, K., 2013. 'Corporate Governance and CEO Turnover: Insights from Private Firms'. Unpublished Working Paper.
http://www.lebow.drexel.edu/sites/default/files/event/LI-GAO-HARFORD_Corporate%20Governance%20and%20CEO%20Turnover_0.pdf

Gompers, P. A., Lerner, J., 1998. 'What drives venture capital fundraising?' (No. w6906). National bureau of economic research.

Halpern, P., Kieschnick, R., Rotenberg, W., 1999. 'On the heterogeneity of leveraged going private transactions'. The Review of Financial Studies, 12(2), 281-309.

Hege, U., Palomino, F., Schwienbacher, A., 2009. 'Venture capital performance: the disparity between Europe and the United States'. Finance, 30(1), 7-50.

Hermalin, B. E., Weeisbach, M. S., 2003. 'Boards of directors as an endogenously determined institution: A survey of the economic literature'. Federal Reserve Bank of New York (FRBNY). Economic Policy Review, 9(1), 7-26.

Huson, M. R., Parrino, R., Starks, L. T., 2001. 'Internal monitoring mechanisms and CEO turnover: A long-term perspective'. The Journal of Finance, 56(6), 2265-2297.

Jensen, M. C., 1986. 'Agency costs of free cash flow, corporate finance, and takeovers'. The American economic review, 76(2), 323-329.

Jensen, M. C., 1989. 'Eclipse of the public corporation'. http://papers.ssrn.com/sol3/paper.taf?ABSTRACT_ID=146149

Jensen, M. C., Meckling, W. H., 1976. 'Theory of the firm: Managerial behavior, agency costs and ownership structure'. Journal of financial economics, 3(4), 305-360.

Kaplan, S., 1989 [a]. 'The effects of management buyouts on operating performance and value'. Journal of financial economics, 24(2), 217-254.

Kaplan, S., 1989 [b]. 'Management buyouts: Evidence on taxes as a source of value'. The journal of finance, 44(3), 611-632.

Kaplan, S. N., Minton, B. A., 2012. 'How has CEO turnover changed?'. International review of Finance, 12(1), 57-87.

Kaplan, S. N., Schoar, A., 2005. 'Private equity performance: Returns, persistence, and capital flows'. The Journal of Finance, 60(4), 1791-1823.

Kaplan, S. N., Stein, J. C., 1993. 'The evolution of buyout pricing and financial structure in the 1980s'. The Quarterly Journal of Economics, 108(2), 313-357.

Kaplan, S. N., Strömberg, P., 2009. 'Leveraged buyouts and private equity'. The Journal of economic perspectives, 23(1), 121-146.

Kaplan, S. N., 1991. 'The staying power of leveraged buyouts'. Journal of Financial Economics, 29(2), 287-313.

Lerner, J., Sorensen, M., Strömberg, P., 2011. 'Private equity and long-run investment: The case of innovation'. The Journal of Finance, 66(2), 445-477.

Li, Y., Zahra, S. A., 2012. 'Formal institutions, culture, and venture capital activity: A cross-country analysis'. Journal of Business Venturing, 27(1), 95-111.

Metrick, A., Yasuda, A., 2011. 'Venture capital and other private equity: a survey'. European Financial Management, 17(4), 619-654.

Murphy, K. J., Zimmerman, J. L., 1993. 'Financial performance surrounding CEO turnover'. Journal of Accounting and Economics, 16(1-3), 273-315.

North, D. C., 1990. 'Institutions, institutional change and economic performance'. Cambridge university press.

PSE Group in European Parliament (2007) Hedge Funds and Private Equity-A Critical Analysis. Report of the PSE-Group in European Parliament

Renneboog, L., Simons T., 2008, "Public-to-private transactions: LBOs, MBOs, MBIs, and IBOs". New Modes of Governance. Project no. CIT1-CT-2004-506392.

Shleifer, A., Summers, L. H., 1988. 'Corporate takeovers: Causes and consequences'. University of Chicago Press.

Stromberg P., 2007. 'The new demography of private equity'. http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=6D1E65845930A5E888070D32D7976639?doi=10.1.1.694.9415&rep=rep1&type=pdf

The Globalization of Alternative Investments Working Papers Volume 1: The Global Economic Impact of Private Equity Report 2008 is published by the World Economic Forum.
http://booksmedia.online/files/global-economic-impact-of-private-equity-report-2008.pdf

Tykvová, T., Borell, M., 2012. 'Do private equity owners increase risk of financial distress and bankruptcy?'. Journal of Corporate Finance, 18(1), 138-150.

Warga, A., Welch, I., 1993. 'Bondholder losses in leveraged buyouts'. The review of financial studies, 6(4), 959-982.

Weisbach, M. S., 1988. 'Outside directors and CEO turnover'. Journal of financial Economics, 20, 431-460.

Robbie, W., Mike, K., 1998. 'Venture capital and private equity: A review and synthesis'. Journal of Business Finance & Accounting, 25(5-6), 521-570.

Wright, M., Amess, K., Weir, C., Girma, S., 2009. 'Private equity and corporate governance: Retrospect and prospect'. Corporate Governance: An International Review, 17(3), 353-375.

Zahra, S. A., Fescina, M., 1991. 'Will leveraged buyouts kill US corporate research & development?'. The Executive, 5(4), 7-21.

I. Do PE firms increase the sensitivity of CEO turnover to firm's performance: the case of going private transactions?

1. Introduction

Monitoring and review of managers by the board of directors is a major internal managerial control mechanism[13] (Coughlan and Schmidt, 1985), while the decision of chief executive officer (CEO) replacement remains one of the most important jobs for corporate boards. A huge literature documents the relation between the company's financial performance and the probability of CEO turnover (primarily, in public firms). This topic, however, continues to attract the researchers' considerable interest, since there is still no largely accepted opinion on whether this performance-turnover relation reflects the effectiveness of monitoring (Jenter and Kanaan, 2015; Gao et al., 2013; Cornelli and Karakas, 2015).

Some recent findings contest the canonical interpretation of the negative relation between a firm's financial performance and the likelihood of CEO turnover as a result of an effective monitoring. The two issues are discussed in the scientific literature in the context of CEO performance-induced turnovers. The first problem is whether the corporate boards are capable to effectively relate the financial underperformance to the CEO quality. Theoretically, the boards should ignore all the factors that might explain the financial underperformance but are beyond CEO control. But Jenter and Kanaan (2015) show that the boards of public corporations may sometimes overreact and fire CEOs for the reasons that do not depend on the CEO quality. The authors show, thus, that the corporate boards fail to ignore the exogenous factors while assessing the CEO quality. For instance, the CEOs are more likely to be fired when the industrial performance declines (Jenter and Kanaan, 2015).

[13] Warner et al. (1988) cite three internal control mechanisms: monitoring by the corporate boards, mutual monitoring among the firm's managers and monitoring provided by holders of large share blocks (blockholders).

The second problem is whether an effective board should only take into account the observed financial variables to evaluate a CEO quality and, consequently, take the decision to replace the manager. Gao et al. (2013) argue that in the firms with concentrated ownership where the owners have stronger monitoring incentives the information obtained from direct monitoring allows to better evaluate a CEO's quality. As a result, CEO turnover should be less sensitive to financial performance in firms with concentrated ownership.

These new findings are not consistent with prior literature that considers high CEO turnover rate and performance-turnover sensitivity as a demonstration of an active and effective corporate board. For instance, Weisbach (1988) shows that outside-dominated boards with higher presence of independent directors increases the negative relation between financial performance and CEO turnover and argues that this type of board is more effective than those with the dominance of inside directors[14]. Jenter and Lewellen (2010) confirm these findings with updated recent data. At the same time, Hermalin and Weisbach (2003) note that outside directors' impact on the performance-turnover relationship may be explained by the absence of the opportunity to observe other non-financial variables while inside directors involved in daily activities have more information about CEO's ability.

In our essay, we propose to analyze CEO turnover rate as well as CEO performance-turnover sensitivity in the companies that were taken private by institutional investors (private equity firms, PE) (via, primarily, leveraged buyout mechanism) in European countries during the period from 2002 to 2008 and we use as benchmark public firms. We focus on the transactions where the majority stake is acquired by new owners where at least one of them is a private equity firm. We argue that in these transactions PE firms provide, besides financial resources, larger capabilities of monitoring the companies comparing with the internal control mechanisms of the public firms. Given the experience in restructuring other companies the PE firms are much more skilled in implementing monitoring and advisory devices (Wright et al., 2009).

The objective of this paper is to investigate the differences in internal governance mechanisms that occurred in the companies that were taken private by private equity firms.

[14] Outside director implies any member of a company's board of directors who is not an employee or stakeholder in the company.

We examine, particularly, the extent to which firms taken private have different CEO turnover-performance sensitivity from companies that remain listed.

We outline several aspects where PE firms may be expected to bring benefits from a governance perspective. Firstly, we argue that the post-buyout governance structure with higher ownership concentration, higher incentive to monitor, and relatively lower agency costs will lead to a better internal control mechanism that allows to better evaluate the CEO quality. As it is shown by Cornelli and Karakas (2015), PE investors are sitting on the boards of directors of the companies they finance and are different from both inside and outside directors. They have no particular relation to the CEOs and, thus, act as outside directors with a large equity stake of the firm; so they should not hesitate to replace an underperforming CEO. At the same time, they are heavily involved in the targeted firm's activities and, thus, behave like inside directors and have inside information beyond observations of the past financial performance.

Given the greater ownership concentration and generally stronger governance possible in PE-backed firms, we hypothesize that CEOs of PE-backed firms face a greater likelihood of turnover for poor performance than do CEOs of public firms. The PE sponsors will, thus, act like blockholders in public companies and their presence will strengthen the relation between financial underperformance and the probability of CEO turnover.

Alternatively, more sophisticated and stronger direct monitoring in PE-backed firms coupled with the lack of pressure on boards from dispersed shareholders may lead PE sponsors to use other information when evaluating a CEO's quality, soft information obtained from direct monitoring (Cornelli et al., 2013). This may imply that the CEOs of PE-backed firms are less likely to be fired in the face of short-term underperformance. This latter hypothesis is consistent with the recent findings of Cornelli and Karakas (2015) who find that both CEO turnover rate as well as CEO turnover-performance sensitivity decrease in the companies taken private. The explanation proposed by the authors implies that the new owners, i. e. private equity sponsors, give the CEOs wider horizons.

Another aspect of governance improvement in PE-backed companies is the efficiency of CEO turnover. The standard theory underlines that the boards should ignore all the components that could cause firm's underperformance but are beyond the CEO's control.

Some recent studies show, however, that CEOs of public companies are more likely to be replaced due to the factors such as negative performance shocks to their peer group, i. e. due to the factors that are beyond a CEO's control (Jenter and Kanaan, 2015).

Thus, an efficient turnover implies that the board should utilize optimally the information publicly available in order to evaluate a CEO. We argue that PE firms may be better informed than the boards of public firms about industry conditions and the extent to which the CEO are responsible for the financial underperformance given the current industry conditions. What's more, in the absence of dispersed shareholders the CEOs of PE-backed companies have more chances to point out to their boards that competitors are performing worse and induce the board to use relative performance evaluation. By its turn, public firms are likely to be continuously monitored by the press and professional investors and are often criticized by the press for being insufficiently vigilant guardians of shareholders' money. We hypothesize, thus, that the public firms will be less likely to base the turnover decision on the basis of industry-adjusted financial performance comparing with PE-backed companies.

Finally, we examine whether the turnover rate and turnover-performance sensitivity differ between PE-backed and public firms because of the CEO labor market segmentation. We study whether the PE-backed firms are more likely to promote their CEOs externally than public firms do. Huson et al. (2001) note that companies with strong governance are more likely to select outside CEOs, as outside CEOs are more willing to break away from the failed policies of their predecessors. This argument predicts that PE-backed firms are more likely to hire external CEOs than public firms.

Our analysis covers public-to-private transactions, where the majority stake of the company is acquired by an investment firm (private equity firm)[15]. In contrast with other studies on CEO turnover in LBO-backed companies we address the problem of an adequate benchmark. In fact, previous papers (e. g. Gao et al., 2013; Cornelli and Karakas, 2015) use only size and industry matching to construct control sample. But given that PE firms select the companies non-randomly (Wright et al., 2009) the targets may show the financial results that differ from the sector. Thus, using properly matched peers instead of only size and industry matched companies as a benchmark is crucial for the valuation of PE governance

[15] More than 80% of the deals are financed via LBO.

activity, given the clearly non-random PE target selection. We identify an adequate benchmark via propensity score matching[16] (Rosenbaum and Rubin, 1983; Heckman et al., 1998; Acharya et al., 2009[b] Gaspar, 2012; Tykvova and Borell, 2012).

Our study covers the sample of large public corporations that were taken private over the period from 2002 to 2008 in four European countries (France, Germany, Netherlands and UK)[17]. These companies are observed within two years before the going private deal and five years after the public-to-private deal. Our final sample consists of 987 public firm-year observations involving 99 CEO turnover cases, and 877 PE-targeted firm-year observations involving 129 CEO turnover cases from 2000-20013. We focus, primarily, on CEO turnover in post-acquisition period as on the most difficult decision taken by the boards.

Our result show that there is a significantly higher likelihood for PE-backed firm CEOs to experience turnover compared to their public firm counterparts. Further, there is stronger turnover-performance sensitivity for PE-backed firm CEOs than there is for public firm CEOs. We find, however, that PE-backed companies are more likely comparing with public firms to base their turnover decision on industry-adjusted performance measure. These results suggest that comparing with public firms the PE-backed companies are more active, and their CEO turnover decision is more efficient, since they take into consideration the observable variables that are beyond a CEO's control.

Subsequent tests show that PE-backed companies are more likely to promote their CEOs externally than public firms do. The combined evidence suggests that there is greater turnover risk for the CEOs of PE-targeted companies.

We relate our essay to a growing literature documenting the effects of the governance role of private equity firms (PE) in post-transaction companies. For instance, Gong and Wu (2011) examining CEO turnovers in PE-sponsored LBOs in US demonstrate the evidence that the CEOs in the companies with high agency costs, measured by low debt ratio and high free cash flow, are more likely to be dismissed after the going private transactions. The authors

[16] We explore the concrete algorithm of our propensity score model in the methodological chapter.

[17] The US buyout market emerged in the early 1980s and has since diffused worldwide. The Western European market grew by more than 50 per cent in 2005 and rose further in 2006 to reach €160bn and the UK PE market rose some 70 per cent in value in 2007. Public to private (PTP) transactions were a particular feature of this explosion (Wright et al. 2009).

also find that the pre-buyout returns on assets (RoA) increase the likelihood of CEO replacement after the LBO deal[18]. We find consistent results for both firm-specific and industry-adjusted RoA. Inconsistently with Cornelli and Karakas (2015), we find that CEO turnover-performance sensitivity increases in the companies taken private following the buyout. In contrast with PE sophistication hypothesis, we find that the relation between the probability of CEO turnover and firm's performance is strengthened by the presence of PE sponsors.

We add to this literature evidence on the identity of new CEOs in private versus public firms. We find, particularly that PE-backed companies are more likely to replace the incumbent CEO by an outsider. A possible interpretation of these results is that running a public company requires less frequent competence.

In a general manner, our essay contributes to the debates over whether corporate governance in PE-backed companies characterized by active monitoring and, most commonly, by debt discipline is superior comparing with governance in public companies characterized by dispersed ownership and more severe agency costs (Jensen, 1989). We show that PE-backed companies are more active in replacing poorly performing CEOs comparing with public companies; their CEO turnover decision is, however, more efficient, i. e. based on industry-adjusted performance measure.

The essay is organized as follows. Section 2 presents the related literature and hypotheses' elaboration. Section 3 describes the data and our sample. Section 4 presents the main empirical analysis. We conclude in Section 5.

2. Literature review and hypothesis elaboration

The scientific literature counts many factors that impact the CEO turnover-performance sensitivity. Studying CEO turnover in the companies taken private by PE firms relates both to internal and external control mechanisms. The PE sponsors are heavily involved in governance of the acquired companies and, thus, use internal control mechanisms. At the same time, PTP transactions represent an external investment activity. This is the

[18] The authors define dependent variable is whether the CEO is replaced or not within two years following the LBO. The LBO deal is defined by the authors as investor's activism against public companies.

reason why this chapter surveys the literature on CEO turnover from the point of view of internal and external control mechanisms.

2.1 The evolution of internal control mechanisms

Coughlan and Schmidt (1985) were among the firsts who showed the dependence of the CEO replacement probability on the prior company's stock price performance. This paper provides an empirical evaluation of other corporate internal control procedures, in particular, compensation. The results show that rates of change in executive compensation are positively associated with stock price performance.

Denis and Denis (1995) qualify internal monitoring mechanism as effective when one observes a greater management turnover rate in poorly performing firms and when the firm performance following the management change improves. The authors note, however, that a manager departure from the firms that perform poorly may, firstly, be attributed to the desire of a CEO to avoid a possible shareholders lawsuit. Secondly, boards may replace a CEO in bad times for the reasons that the managers are not responsible for. Under these interpretations a negative relation between stock price performance and managerial turnover cannot be considered as a demonstration of an effective internal control mechanism. What's more, the authors emphasize that the majority (over two-thirds) of forced turnovers observed are due to factors such as blockholder pressure, takeover attempts, financial distress, etc., and cannot be directly attributed to an effective board monitoring.

Weisbach (1988) note the differences in boards' monitoring activity between inside and outside dominated boards. The author demonstrates that companies with outside-dominated boards are more likely to dismiss the CEO on the basis of performance than those with inside-dominated boards[19]. Weisbach argues that outside directors have more incentives to ensure well-running of the company, since better financial results signal their competence to the market, while inside directors, whose career might be dependent on the current CEO, would rather not challenge their top-manager. This finding is consistent with Fama and Jensen (1983)'s supposition that outside directors prefer to develop a reputation of expertise.

[19] These results are consistent for both accounting and stock price performance as proxies for financial performance used by the authors.

Hermalin and Weisbach (1998) interpreting Weisbach (1988)'s study note that the relation between CEO departure and presence of outsiders on the boards may be explained by reverse causality. The authors indicate that outside directors are more likely to join the board and inside directors more likely to leave the board when a new CEO is coming. Inviting outside directors in case of bad performance is seen by the authors as a need to refresh strategy or to install a tougher monitoring. The shareholders may make a pressure on new CEO and demand to add outsiders for greater monitoring. Furthermore, the new CEO may invite outsiders as experts in order to benefit from their advices. Borokhovich et al. (1996) remark, however, that a powerful CEO may hire nominal outsiders that will support his or her decision. Moreover, a CEO may also be a director in the firms where the outsider directors are executives. In this case, the desire of an outsider to challenge CEO will be reduced.

Murphy and Zimmerman (1993) note that previous studies on CEO turnover focus on single-variable analysis (e. g. stock or accounting performance, R&D expenditures) and ignore related financial variables. The authors emphasize the importance of differencing the variables that are subject to considerable managerial discretion (e. g. advertising, capital expenditures, etc.) and those that reflect rather economic health of the organization (such as sales or stock price performance).

Denis et al. (1997) introduce managerial ownership as a variable that can impact the internal control mechanism and, thus, influence the CEO turnover-performance sensitivity. According to the authors' findings, the probability of top management replacement is significantly less sensitive to performance when the officers and directors possess between 5% and 25% of the capital comparing with the firms where the managers own less than 5% of the shares. Besides, the authors find that the presence of an outside blockholder as well as an institutional investor increases both the probability of turnover and turnover-performance sensitivity. The interpretation of these results provided by the researchers implies that, firstly, higher ownership serves as a proxy of top executive power[20], and, secondly, higher equity in the hands of the managers insulates from the pressure executed by the external corporate control market. This ownership issue was also formalized by Hirshleifer and Thakor (1994) who argued that in case of high management ownership the boards might find it more difficult to provide necessary disciplinary actions against poorly performing manager. The

[20] This negative ownership effect is labelled by the authors as managerial entrenchment.

effectiveness of internal monitoring mechanisms is, thus, contested for the firms with high managerial ownership.

Huson et al. (2001) study CEO turnover at large public corporations over the period from 1974 to 1994 and provide evidence on the evolution of internal control mechanisms. They document a relative increase of outsider representation on the boards, level of compensation paid to outsiders, external pressure from the institutional shareholders, and decrease of average board size for the examined period. The authors argue that legal, political, and regulatory processes impacted both the internal and external control mechanisms. However, the relation between the likelihood of forced CEO turnover and firm performance did not change significantly during the period they examine, despite substantial changes in internal governance mechanisms. They, thus, conclude that the more developed internal governance mechanisms did not increase the likelihood that a CEO of poorly performing firm will be replaced.

In a relatively recent paper Kaplan and Minton (2012) provide new evidence studying CEO turnover at large US companies for the period from 1992 to 2007 and document increases in CEO turnover rate as well as CEO turnover-performance and decrease of CEO tenure for the studied period. Comparing with previous works, the authors also find significant and stronger relation between firms' stock performance and internal (board-initiated) CEO turnover. The authors provide several propositions that explain the increased CEO turnover rate and turnover-performance sensitivity. First, they find that stronger relation between CEO turnover and firm's performance is explained by an increase of block holdings. Secondly, Kaplan and Minton show that the boards study not only the industry adjusted poor performance but also to the performance of the industry when they evaluate a CEO quality. The authors show that the dependence of CEO turnover on the industry performance is more typical for the external turnovers from hostile takeovers and interpret their results as a fact that boards and shareholders started to accomplish the role played by hostile takeovers during the hostile takeover activity in the 1980s. Finally, Kaplan and Minton (2012) find that turnover sensitivity to stock performance is shortened by CEO tenures at the position of CEO.

Jenter and Kanaan (2015) study a new data set of voluntary and forced CEO turnovers in US for the period from 1993 to 2009 and find that inconsistently with theoretical predictions the boards take the decision to replace CEO basing on the factors that are beyond

CEO control. They find, particularly, that lower industry performance increases the probability of a forced CEO turnover. The authors suggest that in bad times boards may receive more signals about CEO quality. For instance, some specific CEO skills might be required when industry declines. Another explanation is that boards may fail to isolate exogenous shocks and misattribute exogenous components to the CEO evaluation.

2.2 Role of takeovers and institutional activism

Another strain of empirical research notes the role of corporate takeovers and institutional activism in disciplining top management. Coughlan and Schmidt (1985) noted that when the internal control mechanisms do not function perfectly, the outside pressure (market of corporate takeovers) may provide the changes in management. According to the authors, the managers' expectations towards probable executive changes following mergers, acquisitions or takeovers force them to increase shareholders wealth.

Consistently, Jensen (1986) notes an important role of the takeover market in disciplining managers and preventing them from wasting resources and notes, particularly, that leveraged buyout represents a new organizational form that competes successfully with corporations' governance model due to the debt discipline and the control over free cash flow[21].

Concerning CEO turnover, Jensen (1986) notes also that top management departure after a takeover can be viewed as demonstration that the acquirer supposes that the previous board has failed to effectively monitor top management. Hence, if the pre-buyout financial performance seems to be unsatisfactory for the new owner, it is reasonable to expect that an ineffective (from the point of view of new owners) CEO will be fired after taking control of the target company.

Kini et al. (1995) find a significant negative relation between post-takeover CEO turnover and pre-takeover (market-adjusted) performance. However, this relation exists only

[21] "Free cash flow is cash flow in excess of that required to fund all the projects that have positive net present values when discounted at the relevant cost of capital" (Jensen 1986, p. 2.).

for firms with inside-dominated boards[22]. These results support the hypothesis that the external market for corporate control substitutes for outside directors in disciplining top management.

Mikkelson and Partch (1997) study the impact of takeover activity in US on disciplining managers and find that management turnover rate increases during the period of active takeover market (1984-1988). This evidence is particularly pronounced among poorly performing firms. When takeover market activity declines, there is no significant relation between firms' performance and managerial turnovers.

Huson et al. (2001) note an increased role of institutional ownership and shareholders activism for the period from 1971 to 1994. Mutual funds, private pension and government retirement funds, insurance companies all increased the aggregate level of equity holdings from 19.8% to 43.9% and become much more involved in targeting of poorly performing firms. Concerning CEO turnover, Huson et al. (2001) found stronger performance-turnover sensitivity for the sub-period from 1989 to 1994 when the increased institutional activism was more notable. They also find that institutional ownership strengthens the relation between firms' performance and probability of CEO replacement. This suggest that the internal governance mechanisms and external control market serve as substitutes in improving the monitoring of managers and increase the likelihood that CEOs of poorly-performed companies will be replaced.

A particular interest in the context of institutional activism and corporate governance is paid to the governance role of private equity firms. In a typical private equity buyout, PE firms with or without current management of a targeted company buy a company, most commonly, using debt provided by commercial or investment banks and hedge funds but also their own financial resources. Starting with Jensen (1986 and 1989) many researchers argue that the financial success of the private equity industry[23] result from a superior governance model that PE investors implement in their portfolio companies. An essential part of this superior governance model is the disciplining role of debt. Debt prevents managers from

[22] Hirshleifer and Thakor (1994) propose also a theoretical model for the interaction between the takeover market and the board of directors underlying the importance of board composition (notably, the role of outside directors) for an effective control device.

[23] Kaplan and Schoar (2005), Acharya et al. (2009[a]), Guo et al. (2011) provide the evidence of value creation in LBO-backed companies

wasting resources, i.e., from excessively investing free cash-flows in projects with negative net present values, because the managers are forced to repay the loans (Tykvova and Borell, 2012).

PE firms provide also capabilities of monitoring the companies. Indeed, PE firms may be much more skilled in how they implement monitoring and advisory devices given their past experience (Wright et al., 2009). Thus, private equity firms represent a new external governance mechanism that improves internal control. Comparing with private companies, public corporations characterized by dispersed shareholding might suffer from agency problems. In case of public-to-private reorganization, the PE firms' abilities in restructuring the acquired companies should be more efficient.

In our essay we propose several hypotheses that try to explore the differences in governance between the companies that were taken private by PE firms and public corporations. Besides PE firms' monitoring abilities, buyouts are also typically characterized by high leverage and the concentration of equity. Our main question is how this combination of characteristics should impact CEO performance-turnover sensitivity.

2.3 Hypothesis elaboration

The theory that underlines the relation between firm's performance and CEO turnover assumes that the performance is the sum of manager's quality and a random component outflowing from the industry shocks or other exogenous factors (Jenter and Kanaan, 2015). This theory suggests that the governance mechanisms should isolate all the effects that might cause low performance and do not depend on CEO quality. Despite the findings that demonstrate that corporate boards sometimes fail to isolate these exogenous shocks (Jenter and Kanaan, 2015), some recent papers contest also the hypotheses that CEO turnover-performance sensitivity is a positive outcome of an effective monitoring.

Thus, Cornelli and Karakas (2015) study leveraged buyouts[24] of public companies in the UK and find that after going private the LBO-backed firms experience a decrease in both CEO turnover rate and performance turnover sensitivity. As a reason why CEO turnover rate and turnover-performance sensitivity decrease in LBOs, Cornelli and Karakas suppose that

[24] The authors define an LBO as going private transactions.

new sponsors (PE firms) give a CEO a longer horizon. These results bring new insights to the discussion of the short-termism of public firms. In another contemporaneous paper, Gao et al. (2013) compare CEO turnover and CEO turnover-performance sensitivity in public versus private firms. They find that CEO turnover is more sensitive to performance in public firms, while performance improvements following CEO turnover in public firms are as strong as those following CEO turnover in private firms.

In our essay we present several hypotheses testing the relationship between poor performance and the probability of CEO turnover. We argue that CEO turnover-performance sensitivity in PE-backed companies may be similar to that in public companies or it may differ for a variety of reasons. We discuss, first, why CEO turnover-performance sensitivity in PE-backed companies could be higher comparing with public companies.

2.4 Control hypothesis

Private equity firms tend to be more closely involved in monitoring of the companies they finance (Wright et al., 2009). What's more, concentrated illiquid ownership structure provides stronger shareholder monitoring (Gao et al., 2013). Given the greater ownership concentration and generally less severe agency problems in PE-backed firms, one can argue that PE-backed firms' tighter control leads to the governance mechanism where CEOs face a higher chance of dismissal in the face of poor performance. We have, thus, the

Control hypothesis: CEO turnover-performance sensitivity is higher in PE-targeted companies comparing with public firms.

This hypothesis coincides with Weisbach (1988) who argues that more independent boards (outside-dominated) increase the probability that CEOs of poorly performing firms will be replaced. But, as it was argued by Cornelli and Karakas (2015), the PE sponsors act like both insiders and outsiders. They have no special links with incumbent managers and are, thus, similar to outside directors in public corporations. At the same time, PE sponsors are heavily involved in daily activity of the targeted companies and are, thus, similar to inside directors.

2.5 PE sophistication hypothesis

We develop, thus, an alternative hypothesis that implies lower performance-turnover sensitivity in PE-backed companies. Firstly, one of the main distinctions between PE-backed and public firms is the existence of a long-term objective concerning the targeted by PE sponsor companies, i. e. an investment exit. Thus, PE-backed firm's managers can afford to take a long-term view, knowing that they will not be penalized for poor short-term performance.

Another possible alternative explanation why CEO performance-turnover sensitivity might be lower in PE-backed companies is that PE sponsor may make their turnover decisions on the basis of inside information. Direct monitoring incentives are stronger in a private firm (Gao et al., 2013), which allows PE-backed firms' boards to rely more on subjective performance evaluation for making CEO turnover decisions relative to boards in publicly listed companies. This view is consistent with the findings of Gao et al. (2013) who provide evidence of a substitution between direct monitoring and the use of explicit performance measures across firms with different ownership structures, and findings in Cornelli et al. (2013) who show that in private firms soft information (e.g., subjective evaluation) plays a much larger role than hard information (e.g., accounting performance) in boards' decisions to fire CEOs.

Another distinction between PE-backed and public firms is the existence of a pressure from less sophisticated shareholders. In the companies taken private only accounting statistics are available, while shareholders of public corporations can observe stock price data, published in press. For a publicly traded company the shareholders can easily be unhappy when they take a newspaper that publishes the statistics on stock price performance (Gao et al., 2013). Moreover, Hermalin and Weisbach (2003) note that boards are often criticized by the press for being insufficiently vigilant guardians of shareholders' money and being too dependent on managers. The public firms' boards should, thus, be under a higher pressure from (potentially myopic) shareholders. The CEO performance-turnover sensitivity may, thus, be higher in public companies comparing with the firms taken private. We have, thus, an alternative 'PE sophistication' hypothesis:

PE sophistication hypothesis: CEO turnover-performance sensitivity is lower in PE-backed firms comparing with public companies.

2.6 *Myopic investor's hypothesis*

Another way to evaluate the CEO turnover quality is to look at the efficiency of these decisions. Standard economic theory suggests that, when assessing the quality of its CEO, the board of directors should ignore components of firm performance that are caused by factors beyond the CEO's control. For instance, to conduct relative performance evaluation, the board also observes a group of peer firms subject to similar industry and market shocks. The theory suggests that boards should filter all observable exogenous shocks when they assess a CEO quality. In a recent paper Jenter and Kanaan (2015) studying a large sample[25] of CEO turnovers in public firms find that boards of public companies allow exogenous shocks to affect their CEO turnover decisions. The paper shows, particularly, that CEOs are significantly more likely to be fired after negative performance in their peer firms.

In our essay we suggest that errors in evaluating CEO's quality in taking decision on CEO turnover are more likely for the public companies due to the influence of less sophisticated shareholders, while boards of PE-backed companies can filter industry impact when they take the decision to retain or fire a CEO. A sense of the short-term pressures in public companies comes from outside investors' desire to make CEOs share the disappointment of poor returns. As it is shown by Fisman et al. (2013), if shareholders are uninformed, have limited time horizons, or are subject to overreaction or other biases, shareholders may demand CEO dismissal in response to performance changes outside of the CEO's control. This demand is less evident for the sample of PE-backed companies whose shareholders are considered as market experts. We have, thus,

Myopic *investor's* hypothesis: The public firms are less likely to base the turnover decision on the basis of industry-adjusted financial performance comparing with PE-backed companies.

[25] 2490 voluntary and 875 forced CEO turnovers in 3042 public firms from 1993 to 2009.

2.7 Outside succession

In order to better understand the difference between CEO turnover-performance sensitivity in public and PE-targeted firms we also examine whether the segmentation in the labor market for CEOs may help explain why the turnover-performance sensitivity differs. Private investment firms often have long experience in restructuring companies and, thus, have access to a larger pool of CEOs, which quality was already tested. This might be a reason why CEO turnover-performance sensitivity is higher in PE-backed firms.

To test this possibility, we examine whether PE-targeted firms are more likely to hire external CEOs. Our intuition is dictated by a consideration that experienced private equity firms have access to a large pool of CEOs given the high number of companies that these firms have restructured.

Denis and Denis (1995) emphasize that besides removing poorly performing managers the boards should also identify and attract professionals for replacement. Board members interested in maximizing stockholder value are likely to appoint the most qualified replacement candidate to the position (Huson et al., 2001).

Borokhovich et al. (1996) note that the outside directors select the best candidate regardless of whether new CEO is an outsider or insider. But the inside directors are more likely to appoint an insider for several reasons. Firstly, an insider appointment implies that it is one of the insiders who take the position. Secondly, an insider is less likely to change substantially company's policy that insiders have developed. Finally, inside appointment are not likely to lead to senior managers' turnover.

Parrino (1997) argue that outsiders are more likely to be appointed CEOs when a firm needs a change in firm policies. Huson et al. (2001) note that companies with strong governance are more likely to select outside CEOs, as outside CEOs are more willing to break away from the failed policies of their predecessors. This argument predicts that PE-backed firms are more likely to hire external CEOs than public firms.

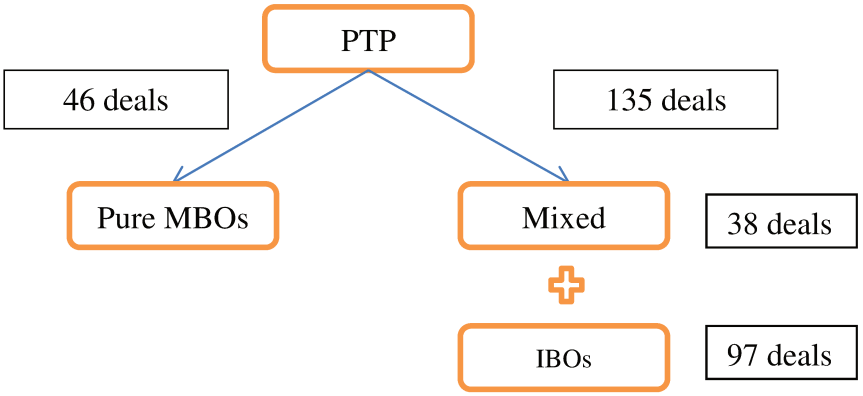
Outside succession hypothesis: In comparison with public firms, the PE-backed firms are more likely to hire an outsider as new CEO.

3. Data and methodology

3.1 Sample of going private transactions

We construct our sample by, firstly, identifying going private transactions in 4 European countries for the period from 2002 to 2008. We obtain the data on the companies undergoing public-to-private transaction from Capital IQ database. We stop in year 2008 since we will then observe the companies taken private within 5 years after going private deal. The year 2002 gives us opportunity to obtain information on CEO turnover (the reason of departure, identity of new CEO, CEO's background, etc.), since Capital IQ provides detailed statistics on CEO turnover from 2001.

Figure 1. The schematic illustration of the sample.



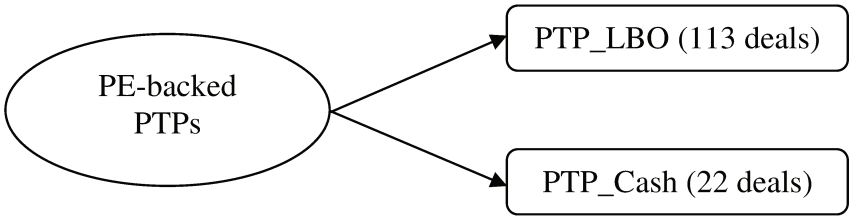
Notes: This schema illustrates the constitution of our sample. The taxonomy of going private companies in our sample distinguishes between pure MBOs that imply a deal where only the management team takes the company private and other deals where either a financial institution that takes control over the company (Institutional buyouts, IBOs) or the transactions where incumbent management plays in consortium with financial institution. We exclude pure MBOs where top management teams initiate and lead the buyout, since our objective is to examine investment firms' governance role.

The initial screening of the going private transactions gives us 181 deals. Capital IQ define a going private transaction "whenever a financial buyer and/or management and/or individual acquires 100% stake or remaining stake that it does not already own (and consequently ends up owning 100%) in a publicly-traded company. Thereafter, the acquired company ceases to trade its securities in the public market" (Capital IQ financial glossary). This criterion allows, thus, to exclude the deals with minority stakes.

We then add the criterion of presence of at least one private investment firm that sponsors the buyout transaction. This leaves us 135 transactions. Our sample excludes, thus, so called pure MBOs where only the management team takes the company private (**Table A2 in Appendix** provides definitions and examples of the different types of leveraged buyouts).

Our final screen of public-to-private transactions represents mixed transactions, i. e. those with only participation of private equity firms (97 transactions) and deals where the incumbent managers participate in backing firm in cooperation with private investment firms (38 transactions). Among these transactions 113 deals represent leveraged buyout operations and 22 transactions are the operations using only cash (**Figures 1** and **2** illustrate the constitution of our sample).

Figure 2. The schematic illustration of the sample (continued)



Notes: this schema illustrates the constitution of our sample. Among final 135 public-to-private transactions 113 are leveraged buyouts and 22 deals represent cash tenders.

3.2 Obtaining control sample: propensity score matching

To measure the effect of PE governance on CEO turnover in the acquired companies, we analyze differences in the relevant variables that determine the probability of PE-sponsored going private deals and the outcomes of these variables for comparable public firms. A crucial feature in the construction of our control sample is the selection of the public firms that have ex-ate the same probability to be PE targets.

We employ propensity score matching, as developed by Rosenbaum and Rubin (1983) and Heckman et al (1993). The goal of this matching approach is to find 'twin' firms which have similar characteristics as PE-backed buyouts but were not acquired.

We first collect from CIQ the sample of public firms whose financial data is available for the years prior to the LBO transactions. Our final sample includes 4138 firm-year observations of control firms.

Table 2 provides variables' description and **Table 3** provides summary statistics on the variables that were used in propensity score matching procedure for buyouts (Panel A) and non-buyouts public firms (Panel B).

Scientific literature developed different hypotheses concerning the nature of the LBO and public-to-private transactions. Essentially, several mechanisms can be identified to explain the value creation in going private decisions for the shareholders and, thus, motivation to go private.

One of the main strands of literature on PTP transactions deals with free cash flow hypothesis. According to Jensen (1986), managers of the public corporations have substantial freedom in distributing the operating cash generated by the company. They can direct the money in useless projects instead of pay out the dividends[26]. After a PTP, that is usually represents an LBO[27], the high leverage forces the managers to direct the money to pay the debt. The shareholders, thus, will benefit from it, since the managers will thereby use money more effectively. The free cash flow hypothesis suggests, thus, that the proportion of a firm's assets consisting of free cash flow should relate directly to the likelihood of a firm going private.

Lehn and Poulsen (1989) and Singh (1990) lend support to the free cash flow hypothesis by reporting that firms going private have greater free cash flow than firms remaining public. In addition, they found that PTPs exhibited lower sales growth, indicating

[26] Jensen (1986) mentions the 'empire building' phenomena, when the managers retain the financial resources to grow their firms beyond an optimal size.

[27] Virtually all public-to-private transactions are financed by borrowing substantially beyond the industry average, and this is the reason why they are called LBOs (Renneboog and Simons, 2008). For example, Halpern et al. (1999) identifying the PTPs for the period from 1981 through 1986 find that only two of transactions were not those with over 50% of debt financing.

poorer growth prospects. We add, thus, free cash flow/assets ratio in our propensity score model (**Table 2** provides the formula for the free cash flow's variable). To proxy for growth prospects for each firm, we calculated the average annual percent increase in net sales and Tobin's Q to measure the growth prospects perceived by the financial market.

Jensen (1986) also hypothesizes that the pre-buyout firms will have underutilized their debt capacity, so the benefit of high level of post-buyout debt is the forced distribution of the firms' free cash flow to service the debt rather than value dissipating investments. We add, thus, debt ratio (Net debt/EBITDA) to proxy for the ability of the buyer to leverage up and to payback debt quickly.

Tax benefits resulting from going private decision may represent an important advantage for targeted companies comparing with the public companies. Kaplan (1989) shows two ways how buyout-backed company can benefit from the tax reduction. First, the debt used to finance a LBO leads to high interest payments that reduce the taxable income. Thus, the amount of the debt payments associated with the buyout multiplied by the tax rate gives the value of benefit from increased interest deductions. Another way to take advantage from tax benefits available after buyout decision is to increase the tax basis of the acquired company. The acquired company can review the value of its assets and use the sum of the value of the purchased equity. Consequently, higher tax basis will generate higher depreciation deductions. We add, thus, effective tax rate to proxy for potential tax shield savings.

We add also return on capital to proxy for profitability, assets turnover to proxy for operating efficiency, operating Working Capital to proxy for operating characteristics of the firm and/or investment opportunity (Gaspard, 2012). All the variables' formulas used in propensity score matching model are presented in the **Table 2.**

We then run a logit regression model[28] that estimates the likelihood of a firm being the object of a going private transaction in a given year. The estimated probability (propensity score) is then used to find a matching control for a firm that indeed was the target of a PE firm.

[28] We run also probit regression with barely identical results.

As for dummies, we add them for each industry and country, but we did not introduce time variables for several reasons. First, since we have only 125 companies taken private it was infeasible to interact time dummies with specific industry and country. In fact, for some years we do not just observe some industrial sectors. Secondly, we match later manually the deals year by year by choosing the closest score at the same year as that of going private date.

We identify the matching partners for each buyout firm by minimizing the propensity score distance between firms taken private and public companies (nearest-neighbors criterion).

In order to meaningfully employ matching, it is necessary to condition on the support common to both taken private and public companies (Heckman et al., 1998). Implementing the common support condition ensures that any combination of characteristics observed in the buyout group can also be observed in the control group.

It is also urgent to check whether the matching procedure is able to balance the distribution of the relevant variables in both the control and buyout group ('balancing property'). In fact, propensity scores are used to create treatment and comparison groups that are as similar as possible on a set of observed covariates (in our case, the determinants of a going private transaction). If the balancing property is not satisfied, the treatment and comparison groups are unlikely to be sufficiently similar to reduce selection bias in our treatment effect estimate. In order to respect the balancing property, we sacrificed several observations because of the extremity of the data to respect the 'balancing property' and our final sample contains 125 LBO firms and for all of them we matched a public firm.

Table 1 reports the composition of the going private transactions sample by year, country and industry. It shows that the majority of going private deals takes place in 2006 after a continuous increase since 2002. In 2007 the deals frequency dropped (Panel A). The largest public-to-private markets are the UK and France (Panel B). Most transactions take place in the consumer discretionary industry (Panel C).

Table 1. Number of public-to-private deals by year, country and industry.

Panel A: Distribution by year

Year	Frequency	Percent
2002	9	7.2
2003	14	11.2
2004	16	12.8
2005	17	13.6
2006	29	23.2
2007	22	17.6
2008	18	14.4

Panel B: Distribution by country

Country	Frequency	Percent
France	22	17.6
Germany	3	2.4
Netherlands	9	7.2
UK	91	72.8

Panel C: Distribution by industry

Industry	Frequency	Percent
Consumer Discretionary	42	33.6
Consumer Staples	4	3.2
Energy	2	1.6
Financials	16	12.8
Healthcare	9	7.2
Industrials	26	20.8
Information Technology	13	10.4
Materials	6	4.8
Telecommunication Services	2	1.6
Utilities	5	4.0

Notes: All going private transactions are (N=125)

Table 2. Propensity score model's variables

Label	Variable's name	Variable's description	Variable's formula	
rev	**Sales**	Total revenue (natural logarithm); as a proxy for company's size	**Total revenues =**	ln(Revenue + other revenue)
rev_growth	**Sales' growth**	Percentage change in total revenue from the previous year; proxy for size's trends	**Sales' growth =**	(Total Revenues(t)-Total Revenues(t-1))/Total Revenues(t-1)
roc	**Return on capital**	Return on invested capital to proxy for profitability (e.g. Lehn and Poulsen, 1989)	**Return on Capital =**	(EBIT*(1-Tax rate) / ((Total Capital(t) + (Total Capital)(t-1))/ 2)
			Total capital =	Total Preferred Equity + Total Debt + Total Common Equity
assets_turn	**Assets turnover**	Proxy for operating efficiency	**Assets Turnover =**	Total Revenues / ((Total Assets (t) + Total Assets(t-1) / 2)
ndebt	**Net debt ratio**	Proxy for the ability of the buyer to leverage up and to payback debt quickly	**Net debt ratio =**	Net debt/EBITDA
			Net debt =	Total Debt - Total Cash & Short-term Investments
cash	**Free cash-flow ratio**	Proxy for the ability of the buyer to payback debt quickly	**Unlevered free cash flow/Total assets =**	[EBIT*(1 - Tax Statutory Rate) + Depreciation & Amortization + Amortization of Deferred Charges + Capital Expenditure + Sale (Purchase) of Intangible Assets + Total Stock-Based Compensation - Amortization of Debt Issuance Costs - Change In Net Working Capital] / Total assets

work cap ratio	**Operating Working Capital**	Proxy for operating characteristics of the firm and/or investment opportunity	**Work cap ratio =**	(Total current assets - Total current liabilities)/Total revenues
q	**Tobin's Q**	Proxy for growth prospects as perceived by the market	**q =**	(Market capitalization + Book value of preferred equity + Book value of liabilities) / Book value of assets
tax	**Effective Tax rate**	Proxy for potential tax shield savings (Kaplan, 1989)	**Tax =**	Income Tax Expense / EBIT

Notes : The table represents the description and formulas of the variables that were used in propensity score matching model.

Table 3. Summary statistics on LBOs vs. Public firms

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A : PE-backed companies					
sales (log)	125	5.297519	1.703719	-1.420526	9.128392
rev_growth	125	19.58102	41.23257	-40.7	362.7
roc	125	6.876688	10.11186	-53.2	42.1
assets_turn	125	0.9642806	0.7590999	0.004	4.94
ndebt	125	1.978857	2.198647	0	10.8
wc_ratio	125	-0.207092	5.587038	-58.96296	26.11763
cash	125	0.0775793	0.4421102	-2.205714	4.046169
tax	125	31.75075	13.04375	1	84.3
q	125	1.363513	0.543766	0.5608547	3.403564
Panel B : Public firms					
sales (log)	4138	6.699294	2.172124	-0.046044	13.03541
rev_growth	4138	19.75008	236.2	-91.1	14472.7
roc	4138	9.509763	8.347465	-11.2	190.7
assets_turn	4138	1.129683	0.712044	0.024	8.99
ndebt	4138	2.462692	5.308214	0.002	192.8
wc_ratio	4138	0.1410055	0.5647236	-5.995216	9.897324
cash	4138	0.0193609	0.4141193	-11.5608	5.682353
tax	4138	38.01361	81.59002	0.01	2781.5
q	4138	1.421387	0.8994437	0.2925046	33.36651

Notes : The sub-sample of the Public firms represents the firm-year observations while the financial information of the sub-sample of PE-backed companies represents the last available statistics before the buyout deal announcement.

Our PE-backed firms' sample firms have a return on capital of 6.9% (Table 3) that is lower than the mean of capital returns of the public firms (9.5%). Renneboog et Simons (2008) argue that it is typical for the MBOs as well as for IBOs (i. e. institutional buyouts) to target underperforming companies. This suggests that buyouts have a disciplinary nature. An alternative interpretation is that these corporate control transactions represent a reaction to the undervaluation of the target firms' shares, since the firms with smaller capitalization, on average, underperformed the market in the 1990s. This is related also to the fact the firms' revenues used as proxy for corporate size show high and negative significance in explaining our logit model (**Table 4**).

3.3 PSM Results

Table 4 shows the results of fitting the logit equation. The results indicate a rather strong fit for a cross-sectional regression (14.36% pseudo R-square)[29].

Table 4. Propensity score model results

Dependent Variable	Dummy variable = 1 if firm is taken private
	(1)
Log Sales	-0.2984427****
	(-6.00)
Sales' growth	-0.0004677
	(-0.44)
Return on Capital	-0.0516999**
	(-2.57)
Assets turnover	-0.0588436
	(-0.35)
Net debt ratio	-0.147622***
	(-2.71)
Work cap ratio	-0.0012854
	(-0.02)
Free cash-flow ratio	0.6811984**
	(1.98)
Tobin's Q	0.0181925
	(0.21)
Effective tax rate	-0.0036154
	(-0.99)
Constant	-1.123509*
	(-1.72)
Country dummies	YES
Industry dummies	YES
Time dummies	NO
N	4394
Pseudo R-squared	14.36%

Notes: This table presents results for the propensity score logit regression, where the left hand side variable is an indicator variable of whether a firm is target of an LBO transaction in a given year. The right-hand side variables as follows. Log Sales is the natural logarithm of company Total revenues. Sales growth is the percentage change in sales from the previous year. Ndebt ratio is the net financial debt divided by EBITDA (Earnings before interest, taxes, depreciation, and amortization). Return on Capital is calculated as in the definition presented in Table 2. Assets turnover is the ratio Total revenues/Total Assets. Work cap ratio is Operating Working Capital (the difference between short-term assets and short-term liabilities) divided by Total revenues. Free cash-flow ration is the amount of marketable securities divided by Total assets. Effective tax rate is the ratio between tax paid and pretax income. The logit specification also contains country, time and industry dummies. T-statistics are calculated using robust clustered standard errors. The symbols ****, ***,**,* denote significance levels of 0.1%, 1%, 5% and 10%, respectively, for the two-tailed hypothesis test that the coefficient equals zero.

[29] Gaspar (2012) finds 17%

The likelihood of becoming an LBO target decreases in firm size and profitability, confirming the intuition that PE firms choose the companies bearing some financial difficulties. In fact, rather small, listed companies experience problems to gain access to growth capital to fund acquisitions or organic expansion. Private equity firms, thus, take advantage of this need and take underperforming firms private.

The pre-deal effective tax rate paid by the target firm has no impact on the likelihood of a bid, rejecting, thus, the hypothesis of possible tax savings from leveraging up. This is in line with Renneboog et al. (2007) who studied the going private activity in UK and did not find relation between target firm's tax burden prior to the PTP and the expected wealth gains and does support the Kaplan (1989)'s findings on US buyout market. One of the possible explanations is that the tax benefits depend on the fiscal regime of the countries of the sample.

The coefficients of financing structure variable (Net debt ratio) have the expected negative sign and statistically significant.

The cash flow ratio coefficient is positive and statistically significant. It means that the firms that had ex ante the same probability to go private as do the firms of our initial sample have significantly greater undistributed free cash flow. The level of a firm's free cash flow is, thus, a significantly positive determinant of its probability of engaging in a going private transaction. It confirms the hypothesis advanced by Jensen (1986) that a major source of stockholder gains in going private transactions is the mitigation of agency problems associated with free cash flow. It is also consistent with Lehn and Poulsen (1989)'s paper that is frequently cited as providing evidence of the applicability of Jensen's free cash flow hypothesis for levered going private transactions.

Generally, we find that underperforming companies with high level of undistributed free cash flow and low debt ratio are more likely to be engaged in a going private transaction.

3.4 Data on CEO turnover

We start our sample in 2000, i. e. two years before going private decision, in order to calculate then differences in the rate of CEO turnover before and after buyout.

We use Capital IQ database that starts in 2001 to record detailed information on CEO turnover such as why a CEO is replaced, who the new CEO is, and what the new CEO's background is. We need also to estimate, as precisely as possible, the point in time at which the board makes the turnover decision in order to choose accurately the period for performance measures that should reflect the information available to monitors at the time when the decision of the turnover takes place.

Table 5 presents annual frequency of CEO turnover in PE-targeted and public firms. The table shows that both public and private firms experience increasing occurrence of CEO turnover over the sample period, peaking in the middle of the recent financial crisis (2008). Further, it is clear that PE-targeted firms' CEOs experience on average a higher likelihood of turnover at 12.5% per annum as compared to public firm CEOs at 10% per annum.

Table 5. CEO turnover over time

	Public firms			PE-targeted firms		
Year	Number of firm-year	CEO turnovers	Percentage of firms with CEO turnover	Number of firm-year	CEO turnovers	Percentage of firms with CEO turnover
2000	9	1	11,11%	9	0	0,00%
2001	24	3	12,50%	23	1	4,35%
2002	38	6	15,79%	39	9	23,08%
2003	57	5	8,77%	53	7	13,21%
2004	84	7	8,33%	79	12	15,19%
2005	109	11	10,09%	97	17	17,53%
2006	124	9	7,26%	114	21	18,42%
2007	123	16	13,01%	110	15	13,64%
2008	113	13	11,50%	102	13	12,75%
2009	99	13	13,13%	92	14	15,22%
2010	85	6	7,06%	73	12	16,44%
2011	67	5	7,46%	51	6	11,76%
2012	40	3	7,50%	24	1	4,17%
2013	15	1	6,67%	11	1	9,09%
Total	987	99	10,01%*	877	129	12,49%*

This table presents the annual frequency of CEO turnover in both the public and LBO-backed firms. Our sample consists of 987 public firm-year observations involving 99 CEO turnover cases, and 877 PE-targeted firm-year observations involving 129 CEO turnover cases from 2000-20013. The turnovers associated with retirement, deceases and career advancement are removed.
*represent the average turnover rate.

4. Empirical results: CEO turnover

The **Table 5** in the previous section shows that the average turnover rate is higher for CEOs in companies taken private relative to CEOs of public firms.

Table 6 reports the summary statistics for the CEO turnover rate before and after the LBO (excluding the transition period). We can see that for the PE targets there is no significant difference in CEO turnover rate after the transition into private. This result is not consistent with Cornelli and Karakas (2015) who find that CEO turnover rate dropped significantly after the going private transition. We observe also that there is no significant difference in average CEO turnover rate in PE targets and matched public companies before the going private transaction (11.2% and 9.7% respectively), while the average CEO turnover after the going private is exactly the same (11.4%).

Table 6. CEO turnover rate before and after (excluding transition)

	Before	After	diff
PE targets	11.2%	11.4%	0.18%
Matching companies	9.7%	11.4%	1.62%
Obs.	249	249	

Notes: This table reports the average CEO Turnover for PE-targeted companies and for the matching public firms. The CEO Turnover is computed as the number of times a CEO is changed, divided by the number of years over which this is measured. The CEO Turnover has been computed separately for the years before and after a firm goes private. In CEO turnover rate calculations, the year in which the transition from public to private occurs is not taken into account.

We then explore the differences in CEO turnover-performance sensitivity in a multivariate setting. We estimate the logit regression where the dependent variable is CEO turnover, which takes the value of one if a firm changes its CEO in year t, and zero otherwise. PE is an indicator variable that takes the value of one if the firm is the company taken private by private equity firm, and zero if the company is public company from control sample. The interaction terms between the PE firm indicator variable and measures of firm performance (return on assets) capture the incremental differences in CEO turnover-performance sensitivity in PE-targeted firms relative to that in public firms. **Table 7** presents the results.

4.1 CEO turnover-performance sensitivity in PE-targeted and public firms

In Columns (1) and (2) of **Table 7** we estimate the likelihood of CEO turnover separately for PE-targeted and public firms. We show that both PE-targeted and public firms' CEO turnover responds significantly to bad performance as captured by negative coefficient of RoA. RoA growth is only significant for the PE-targeted firms. We, thus, confirm prior evidence as first shown in Coughlan and Schmidt (1985) and Warner et al. (1988) and recently by Gao et al. (2013) that poor performance drives CEO turnover decisions by the board. The regression using the full sample (Column 3) shows also that, in general, CEO turnover is dependent on lagged RoA but not on the change of RoA.

Table 7. Differences in CEO turnover-performance sensitivity between PE-targeted and public firms

	PE targets	**Public**	**Full sample**	**Full sample**	**Full sample + controls**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Intercept	-1.684****	-2.057****	-1.921****	-2.057****	-1.881****
	(-10.57)	(-18.58)	(-18.58)	(-15.20)	(-10.47)
RoAt-1	-0.03535**	-0.023**	-0.0225***	-0.023**	-0.0206**
	(-2.23)	(-2.55)	(-2.99)	(-2.55)	(-2.28)
ΔRoA	-0.05249**	-0.001	-0.0143	0.00101	0.00025
	(-2.01)	(0.09)	(-0.80)	(0.09)	(0.02)
PE dummy				0.373*	0.3068
				(1.78)	(1.42)
RoAt-1 x PE dummy				-0.0123	-0.0132
				(-0.68)	(-0.71)
ΔRoA x PE dummy				-0.0535*	-0.0518*
				(-1.88)	(-1.72)
Tenure					-0.00185
					(-0.11)
Duality					-0.2109
					(-0.78)
Founder					-0.7723*
					(-1.75)
N	336	612	948	948	930
Pseudo R-squared	2.7%	1.5%	1.5%	2.44%	3.5%

Notes: This table presents the marginal effects of a logit regression where the dependent variable, CEO turnover, takes the value of one if a firm changes its CEO in year t, and zero otherwise. Our sample consists of 336 PE-targeted firm-year observations and 612 public firm-year observations from 2003-2013. The year where the going private transaction takes place is not taken into account. PE dummy takes the value of 1 for the companies taken private by PE firms, and zero otherwise RoA is one-year lagged return on assets and ΔRoA is one-year growth of return on assets. Z statistics are presented in brackets. Superscripts ****, ***, **, * correspond to statistical significance at the 0.1, 1, 5, and 10 percent levels, respectively.

Columns (4) and (5) test our main hypotheses on the differences in CEO turnover-performance sensitivity in the companies taken private by PE firms and public firms. In the column (4), we, first, show that compared to public firm CEOs, PE-targeted firms' CEOs are about 37% more likely to be replaced, inconsistent with the argument that new sponsors give them longer horizon (Cornelli and Karakas, 2015). In fact, the coefficient estimate on the PE firm dummy variable is around 0.37 point and significant at the 10% level.

At the same time, in the columns (4) and (5) the coefficient estimates on the interaction terms between the PE firm indicator variable and change in RoA are also negative and significant at 10%. Thus, there is significantly greater CEO turnover-performance sensitivity in PE-targeted firms as compared to public firms, consistent with our control hypothesis. The PE dummy strengthens the negative relation between financial performance measure and CEO turnover.

The results of columns (5) show also that the CEOs who are founders or members of founding family are less likely to be replaced. The coefficient of Founder indicator is significant at 10% level.

4.2 Relative Performance Evaluation in PE-targeted and public Firm CEO Turnover

Standard economic theory suggests that, when making CEO firing decision, the board should only focus on components of firm performance that are within a CEO's control, and hence the so-called relative performance evaluation in CEO turnover (Gao et al., 2013; Jenter and Kanaan, 2015). Prior work such as Jenter and Kanaan (2015) and Kaplan and Minton (2012) have shown the presence of relative performance evaluation in CEO turnover decisions. These papers also show that CEOs are significantly more likely to be fired after negative performance in their peer firms. To examine whether the differential turnover-performance sensitivity between PE-targeted and public firm CEOs is driven by the use of relative performance benchmarks, we run the regression with industry-adjusted measures of firm's performance. **Table 8** presents the results.

Table 8. CEO Turnover-Performance Sensitivity Using Industry-Adjusted Performance

		Full sample	Full sample
	(1)	**(2)**	**(3)**
Intercept		-2.165	
		(-16.09)	
PE dummy		0.1823	-0.0709
		(0.82)	(-0.21)
PE x Industry-adjusted RoA		-0.034**	
		(-2.50)	
PE x Industry-adjusted change in RoA		-0.03707**	
		(-2.11)	
Industry-adjusted RoA	-0.000734	-0.0008	
	(-1.15)	(-1.23)	
Industry-adjusted change in RoA	0.00054	0.0021	
	(0.39)	(0.26)	
PE x Industry RoA			0.06187*
			(1.75)
PE x Industry change in RoA			-0.03935
			(-1.34)
Industry RoA			0.00069
			(1.03)
Industry change in RoA			-0.001006
			(-0.24)
N	946	946	946
Pseudo R-squared	0.2%	2.3%	1.4%

Notes: This table presents the marginal effects of a logit regression where the dependent variable, CEO turnover, takes the value of one if a firm changes its CEO in year t, and zero otherwise. Full sample consists of 946 firm-year observations from 2003 to 2013. The year where the going private transaction takes place is not taken into account. PE dummy takes the value of 1 for the companies taken private by PE firms, and zero otherwise. Industry-adjusted RoA is firm's return on assets minus average industry RoA. Industry-adjusted change in RoA is firm's one-year change in return on assets minus one-year industry growth in RoA. Industry RoA is average industry return on assets. Industry change in RoA is industry one-year growth in RoA. Z statistics are presented in brackets. Superscripts ****, ***, **, * correspond to statistical significance at the 0.1, 1, 5, and 10 percent levels, respectively.

The interaction terms between the PE-targeted firm indicator variable and measures of industry-adjusted firm performance capture the incremental differences in CEO turnover-firm-specific performance sensitivity in PE-targeted firms relative to that in public firms.

In column (1) we test, firstly, the likelihood of CEO turnover in both PE-targeted and public firms using industry-adjusted measures of financial performance (return on assets and one-year change in return on assets). We show that the coefficients of the financial variables are not significant.

In column (2) we show that the coefficient estimates on the interaction terms between the PE firm indicator variable and measures of firm performance (measured in terms of industry-adjusted RoA and industry-adjusted change in RoA) are negative and significant at 5% level, indicating that there is significantly greater turnover-performance sensitivity in PE-targeted firms as compared to public firms, based on industry-adjusted performance measures. It shows also that PE-backed firms are more likely to base their turnover decision in the basis of the industry-adjusted performance.

Column (3) presents the results of the test that examines whether PE-backed firms are more likely to respond to the industry performance when they evaluate CEO quality and take the decision about CEO replacement. We find that interaction term is positive and significant at 10% level. This result means that PE dummy increases the likelihood of CEO departure when the industry performs better. It also means that PE-backed firms are less likely to replace a CEO when the industry performance declines.

In summary, we conclude that using industry-adjusted performance measures, we continue to find that there is greater turnover-performance sensitivity in PE-targeted firms compared to that in public firms. This suggests that PE-backed companies are more active in disciplining poorly performing CEO. What's more, their decision is more efficient, since they are more likely comparing with their public peers to use industry-adjusted financial measures and are less likely to fire CEOs when industry declines.

For the reason of robustness we run also the logit regression with inversed dummy variable where public dummy take value of 1 when the company is public. **Table 9** presents the result.

As we can see in **Table 9**, the public dummy decreases the relation between industry-adjusted performance and the probability of CEO replacement. The interaction term between public dummy and the measures of financial performance (both industry –adjusted RoA and industry–adjusted change in RoA) is positive and significant at 5% level. Assuming that the direct relation between financial performance and probability of CEO replacement is negative, we interpret the positive and significant sign of the interaction term and the measures of financial performance as evidence that public firms are less likely to base their turnover

decision on the industry adjusted measures. This result confirms our myopic investor's hypothesis.

Table 9. CEO Turnover-Performance Sensitivity Using Industry-Adjusted Performance

	Full sample
	(1)
Intercept	-1.9835****
	(-11.13)
Public dummy	-0.1823
	(-0.82)
Public x Industry-adjusted RoA	0.034**
	(2.50)
Public x Industry-adjusted change in RoA	0.03707**
	(2.11)
Industry-adjusted RoA	-0.0348**
	(-2.56)
Industry-adjusted change in RoA	-0.03497**
	(-2.25)
N	946
Pseudo R-squared	2.25%

Notes : This table presents the marginal effects of a logit regression where the dependent variable, CEO turnover, takes the value of one if a firm changes its CEO in year t, and zero otherwise. Full sample consists of 946 firm-year observations from 2003 to 2013. The year where the going private transaction takes place is not taken into account. Public dummy takes the value of 1 for the public companies, and zero for the sample of PE-backed companies. Industry-adjusted RoA is firm's return on assets minus average industry RoA. Industry-adjusted change in RoA is firm's one-year change in return on assets minus one-year industry growth in RoA. Z statistics are presented in brackets. Superscripts ****, ***, **, * correspond to statistical significance at the 0.1, 1, 5, and 10 percent levels, respectively.

4.3 Outside succession

We next examine what factors could explain the differences in CEO turnover-performance sensitivity in PE-backed and public firms. If there is a larger pool of CEOs for the PE-targeted companies, given their experience in companies' restructuring, then one can assume that this experience gives them an access to a pool of CEOs whose quality was already tested. It can, by its turn, explain the differences in CEO turnover-performance sensitivity between PE-backed and public companies.

To explore this possibility, we examine whether PE-backed firms are more likely to hire external CEOs when they take the decision to replace a manager. On the one hand, public firms have better visibility, which provides them better access to external CEO candidates than private firms do. One the other hand, firms with strong governance are more likely to select outside CEOs, as outside CEOs are more willing to break away from the failed policies of their predecessors (Borokhovich et al. (1996) and Huson et al. (2001)). This argument, in turn, predicts that PE-backed firms are more likely to hire external CEOs than public firms.

We, first, compare incoming CEOs across these two types of firms. Following Huson et al. (2004), we define an external CEO as the one who takes the CEO position within one year of joining the firm.

Table 10 presents some basic statistics on internal versus external hires. Within public firms, 64% of the new hires are coming from the same company; in contrast, only 50.8% of the new hires are coming from the same company for the PE-backed firms' sample. The data shows that there are material differences between replaced and incoming CEOs within each type of the firms. Then the important and more interesting question is what leads to labor market segmentation? We argue that the desire to appoint an outsider as new CEO might be negatively related to the financial performance, since the boards would want to replace the CEO who caused the financial underperformance. We estimate then a logit regression where the dependent variable is the identity of new CEO – external versus internal promotion – and we examine whether there is any differential in hiring CEOs from outside an organization between PE-backed and public firms.

Table 10. Internal versus External CEOs

	Public firms	PE-backed firms
Number of CEOs promoted internally	64 (64%)	63 (50.8%)
Number of CEOs promoted externally	36 (36%)	61 (49.2%)
Total	100 (100%)	124 (100%)

Notes: The Table represents the statistics of internally-promoted CEO versus externally-hired CEOs. An external CEO is the one who takes the CEO position within one year f joining the firm.

Table 11 presents the logit estimation results. We show that consistent with our univariate statistics presented in the **Table 10**, PE-backed firms are more likely to hire a new CEO from the outside: The coefficient estimate on the PE dummy indicator variable is 0.62 and significant at the 5% level, suggesting that the likelihood of PE-backed hiring external CEOs is about 62% higher than that of public firms. This confirms our outside succession hypothesis. By showing that PE-backed are more likely to hire external CEOs, we are able to rule out an alternative explanation for the observed higher CEO turnover-performance sensitivity in PE-backed firms because these firms have a larger (external) labor market pool than public firms and hence less tolerant of poor performance. The results show also that poorly performing firms are more likely to hire outside CEOs. Notably, industry-adjusted return on assets is negatively and significantly associated with a firm's likelihood to hire outside CEOs.

Table 11. Outside succession

	Full sample
	(1)
Intercept	-0.74765
	(-3.38)
PE dummy	0.6207**
	(2.09)
RoA_i	-0.00317**
	(-2.65)
N	200
Pseudo R-squared	3.2%

Notes : The table represents the results of logistic regression. The dependent variable is equal to one if new CEO is hired from outside the firm.

Our results show that PE-backed firms' CEOs are paid more than otherwise similar public firm CEOs for poor performance. When combined with our evidence that CEO performance turnover sensitivity is higher in PE-backed firms, our findings could be interpreted as greater turnover risk for PE-backed firm CEOs.

We conclude that the segmented labor market for PE-targeted and public firm CEOs combined with more easily available external CEO candidates in PE-targeted firms contribute to the greater CEO turnover-performance sensitivity in PE-targeted firms as compared to that in public firms.

5. Conclusion

In this essay we compare CEO turnover-performance sensitivity in PE-targeted firms to turnover-performance sensitivity in similar public firms that had ex ante the same probability to be taken private. We find empirically that monitoring and governance practice in PE-backed companies suggest less forgiving for poor financial results. We show, particularly, that CEO turnover-performance sensitivity is higher in PE-targeted companies. The managers of PE-backed firms are, however, less concerned about industry factors that can affect financial underperformance, since PE-backed companies are more likely comparing with public companies to base their CEO turnover decision on industry-adjusted performance.

Our findings did not support the inside information theory of boards (Cornelli and Karakas, 2013). This theory suggests that board's higher reliance on the inside soft information obtained from direct monitoring when taking decision to replace CEO could decrease the sensitivity of CEO turnovers to performance.

The literature on CEO turnover in public firms interprets higher turnover-performance sensitivity as a sign of an active and independent board. This view was further strengthened by the evidence that the presence of a blockholder increases the relation between financial performance and probability of CEO departure. We support this evidence for the sample of the firms taken private. The buyout sponsors that concentrate ownership and, thus, control increase the CEO turnover-performance sensitivity. The CEOs of PE-backed firms, thus, face greater turnover risk.

The theory also suggests that boards should take into account all observable information when they evaluate CEO quality and take the decision to retain or replace a CEO and avoid the mistakes related to the myopia when boards replace CEOs because of the factors that are beyond a CEO's control. We find that PE-backed firms are more likely comparing with public firms to base their CEO turnover decision on industry-adjusted performance that allows us to consider PE-backed governance model as installing superior monitoring mechanism.

We then investigate the reasons for the difference in turnover-performance sensitivity to exist. We find that PE-backed firms tend to promote more external CEOs. These results support the hypothesis that companies with strong governance are more likely to select outside CEOs,

as outside CEOs are more willing to break away from the failed policies of their predecessors (Huson et al., 2001).

Our essay suffers from some limitations. In our analysis we do not distinguish between voluntary or forced turnover. Unfortunately, identification of forced departures is difficult because press releases often do not describe them as such. Thus, for example, a stated retirement may really be a forced departure (Denis and Denis, 1995). We considered, thus, all the turnovers as forced and this is one of the limits of our paper. However, if a press report does indicate that a management change is forced or that it is due to poor performance, we can be confident that the change is indeed forced. We, however, checked whether the replaced CEO takes then a higher position in the holding or in parent company or is hired by the PE fund that financed the buyout. Such turnover should not be associated with poor prior performance and we did not consider such cases as CEO turnovers.

Among the possible extensions of this essay it would be interesting to examine firm performance after CEO turnover in PE-backed and public firms. It would get more insights on the optimality of the turnover decision across these two types of firms. If the higher turnover-performance sensitivity in PE-backed firms is driven by monitoring improvement, then we would see more performance improvement in PE-backed firms following the CEO turnover.

Denis and Denis (1995) studying performance improvements following management replacement find that average and median industry-adjusted return on assets increase over periods starting one year before and ending two or three years after the management change. Performance improvements are larger in case of forced CEO replacement comparing with the cases related to the normal retirement. These results, thus, suggest that management turnovers lead to enhancement of corporate performance. Moreover, the results also note that the positive abnormal stock returns observed around turnover events reflect rational anticipation by investors of subsequent firm performance improvements (Huson et al., 2004).

Gao et al. (2013) comparing CEO turnover in public and private firms and post-turnover performance find that performance improvements is less pronounced in public firms following CEO turnover than following CEO turnover in private firms. The authors, thus, argue that public firms' boards turn CEOs too often and these turnovers are driven by myopia.

Several issues, however, concerning the impact of managerial turnover on subsequent firm performance improvements remain unresolved. Particularly, the performance improvements following turnover decision could be due to mean reversion of the accounting performance and not due to the improved management quality (Huson et al., 2004). The possible research extension on post-turnover performance should, thus, take into account the potential impact of monitoring by influential shareholders such as private equity sponsors that take company private on post-turnover firm performance. Huson et al. (2004) find also that post-turnover firm performance changes are positively influenced by external takeover pressure. The disciplinary effect of external takeover market may explain, thus, both the board's decisions concerning CEO turnover and positive performance improvements associated with takeover pressure.

References

Acharya V., Hahn M., Kehoe C., 2009[a]. 'Corporate Governance and Value Creation: Evidence from Private Equity'. Working paper. http://pages.stern.nyu.edu/~sternfin/vacharya/public_html/20110702_text_clean_final_og.pdf

Acharya, V. V., Hahn, M., & Kehoe, C., 2009 [b]. 'Private equity target selection: Performance and risk measurement based on propensity score matching'. Unpublished working paper, London Business School.

Borokhovich, K. A., Parrino, R., Trapani, T., 1996. 'Outside directors and CEO selection'. Journal of Financial and Quantitative Analysis, 31(3), 337-355.

Cornelli F., Karakas O., 2012. 'Corporate governance of LBOs: The role of the boards'. http://ssrn.com/abstract=1875649 or http://dx.doi.org/10.2139/ssrn.1875649

Cornelli, F., Karakaş, O., 2015. 'CEO turnover in LBOs: The role of boards'. Available at SSRN 2269124.

Cornelli F., Kominek Z., Ljungqvist A., 2013. 'Monitoring manager: Does it matter'. The Journal of Finance, vol LXVIII, No. 2, April 2013.

Coughlan, A. T., Schmidt, R. M., 1985. 'Executive compensation, management turnover, and firm performance: An empirical investigation'. Journal of Accounting and Economics, 7(1-3), 43-66.

Denis, D. J., Denis, D. K., 1995. 'Performance changes following top management dismissals'. The Journal of finance, 50(4), 1029-1057.

Denis, D. J., Denis, D. K., and Sarin, A., 1997. 'Ownership structure and top executive turnover'. Journal of financial economics, 45(2), 193-221.

Fama, E. F., Jensen, M. C., 1983. 'Separation of ownership and control'. The Journal of Law & Economics, 26(2), 301-325.

Fisman, R. J., Khurana, R., Rhodes-Kropf, M., Yim, S., 2013. 'Governance and CEO turnover: Do something or do the right thing?'. Management Science, 60(2), 319-337.

Gao H., Harford J., Li K., 2013. 'CEO Turnover-performance sensitivity in private firms'. Working paper.

Gaspar J-M., 2012. 'The performance of French LBO firms: new data and new results'. Finance. 2012/2 – Vol. 33, pp. 7-60.

Gong J., Wu S., 2011. 'CEO turnover in Private Equity Sponsored Leveraged Buyouts'. Corporate Governance: An International Review, 2011, 19(3): 195-209.

Guo S., Hotchkiss E. S., Song W., 2011. 'Do Buyouts (Still) Create Value?'. The Journal of Finance. Volume 66, Issue 2, pages 479–517, April 2011

Halpern, P., Kieschnick, R., Rotenberg, W., 1999). 'On the heterogeneity of leveraged going private transactions'. The Review of Financial Studies, 12(2), 281-309.

Heckman, J. J., Ichimura, H., Todd, P., 1998. 'Matching as an econometric evaluation estimator'. The Review of Economic Studies, 65(2), 261-294.

Hermalin, B. E., Weisbach, M. S., 1998.' Endogenously chosen boards of directors and their monitoring of the CEO'. American Economic Review, 96-118.

Hermalin B. E., Weisbach M. S., 2003. 'Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature'. Economic Policy Review, Vol. 9, No. 1, April 2003.

Hirshleifer, D., Thakor, A. V., 1994. 'Managerial performance, boards of directors and takeover bidding'. Journal of Corporate Finance, 1(1), 63-90.

Huson, M. R., Malatesta, P. H., Parrino, R., 2004. 'Managerial succession and firm performance'. Journal of Financial Economics, 74(2), 237-275.

Huson M. R., Parrino R., Starks L. T., 2001. 'Internal Monitoring Mechanisms and CEO Turnover: A Long-Term Perspective'. The Journal of Finance, Vol. LVI, No. 6.

Jensen M., 1986. 'Agency costs of free cash flow, corporate finance and takeovers'. American economic review 76, 323-329.

Jensen M., 1989. 'The eclipse of public corporation'. Harvard business review 67, 61-74.

Jenter, D., Kanaan, F., 2015. 'CEO turnover and relative performance evaluation'. The Journal of Finance, 70(5), 2155-2184.

Jenter, D., and Lewellen, K., 2010. 'Performance-induced CEO turnover'. Working paper, Stanford Univ.

Kaplan, S., 1989. 'Management buyouts: Evidence on taxes as a source of value'. The journal of finance, 44(3), 611-632.

Kaplan, S. N., Minton, B., 2012. 'How has CEO turnover changed?'. International review of Finance, 12(1), 57-87.

Kaplan S. N., Schoar A., 2005. 'Private equity performance: Returns, persistence, and capital flows'. The Journal of Finance, 60(4), 1791-1823.

Kini, O., Kracaw, W., Mian, S., 1995. 'Corporate takeovers, firm performance, and board composition'. Journal of Corporate Finance, 1(3), 383-412.

Lehn, K., Poulsen, A., 1989. 'Free cash flow and stockholder gains in going private transactions'. The Journal of Finance, 44(3), 771-787.

Mikkelson, W. H., Partch, M. M., 1997. 'The decline of takeovers and disciplinary managerial turnover'. Journal of financial economics, 44(2), 205-228.

Murphy, K. J., Zimmerman, J. L., 1993. "Financial performance surrounding CEO turnover". Journal of Accounting and Economics, 16(1), 273-315.

Parrino, R., 1997. 'CEO turnover and outside succession a cross-sectional analysis'. Journal of Financial Economics, 46(2), 165-197.

Renneboog, L., Simons, T., and Wright, M., 2007. 'Why do public firms go private in the UK? The impact of private equity investors, incentive realignment and undervaluation'. Journal of Corporate Finance, 13(4), 591-628.

Renneboog L., Simons T., 2008. 'Public-to-Private and Private Equity transactions: The literature on LBOs, MBOs, MBIs and IBOs'. New Modes of Governance.

Rosenbaum, P. R., & Rubin, D. B., 1983. 'The central role of the propensity score in observational studies for causal effects'. Biometrika, 70(1), 41-55.

Singh, H., 1990. 'Management buyouts: Distinguishing characteristics and operating changes prior to public offering'. Strategic Management Journal, 111-129.

Tykvová, T., & Borell, M. (2012). 'Do private equity owners increase risk of financial distress and bankruptcy?'. Journal of Corporate Finance, 18(1), 138-150.

Warner, J. B., Watts, R. L., Wruck, K. H.,1988. 'Stock prices and top management changes'. Journal of financial Economics, 20, 461-492.

Weisbach M., 1988. 'Outside directors and CEO turnover'. Journal of Financial Economics 20 (1988) 431-460. North-Holland.

Wright, M., Amess, K., Weir, C., Girma, S., 2009. 'Private equity and corporate governance: Retrospect and prospect'. Corporate Governance: An International Review, 17(3), 353-375.

Appendix

Table A1. Summary of definitions used in the essay with the deals' examples

Term	Definition and example
LBO	**Leveraged buyout.** An investor activism towards public or private firm using substantial amount of debt.
MBO	**Management buyout.** Transaction where incumbent management team usually supported by private-equity investor takes the control over a firm. The management of Computer Software Group, backed by HgCapital made recommended cash offer to acquire Computer Software Group plc in a management buyout on March 16, 2007.
Pure MBO	A type of MBO where incumbent management bids for the control of firm without any support of investment firm. For example, Ringo Francis, Chairman and Chief Executive Officer of Zenith Hygiene Group Plc, along with Stanley Fink and Arvinder Walia made an offer to acquire the remaining 84.81% stake in Zenith Hygiene Group Plc from AXA Framlington Investment Management Limited and other shareholders on October 9, 2008.
MBI	**Management buyin.** Transaction where outside management team, usually with support of private equity investor, backs the firm and replaces incumbent management team. The Rombi family along with Colette Robert made a bid to acquire the remaining 39.71% stake in Arkopharma SA on June 4, 2007.
BIMBO	**Buyin management buyout.** An LBO where both incumbent and outside managers, usually supported by private equity investor, acquites a company. Tom Farmer, Aileen Pringle, Ervin Landau, Diana Darlington and the management of Regalian Properties led by Lee Goldstone and Roland King made an offer to acquire Regalian Properties Plc on March 30, 2001.
IBO	**Institutional buyout.** Transaction where an investment firm, usually a private-equity fund, acquires a company. For example, Blackstone Real Estate Advisors and Colony Capital made cash offer to acquire Savoy Hotel plc for approximately $870 million on April 7, 1998.

This table represents the taxonomy of public-to-private transactions.

II. Impact of investment firms' specialization on the CEO turnover in the acquired companies

1. Introduction

Chief executive officer (CEO) turnover represents a landmark event for any company. The CEO turnover may signal for significant restructuring of the firm but also for discontent with the firm's short-term performance or long-term strategy. In both cases the decision to replace a CEO is a result of a complex mechanism of corporate governance.

The scientific literature documenting CEO turnover distinguishes between two types of control instruments that link the managers' departure and the corporate governance mechanisms: the internal control that is realized through the boards of directors of the corporations and the external control submitted by the market for corporate control. "It is argued that if the changes in internal governance mechanisms and the external control market improve the monitoring of managers, then the relation between company's performance and the likelihood of CEO replacement should be strengthened" (Huson et al., 2001). In other words, better monitoring increases the probability that the CEO of a poorly performing firm will be replaced. The researchers mention also some other factors (e. g. regulatory processes or product market) that serve as complements for internal control in the same way as external control market (e. g. Jensen, 1993).

Drawing from some important studies on CEO turnover we can note several generally accepted aspects of the turnover-performance relation. First, the CEO turnover is negatively related to prior firm performance (Brickley, 2003). Accordingly, prior evidence has shown that the probability of CEO turnover in public firms depends on the firm's absolute and relative performance (Huson at al., 2001; Kaplan and Minton, 2012; Jenter and Kanaan, 2015). Second, CEO turnover-performance sensitivity varies across firms. Generally, the sensitivity increases with the fraction of outside directors and the presence of independent directors on corporate boards (Hirshleifer and Thakor, 1994; Kini et al., 1995; Weisbach, 1998; Kaplan and Minton,

2012), the concentration of equity holdings (Jensen, 1993), and decreases when the manager is a founder or a member of the founding family of the company (Huson et al., 2001).

It is however difficult to draw strong conclusion from previous empirical research in order to define an efficient CEO turnover case, i. e. a case when the CEO is appropriately punished for poor firm performance. The first difficulty is that corporate boards fail to isolate the effects that force the boards to react but are beyond of CEO control (e. g. exogenous industrial shocks). For instance, Jenter and Kanaan (2015) study the relation between industry performance and CEO turnover and find that CEO dismissals are caused by negative performance shocks of the industry.

A second problem comes from the differential impact of CEO turnover on short-term vs. long-term performance. Edmans (2011) in a theoretical model notes that a CEO that assumes the board's short-term anticipations will be focused on the short-term performance in order to avoid possible dismissing. Such short-term strategy may deter future investments and may hurt the firm's long-term performance.

In our essay we propose that in PTP[30] firms the impact of firm's performance on CEO turnover depends on the investor's degree of specialization. We argue that the higher industrial specialization (relative to the competitors) of an institutional investor implies that the investor knows better the industry conditions of the targeted company and is more able to isolate the factors that cause the low performance but are out of CEO control.

In fact, Gompers et al. (2005), Kasperczyk (2005), Kaplan and Stromberg (2009) note that PE firms tend to focus their activities in specific industries where they try to develop their concrete expertise abilities, and, thus, take advantage of the incremental specific knowledge. Cressy et al. (2007) studying the impact of the PE firms' specialization on the value creation of the acquired companies note that PE specialist reduces information asymmetries as the investor learns more about an average 'private' probability of success in a specific industry.

The PE firms are therefore able to provide more accurate assessment of CEO quality, rely on other internal information instead of firing a CEO immediately on the sole basis of the

[30] Public-to-private companies.

firm's short-term financial performance. Consequently, the dependence of CEO turnover on short-term firm performance should be lower in companies owned by specialized shareholders. We hypothesize, thus, a lower turnover-performance sensitivity in the companies acquired by more specialized PE firms.

We test this idea on a sample of companies taken private by investment firms. These companies represent an interesting sample for the analysis of CEO turnover. Indeed, private investment firms have reputation for generating value for the firms they finance (Kaplan and Stromberg, 2009, Cornelli and Karakas, 2015). Some researchers defend the point of view that the private equity model is superior in terms of governance and mention several ways through which the PE firms contribute to the corporate governance of the acquired companies. For instance, Jensen (1986; 1989) argues that the PE governance model is an effective solution to alleviate the agency costs. According to the author, PE investors are quite successful in realigning the interests of shareholders and managers by granting significant share of the company's equity to executives.

What's more, virtually all going private transactions are leveraged buyouts (LBO), which implies a significant increase in leverage. Jensen (1986; 1989) explains that substantial interest payments provide a useful pressure on the managers and do not allow the managers to waste money through extravagant investments (empire-building projects) or consumption of private perquisites.

Finally, the recent literature that studies the boards' composition of LBO-backed companies shows that the representatives of the PE firms are more actively involved in monitoring than the boards members of public companies. For instance, Cornelli and Karakas (2015) analyze the boards' composition and CEO turnover in the companies that go private in UK and find that following an LBO, the deal's sponsors sit on the boards of the acquired companies and intervene in case of difficult situations[31].

[31] Cornelli and Karakas (2012; 2015) identify the difficult deals requiring more board's effort using several proxies. The authors introduce a dummy variable that takes the value of one when there was a CEO change during the transition from public to private. Second, they construct a dummy that equals to one if the PE firm exits the deal within 5 years after going private. The deals not-exited within 5 years are, thus, considered as difficult cases. Third, the authors consider the presence of outsiders on the boards before going private as another proxy to identify a difficult case.

In order to test our hypothesis we collect a sample of going private transactions realized in 4 European countries[32] (France, Germany, UK, and Netherlands) via, primarily, a LBO mechanism for the period from 2002 to 2008. We exclude pure management buyouts (pure MBOs) from our sample. Pure MBOs imply only participation of the management in taking company private without involvement of private equity firms. Since our objective is to test the impact of PE firms' specialization, MBOs are not appropriate for testing the CEO replacement decisions made by corporate boards controlled by PE firms.

We address in our empirical model some other questions already evoked in the empirical literature on the CEO turnover (Kini et al., 1995; Huson et al., 2001; Lehn and Zhao, 2006; Gong and Wu, 2011; Gao et al., 2012; Kaplan and Minton, 2012; Cornelli and Karakas, 2015). We analyze, beside our main hypotheses, some other problems: whether CEOs with longer tenure are more likely to be fired after a going private transaction, whether CEOs are less likely to be fired if they are also chairmen of the boards and/or founders of the targeted companies. We also test whether the experience of the buyout sponsors have an impact on the probability of CEO turnover.

We document a CEO turnover rate of 27.4% within the year of going private. We also find that 54.1% of the buyout firms experienced a CEO turnover within two years following the buyout. This finding is consistent with Gong and Wu (2011) that document CEO turnover rate of 51% within two years of a PE-backed LBO announcement[33]. Cornelli and Karakas (2015) report that in 52.3% of the LBO-backed going private deals the CEO is changed during the transition[34].

Using a panel logit regression with fixed effects we examine the effects of post buyout financial performance on the likelihood of CEO turnover. We test our moderation hypothesis that suggests that PE firm specialization lowers the relation between short-term financial performance and the CEO turnover.

[32] The majority (more than 90%) of LBO-backed going private deals are observed in theses 4 European countries.
[33] Gong and Wu (2011) define an LBO as a form of investor activism against public corporation.
[34] Cornelli and Karakas (2015) define transition period as a time between the LBO deal resolution and the moment when a new board is installed.

We do not find any evidence that PE firms' specialization impacts the relation between targeted company's financial performance and the probability of CEO turnover. We report, however, that the evolution of the industrial specialization of the PE firm reduces the probability of CEO replacement in the acquired company. We interpret this result as evidence that the more specialized firms rely on other information in order to interpret the underperformance and give the CEO a longer horizon. Another explanation is that that the PE firm specialization might help to filter the factors that are beyond the CEO control. Our findings support the idea of Cornelli and Karakas (2015) who found lower turnover rate in the companies taken private in post-buyout period and suggested that this result might be due to the fact that LBO sponsors give CEOs a longer horizon.

The documented evidence provides an important link between the previous empirical results found by Cornelli and Karakas (2015) concerning the CEO turnovers after LBOs, and introduces a new variable (industrial specialization of the PE firm) that plays a role in the governance of the companies they finance. Our results show that the nature of post-buyout governance reorganization in top management discipline depends on the industrial specialization of the PE firm.

This paper extends the prior literature by studying CEO turnovers primarily during the post-buyout period and observing the acquired companies during five years after going private decision or until the investment exit (when the exit takes place within 5 years after buyout). The PE firm's specialization variable also distinguishes this paper from previous studies. We introduce as well the interaction models where the index of competitive advantages (our specialization's measure) plays a moderation role and test whether the PE firm's specialization impacts the relation between the financial performance (turnover-performance sensitivity moderated by specialization) and CEO tenure (we, thus, test whether the more specialized firms are more likely to fire the CEOs with longer tenure).

We attempt to improve the methodology of earlier researches by using a panel within regression controlling for firm-specific effects and alleviating, thus, the selection bias. In a panel regression with fixed effects we estimate the impact of time-varying, firm-specific characteristics on the probability of CEO turnover and control for the unobserved time-invariant factors that could be correlated with our explanatory variables.

The remainder of the paper is organized as follows. In section 2, we provide a literature review of CEO turnover context and the hypothesis elaboration. Section 3 represents description of the sample and empirical methodology. Section 4 presents the statistical evidence, tests' results, and a discussion of the results. Section 5 contains concluding comments with some possible extensions.

2. Theoretical background and hypothesis elaboration

2.1 Corporate governance and CEO turnover

Extent research has analyzed the relation between firm performance and the probability of CEO turnover (overwhelmingly, in public companies). Most of the studies document that prior firm performance has a negative impact on the likelihood of CEO departure. Coughlan and Schmidt (1985) test whether the frequency of the CEO turnover is impacted by the stock price performance. Weisbach (1988) shows that the negative relation between financial performance and CEO turnover is strengthened by a higher presence of outsiders on corporate boards. This coincides with Fama and Jensen (1983)'s findings suggesting that outside directors provide more effective management monitoring. Weisbach (1995) shows that the management changes are also related to the corporate divestures. Lehn and Zhao (2006) examine the CEO turnover in the companies realizing the mergers and acquisitions activity and find a significant inverse relation between the long-run returns after acquisitions and the probability of CEO replacement.

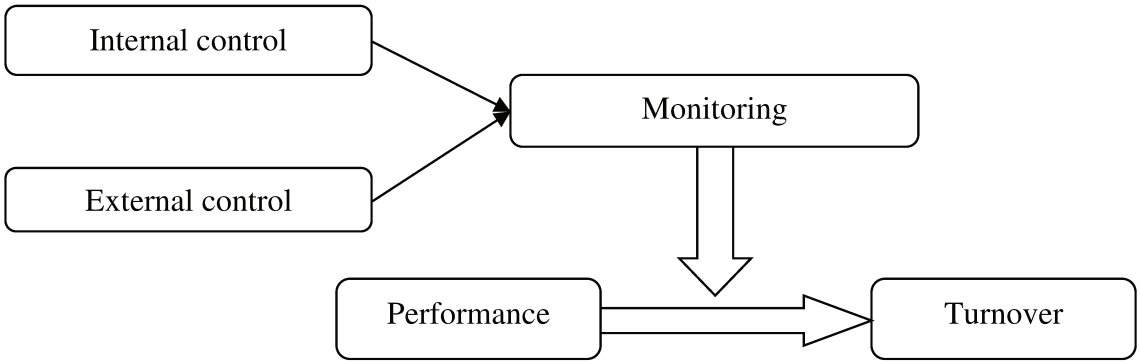
Another strain of empirical research notes the role of corporate takeovers and institutional activism in disciplining top management. Kini et al. (1995) find a significant negative relation between post-takeover CEO turnover and pre-takeover (market-adjusted) performance. The authors provide the evidence that the probability of performance-induced CEO turnover in targeted companies is higher for the targets with inside-dominated boards, but do not confirm this evidence for the companies with outside-dominated boards[35].

[35] Hirshleifer and Thakor (1994) propose also a theoretical model for the interaction between the takeover market and the board of directors underlying the importance of board composition (notably, the role of outside directors) for an effective control device.

Overall, these findings confirm the Jensen (1986)'s arguments that the takeovers can be considered as a powerful mechanism in disciplining ineffective management. The CEO turnover after a takeover can be, thus, viewed as demonstration that the acquirer supposes that the previous board has failed to effectively monitor top management. Hence, if the pre-buyout financial performance seems to be unsatisfactory for the new owner, it is reasonable to expect that an ineffective (from the point of view of new owners) CEO will be fired after taking control of the target company.

Huson et al. (2001) argue that the internal governance mechanisms and external control market serve as substitutes in improving the monitoring of managers and increase the likelihood that CEOs of poorly-performed companies will be replaced. The authors test board's composition and institutional ownership and activism as factors that strengthen the relation between firms' performance and CEO replacement. Figure 1 provides the schematic representation of the ideas developed by Huson et al. (2001).

Figure 1. Theoretical framework of corporate governance.



Notes: This figure represents the schema of the model proposed by Huson et al. (2001). According to the authors, CEO turnover-performance sensitivity is considered as a positive outcome of effective monitoring. The monitoring, by its, turn, is impacted by both internal control realized by corporate boards and by the pressure of the market for corporate control. The monitoring increases CEO turnover-performance sensitivity, i. e. the likelihood that a CEO is replaced in case of low performance.

As it is shown schematically in the **Figure 1**, the CEO turnover-performance sensitivity is impacted by an effective monitoring. The scientific literature mentions, however, the theoretical and methodological challenges in assessing CEO turnover-performance sensitivity. Murphy and Zimmerman (1993) examining the factors surrounding CEO turnovers distinguish between the variables that are assumed to be subject to considerable managerial discretion (such as capital expenditures), and the other figures that are considered by the authors as less discretionary (such as sales, stock-price performance). According to the researchers, these variables reflect, mainly, the economic health of the firm and are hardly to be used to directly assess the CEO quality.

CEO turnover can also be impacted by other factors that are beyond manager's control, such as industry performance. For instance, Kaplan and Minton (2012), Jenter and Kanaan (2015) find a significant negative relation between peer group performance and CEO turnover. These results suggest that the boards do not behave optimally, fail to isolate the industrial effects and tend to blame the CEOs for the underperformance caused by the factors which the managers could not affect. These findings are inconsistent with theoretical predictions that suggest that corporate boards in evaluating CEO's quality should ignore the determinants that affect the company performance but are beyond management's control.

These findings demonstrate empirically the theoretical "scapegoat hypothesis" formulated by Holstrom (1979) and confirmed empirically by Huson et al. (2004). This hypothesis suggests that the CEO quality does not vary across managers, and poor firm performance is explained by a bad luck rather than by low managerial quality. Under this hypothesis CEO turnover arises from a chance, while managers' quality as a function of effort is not directly observable. Since managers dislike effort so they must be threatened with dismissal if performance is low. In equilibrium, all managers supply the same effort (quality) and only those who are unlucky are fired. Boards of directors understand that all managers are alike, but must replace CEOs for low firm's performance to induce other managers to provide the desired level of effort. Consequently, a CEO who is fired for poor performance is considered as a scapegoat.

It is interesting that in the context of private firms the hypotheses confirmed for the public companies are less pronounced. Gao et al. (2013) compare the CEO turnover in public and private firms and find that in private firms with greater ownership concentration and

stronger capacity of monitoring the probability of CEO turnovers as a result of poor performance is less evident that in public firms. These authors suggest that the relatively lower pressure from outside investors in private firms comparing with public companies push the private firms' boards to reveal more other information about the CEO quality instead of quick firing for accounting underperformance.

The mentioned above evidence of CEO turnovers in public firms leads to emerging critics towards public companies' boards for short-termism and failure to distinctly evaluate the CEO quality. Cornelli and Karakas (2015), Jenter and Kanaan (2015), Gao et al. (2013) and other researchers raise the question of whether the boards of public companies might sometimes overreact to poor performance, even when the optimal decision might be to give the CEO a longer horizon to complete his strategic plan.

It coincides with Edmans (2011)'s theoretical model where investors can reduce the value destroyed by an unskilled manager by forcing him to reveal short-term earnings, thus giving themselves the option to terminate him if profits are low. However, the same termination threat may deter a skilled manager from undertaking efficient long-term projects that risk low short-term earnings.

2.2 Impact of PE investors on corporate governance

A growing body of researches studies the performance and governance of the companies undergoing an LBO and the restructuring process caused by the leveraged buyout. A substantial attention is paid to the public-to-private transactions (PTP) where a public company is acquired using the LBO mechanisms.

One of the main differences between the public companies and LBO-backed firms is the concentration of ownership. The ownership of the public companies is dispersed and the boards monitor the hired management of the company on behalf of the owners. Thus, the owners of the public companies can suffer from the lack of sufficient monitoring and impossibility to govern directly the working process of the company. It can lead to the reduction of the shareholder value.

In the LBO-backed companies that are typically acquired by the private equity groups the ownership is concentrated in the hands of few shareholders who are closely involved in running the company. This can create various advantages: better monitoring, better alignment with the shareholders' interests, higher incentives for the managers, reduction of the wasting corporate resources due to the lower managers' discretion, saving of other costs related, for instance, to the stock markets' listing costs.

Finally, the private equity transactions are typically characterized by a substantial increase in debt levels (Kaplan, 1989; Tykvova and Borell, 2012). This can create a positive outcome in the context of corporate governance. The necessity to pay the debt back can be viewed as an effective control mechanism that disciplines the managers of the acquired companies.

In case of a PE-backed going private transaction the outcome of the effectiveness of monitoring can be twofold. From one hand, better monitoring would produce tighter control and, thus, less forgiving for poor firm performance. Unlike the boards of public firms, the private equity firms with concentrated ownership and control in the hands might have a stronger incentive to maximize the value of the acquired firms and to involve tightly in the governance process (Kaplan and Stromberg, 2009). Having a long experience in restructuring firms, the PE firms contribute to corporate governance by redistributing the shares after the buyout among the managers aligning the interests of managers and shareholders. Better monitoring should, thus, result in higher turnover frequency and higher turnover-performance sensitivity.

From the other hand, better monitoring can also permit more accurate assessments of incumbent manager quality and isolating the factors that are beyond CEO control. As a consequence, the turnover-performance sensitivity should decrease.

2.3 Impact of PE specialization on CEO turnover

In our study we are focused on the characteristics of the PE firms and their impact on the likelihood of CEO turnover and on the relation between financial performance and CEO turnover in the firms taken private by the PE investors. In this section we present the hypothesis on the impact of relative specialization of the PE firm on the post-buyout governance of the

acquired company. We argue that the governance of more specialized PE firms may differ from those that do not have a particular industrial specialization.

We, first, present our idea of the direct impact of the PE firm's specialization on the probability of CEO turnover. Jensen (1989) argued that buyouts represent a superior organizational form comparing to the traditional public companies. One of the arguments of Jensen hypothesis is that PE firm performs an important monitoring role obtaining regular reports on performance and replacing underperforming managers. It is also well documented that PE firms differ widely in terms of age, size of funds under management, managerial style, reputation, previous experience, stage and industry focus (Bottazzi et al., 2004; Cressy et al., 2007). Specialization can help PE firms to gain a competitive advantage, since it can give them a greater understanding about an average company's probability of success in a particular industry (i.e. reduced information asymmetries), and more in-depth knowledge of companies in that industry (i.e. reduced uncertainty) (Cressy et al., 2007). In term of governance, more specialized PE firms may, thus, bring more expertise ability that can serve as complement to the CEO quality. Consequently, the CEO role becomes less significant and CEO turnover will be lower in the companies acquired by more specialized PE firms.

Hypothesis 1a. The higher the industrial specialization of the PE firm the lower the probability of CEO turnover in the acquired company.

Alternatively, some studies on the governance impact of venture capital funds show that VCs intervene aggressively in restructuring the companies they finance and replace actively the CEOs. For instance, Hellman and Puri (2002) find that obtaining venture capital is associated with a significantly higher CEO turnover rate. In the context of buyouts, we suppose that more specialized PE firms may have a larger portfolio of managers susceptible to replace the CEOs at the targeted companies. Specialized focus implies also that PE firms observe more easily the CEO's features necessary for a particular industry. We have, thus, an alternative hypothesis:

Hypothesis 1b. The higher the industrial specialization of the PE firms the higher the probability of CEO turnover in the acquired company.

We now present our second idea of an indirect effect of PE industrial specialization. Existing theoretical studies on CEO turnover note that the corporate board learns from firm

performance and other signals about the quality of its CEO (Holmstrom, 1982; Gibbons and Murphy, 1990). If the board's assessment of CEO quality falls below some threshold, often equal to the expected quality of a replacement manager, then the board dismisses the CEO (Jenter and Kanaan, 2015). Obviously, if the performance is lower than an industrial average (or peer group performance) the investor needs to bear some costs in order to gather information on the real cause underlying relatively poor performance. If the cost of monitoring is sufficiently high the investor opts for the short-term discipline. But if the investor's specialization reduces the costs of information gathering the investor will rather choose to assess the CEO quality on a longer period.

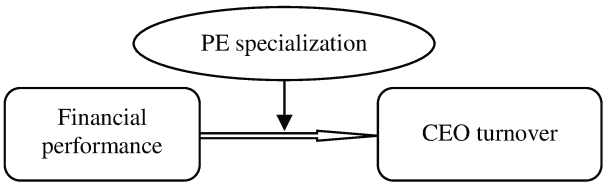
We hypothesize, thus, that the PE specialization can be considered as a variable that reduces the cost that the investor needs to pay in order to reveal the true reason of the lower performance. Obviously, for a non-specialized PE firm the cost of gathering such information is higher, and the board will opt for the short-term discipline. But if the specialization helps the investor to reduce the costs of gathering information then she will choose the reliance on the longer period. Consequently, the dependence of CEO turnover on short-term firm performance in the companies owned by specialized shareholder should decrease.

Another argument is that PE firm's industrial specialization implies better understanding of the specific features of the markets. We suppose that more specialized PE firms have more abilities to isolate the impact of industry shocks while taking decision about the CEO turnover. For example, conveying technical biotech information in biotechnology companies is rather costly and this may force the board to react without going into the details and replace a CEO considering him responsible for the underperformance, whereas for an owner with higher industrial specialization such information costs are fairly low.

Thus, given that CEO's ability assessment by more specialized PE firms is realized over a longer period and given that more specialized PE firms have more abilities to isolate the exogenous factors that are out of CEO control while they assess CEO quality we advance our Hypothesis 2 concerning the indirect effect of PE firm's specialization:

Hypothesis 2: **The higher the industrial specialization of the PE firm that takes the company private the weaker the negative relation between the short-term financial performance of the targeted company and the probability of CEO turnover.**

Figure 2. The indirect effect of the PE firm's specialization



Notes: the figure represents schematically the hypothesis about the impact of PE firm's specialization on the relation between the financial performance and CEO turnover.

3. Data and Empirical Methodology

3.1 Data

To test our hypothesis we construct our sample by first identifying the private-to-public (PTP) transactions realized in Europe over the period from 2002 to 2008 via, principally, LBO mechanisms. The main source of the information about the deals is Capital IQ database, which is considered by some researchers (e. g. Lerner et al. 2009) as one of the most comprehensive source of the information concerning the LBO/MBO activity. The screen gives us 137 going private transactions in 4 European countries (UK, France, Germany and Netherlands)[36]. Ending in 2008 gives enough time range to track the ultimate fate of the transaction and to screen the investment exits.

[36] These 4 countries represent more than 90% of the European LBO (PTP) activity market both in terms of the frequency of the deals and in terms of the amount invested.

This sample includes only the deals where there is at least one PE firm that sponsors the deal and takes the majority stake (≥50%)[37]. From these 137 LBO transactions about 67% are pure LBOs that do not imply any participation of the current managers in financing the deal[38]. Thus, the sample includes both pure LBOs and mixed deals where the company is taken private by management and PE firms and excludes so called pure MBOs that suggest the only involvement of the management of the company having taken the company private.

Private equity firms in our sample have between 41% and 100% of the equity, and, hence, do not need majority of the board votes in order to exercise their control[39]. The average PE firm share in our sample is about 90%.

The majority of the deals (97) are observed in UK, the others are discovered respectively in France (26 transactions), Netherlands (10), and Germany (4) (**Table 1**).

Table 1. Geographical distribution of the sample

Country	Freq.	Percent
France	26	18.98
Germany	4	2.92
Netherlands	10	7.30
UK	97	70.80
Total	137	100

Notes: The table represents the geographical distribution of the PTP transactions in pour sample between 2002 and 2008. A PTP deal is defined a transaction where a publicly traded company is taken private, where there is at least one PE firm that finances this transaction and acquires the majority stake of the acquired company. Data are from Capital IQ cross-checked with Bureau van Dijk's ORBIS database.

[37] In 2 cases the percentage of shares held by the investors backing the PTP deal is less than 50% that is due to the fact that some part of the financial resources was provided by an outsider not concerned by the governance of the target firm (such as former managers).

[38] This means non-participating of the target company's current managers in the deal backing, but do not necessarily reject the distribution of the shares among the management team once the transaction is completed.

[39] For the whole sample we observe only 2 cases where the share held by PE firms are below 50%. In both of them the percentage of the capital provided by the incumbent management team does not exceed 50%.

Table 2 demonstrates the year distribution of 137 PE-backed going private transactions closed between January 2002 and December 2008. A deal is defined as one in which there least at least one private equity firm that finances the transaction and takes the majority stake.

Table 2. Year distribution of the LBO deals

Year	Number	Percent
2002	11	8.03
2003	17	12.41
2004	18	13.14
2005	21	15.33
2006	29	21.17
2007	23	16.79
2008	18	13.14
Total	137	100.00

Notes : The table represents the year distribution of the PTP transactions realized between 2002 and 2008. A PTP deal is defined a transaction where a publicly traded company is taken private, where there is at least one PE firm that finances this transaction and acquires the majority stake of the acquired company. Data are from Capital IQ cross-checked with Bureau van Dijk's ORBIS database.

Table 3 provides information on the size of the acquired companies. As it is shown in the table, about a quarter of the targeted companies are large firms with a size over a billion US dollars. About a third of companies have a size of less than 100 million US dollars. Remaining companies are in the range between the first two. The descriptive statistics summarized in the **Table A3** in Appendix also reports the mean of the targeted companies' size equal to 1215.1 million in US dollars; the median is 341.88 million dollar. The smallest size transaction is 0.42, while the largest size of the company taken private is 21467.4 million US dollars.

Table 3. Number of Deals by Transaction Ranges (in millions of US Dollar)

$mm.	Number	Percent
Greater than 1000	34	24.82
500 - 999.9	16	11.68
100 - 499.9	43	31.39
Less than 100	44	32.12
Total	137	100

Notes : Table provides a description of the size of the acquired companies. The transactions represent the going private deals via, primarily, LBO mechanism where at least one sponsor is a private equity firm that takes the majority stake of the company realized between 2002 and 2008 in 4 European countries (France, Germany, Netherlands and UK).

We then determine which of the 137 target firms experienced CEO turnover after the deal. For each target firm we collect the information about current and previous CEOs and their tenure. These data on CEO turnover were collected for the two years before two years prior to the deal announcement and for each the five following years or till the investment exit. Two firms were dropped because of the lack of the data on CEO turnover. We have finally in our sample 135 firms taken private.

Table 4 demonstrates the statistics on firms experiencing CEO turnovers. The year of buyout and the following year are considered as transition period.

Table 4. Number of companies with CEO change

	CEO change	No CEO change
The year of the transaction	37	98
Within two years after LBO	73	62
Within five years after LBO	82	53
	Total	135

Notes: The table contains statistics on the companies experiencing a CEO turnover within the year of buyout, within 2 years following the buyout and within 5 years following the buyout. These companies were taken private via, primarily, LBO mechanisms between 2002 and 2008 in 4 European countries (France, Germany, Netherlands and UK). We have no observations on CEO turnover for two companies in our initial sample of 137 LBOs.

In our sample 37 firms out of 135 (27.4% of the total public-to-private transactions) experienced CEO turnover during the year of buyout and in 73 (54.07%) the CEO was changed within two years following the buyout deal's closed date. Comparing with other papers we find barely consistent results. For instance, Acharya et al. (2009) find 39% CEO turnover rate within 100 days after an LBO, Gong and Wu (2011) report 51% CEO turnover within two years following the going private deal, Cornelli and Karakas (2015) show that CEO is changed in 52.3% of the acquired firms during the transition period[40]. Since our results are slightly higher than those found by other authors, we refer to Kaplan and Minton (2012) who report an increase in average CEO turnover rate from 2000 to 2007 compared with the studies over earlier periods.

[40] Cornelli and Karakas (2015) define the transition time as the period between the date of LBO announcement and the date where a new corporate board is observed.

In our analysis we check whether the replaced CEO takes then a higher position in the holding or in parent company or is hired by the PE firm that financed the buyout. Such turnover should not be associated with poor prior performance and we do not consider such cases as CEO turnovers. We introduce also CEO age as a variable that should reflect CEO retirement due to age.

Table 5 shows the distribution of the CEO turnover in time where the year t means the year of buyout. As it is reported in the table, the most of the turnovers is observed during the year of buyout. Such result is expected. Indeed, CEO change during transition is due to a change in control. We note, however, the lower turnover rate after the going private. Interestingly, in subsequent tests we find also that all the firms in our sample that experienced a CEO change during the year changed their CEOs at least one more time later.

Table 5. Frequency of CEO change by the year of the deal

Year	Number	Percent
t-2	14	10.00
t-1	17	12.14
t	37	26.43
t+1	23	16.43
t+2	19	13.57
t+3	13	9.29
t+4	12	8.57
t+5	5	3.57
Total	140	100.00

Notes: The table contains statistics on CEO turnover frequencies of the companies that were taken private via, primarily, LBO mechanisms between 2002 and 2008 in 4 European countries (France, Germany, Netherlands and UK). Year t corresponds to the year of buyout, t+1 is the following year, etc.

Table 6 presents the CEO turnover distribution by real calendar year.

Table 6. Frequency of CEO change by calendar year

Year	Number	Percent
2000	0	0.00
2001	2	1.43
2002	13	9.29
2003	11	7.86
2004	11	7.86
2005	19	13.57
2006	22	15.71
2007	16	11.43
2008	12	8.57
2009	15	10.71
2010	11	7.86
2011	6	4.29
2012	1	0.71
2013	1	0.71
Total	140	100.00

Notes: The table contains statistics on CEO turnover frequencies of the companies that were taken private via LBO mechanisms between 2002 and 2008 in 4 European countries (France, Germany, Netherlands and UK).

Then we construct our sample on CEO biographies of the targeted companies for the period covering two years before the transaction and 5 years after the going private decision or before the investment exit for the cases where the backed companies were exited within the 5 years after buyout. We identify also the manager's tenure at the CEO position, whether the CEO is also the chairman of the corporate board and whether the CEO is also the founder of the company (or a member of the founding family). We add also CEO age in our model to control for the cases of retirement. Brickley (2003) notes that the age of the CEO is even more important in explaining CEO turnover than financial performance. It is consistent with Murphy (1999) who reports that the probability of a CEO leaving office during a given year is nearly 30 percent higher when the CEO is over age 64 than when he is younger.

Information on the CEO tenure was obtained from Capital IQ and ORBIS databases as well as from the searching in the press using Factiva.

The problem was that once the company goes private in an LBO, the firm is usually entered into quite complex structure with several layers where with several subsidiaries and holdings (Cornelli and Karakas, 2015). What is more, this structure can change over the years of the LBO, and it was extremely hard to detect the relevant CEO identified separately for every corporate layer[41].

A critical task was to correctly match the name of the PE backed company, as provided by Capital IQ, with the accounting information provided by ORBIS. The target company can be confused with its parent company or a subsidiary. See also the chapter "Methodological issues" in **Appendix** for a description of the other difficulties met during the construction of our sample on the companies undertaken an LBO and gone private.

3.2 Financial measures

To analyze the performance of target firms we use different measures. First, we use both return on assets (RoA) as well as industry-adjusted returns on assets. The absolute value of a measure of financial performance preceding the turnover decision provides an indication of recent accounting performance relative to other industry firms. Then we use both change in RoA and industry-adjusted change in RoA that provide a different perspective. The change in RoA shows the trend in accounting performance.

Return on assets are calculated for the annual periods[42] that best reflect the information available to internal monitors (Huson et al., 2001). If the CEO turnover is realized before the middle of the fiscal year, the measure for the previous year is used.

The financial data are observed within 5 years after the buyout or till the investment exit, i. e. [2002+5; 2008+5]

While creating the financial performance data set, we encountered challenges similar to the ones experienced while creating the CEO turnover's sample. After going private, the firms

[41] Some of the companies change not only their status (PLC to Limited) but also the name. The examples of the re-registration as a private company under its new name: Espotra PLC becomes EG01 Limited; ENERGIS PLC becomes Energis communications Ltd; Symrise was re-founded in 2003 by the merger of Haarmann & Reimer (H&R) and Dragoco, etc.

[42] Quarterly accounting data would provide a more precise measure, but given the difficulties in obtaining the data for the private companies we are happy to have at least annual accounts.

have complex pyramidal structures of ownership that create difficulties in reaching the relevant financial performance figures. Moreover, as firms become private, the performance figures become less reliable. To identify reliable performance data we cross-checked for each company the figures reported from Capital IQ with those provided by ORBIS database.

Another technical difficulty was due to the statistical methodology applied by the databases. In some cases the CIQ's restate the financial reports presenting EBIT after having excluded or included the unusual terms while ORBIS reports the raw data. So, we needed to restate the figures provided by CAPITAL IQ in order to aggregate two databases.

Given that we track at least one observation for every firm in our sample concerning CEO turnover and financial performance measure we argue that the sample is representative of the population. Unfortunately, for some companies we can observe the data for only for one-two years, principally, for the transition period implying two years after the buyout.

3.3 PE firm's specialization

In order to measure the relative specialization if private equity firms that take the company private we calculate the Index of Competitive advantage (ICA) following the methodology of Cressy et al. (2007): $ICA = (C_i / C'_i) / (C'/C'')$

C_i is the number of transactions realized by PE firm in industry I (last 5 years)
C'_i is the total number of companies invested in industry i by all PE firms (last 5 years)
C' is the total number of transactions during last 5 years of the PE firm
C'' is the total number of companies invested by all PE firms during last 5 years (i.e. across all industries).

The numerator (C_i /C'_i) represents PE firm's share of all investments in industry i and the denominator (C' /C'') its share in all investments. ICA therefore measures the PE company's investment focus in industry i relative to that of its PE competitors. Thus a value of ICA greater (less) than one indicates that the PE firm is relatively specialized (unspecialized) in

industry i. The table A1 in Appendix provides the evidence on the industry of the targeted companies.

$$ICA\begin{cases}\geq 1 \Leftrightarrow (C_i / C'_i) \geq (C'/C'') \\ < 1 \Leftrightarrow (C_i / C'_i) < (C'/C'') \\ = 0 \Leftrightarrow C_i = 0\end{cases}$$

The specialization formula is calculated relatively to the transactions of all the PE firms in the sample and treats in the same manner all types of transactions (realized as a buyer), i. e. merger and acquisitions, participation, other placements, etc. In fact, the Mergers/Acquisitions (M&A) and participations represent about 99% of the deals and are equally distributed (about a half of all the transactions tracked represent an M&A transaction, while about a half of the deals are participations).

According to the Capital IQ financial glossary, Merger/Acquisition (M&A) "means that a company acquires another company and folds it into itself completely, so that the acquired company ceases to exist. Under this transaction the buyer purchases existing securities (equity or debt) of the company being acquired.

An acquisition or a takeover is acquiring control of one company (or companies - often referred to as target/s) by another company (often referred to as Buyer) by buying a majority or a minority equity stake in the target in a friendly or a hostile manner.

S&P Capital IQ covers both the scenarios under one transaction type - "Merger & Acquisition (M&A)". Capital IQ defines private placement as "a private sale of newly issued securities (equity or debt) by a company to a selected investor or a selected group of investors. The stakes that buyers take in private placements are often minority stakes (under 50%), although it is possible to take control of a company through a private placement as well".

When there are several firms that back the buyout transaction we choose the most specialized firm at time t (t represents a calendar year). For every target/year observation we calculate the Index of Competitive Advantage for every private equity firms that financed the buyout to determine the firm with a higher index value. Since the degree of specialization (ICA

Index) changes over time, the more specialized firm may, thus, vary during the years following the buyout. We observe several cases, where we needed to change the PE firm and pick another one, whose industrial specialization was higher in a given year.

3.4 Other PE firm's characteristics

We look also on the number of private equity firms involved in going private transaction (without distinguishing between lead and no lead investors). If there are multiple PE firms that are involved in a buyout transaction they might find it difficult to take a common decision concerning a CEO future.

We introduce the experience of the PE firm that is measured as the number of deals recorded in Capital IQ in which the private equity firm was involved before the deal of our sample as a buyer for the last 5 years. This variable captures also the firm's activity during the last five years. More experienced PE investors are likely to be better at monitoring and may be able to reduce pre-buyout agency problem that arise due to the informational asymmetries about potential investees (Meuleman et al., 2009).

3.5 Control variables

Another issue addressed in the essay is CEO tenure. Gong and Wu (2011) find that CEO tenure increases the likelihood of CEO turnover following an LBO. But the authors consider this evidence as a demonstration of the agency cost problem. CEO tenure is, thus, shown as managerial entrenchment. As it explained by Bebchuk et al. (2008) powerful managers may use their discretion, which makes it difficult to replace them in case of poor performance. Lehn and Zhao (2006), thus, find that longer CEO tenure is associated with a lower probability of turnover in public companies. For the post-LBO companies Gong and Wu (2011) found that more entrenched CEOs (longer tenure) are likely to be replaced.

Jenter and Kanaan (2015) mostly confirm that the firm specific performance should affect CEO turnover more strongly in recessions. The quality of a CEO is, thus, easier observable in bad times. At the same time, the authors find no evidence that the effect of peer performance on CEO turnover is smaller for CEOs with longer tenure. This result is considered as surprising, since, obviously, the CEO with long tenure should have already proven their

skills in both good and bad times, and hence a CEO with shorter tenure should be affected more by the exogenous factors.

We argue that PE firm's specialization may help in revealing the real quality of the CEO and estimate the benefit of CEO tenure. We include, thus, incumbent CEO tenure as a control variable in our empirical analysis.

Additionally, we control our model by target firm size, whether or not the CEO also serves as chairman of the board, whether the CEO is a founder of the company (or a member of founding family), whether the PE firm is bank-affiliated fund.

Jensen (1993) notes that when the CEO is also the chairman of the board, internal control mechanism becomes less useful and fails to perform its key function in case of necessity, e. g. firing CEO if the firm's financial performance is not satisfactory. Hence, we control the model by the variable that equals to one if the CEO is also the chairman of the corporate board.

A dummy variable that equals to one if the CEO is a founder of the company (or belongs to the founding family) and to zero otherwise is also included to the model in order to control for the CEO's managerial depth as proposed by Huson et al. (2001) who argue note that the members of the founding family enable to retain their positions longer than other CEOs.

We control for the size of the targeted company, since larger companies are usually more attractive to outside managerial talents and have more qualified potential CEOs within management team. We use the transaction value of the targeted company as proxy to company's size.

3.6 Empirical Model

We consider the following panel data equation:

$$\Pr(\text{Turnover})_{it} = x'_{it}\,\beta + y'd_t + \varepsilon_{it}$$

$$\varepsilon_{it} = \eta_i + \nu_{it}$$

where our dependent variable equals to 1 if there was a CEO turnover of a given company in a given year and all other potential outcomes are coded as 0 (i. e., no CEO turnover

or retirement). x'_{it} is a vector of firm specific characteristics, and d_t is a vector of year dummies with 1 in the t-th position and 0 otherwise. The error term ε_{it} consists of a firm component, η_i, and an idiosyncratic term, ν_{it}. Unobservable time-varying industrial characteristics are captured by year dummies.

We then ask which firm-specific variables are responsible for the probability of CEO turnover using a logit regression. We estimate our model in a panel data sample, since in a pooled cross-sectional sample there is a risk of potential problem due to the unobserved heterogeneity. In fact, our dependent variable is likely to be correlated with unobservable (or unobserved) time-invariant, industry-specific omitted variables. Actually, industries can be thought of as being characterized by different propensities to management turnovers, related to the dynamism of the industry that evolve very slowly over time and can be assumed to remain constant over sample period.

Lehn and Zhao (2006) suppose that the monitoring role of the boards differs in terms of information costs. For instance, in some industries the owners need to convey specific technical information in order to estimate the CEO quality and justify the turnover. The turnover-performance sensitivity will be lower in such industries. Consistently, turnover-performance sensitivity is higher in the industries where the owners do not need to bear additional information costs in order to see the unbiased quality of the CEO.

Eisfeldt and Kuhnen (2013) note that performance's measures are more precise in the industries with low dynamism, and, consistently with this argument, finds that the likelihood of forced turnover increases with industry homogeneity. Other examples might include industries that are deregulated or industries in which there are significant technological innovations. When industrial shocks arrive, the quality of firm-CEO matches in that industry deteriorates. In old industries with low dynamism the optimal manager for the old environment does not possess the skills necessary for the new state of the industry. As a result, the probability of replacement increases. Moreover, the shock implies that firms demand managers with different skills and this leads to higher managerial replacement.

Econometricians often control for omitted variables in a panel data setting by assuming they are correlated with other variables already introduced in the model (e. g. Da Rin et al.,

2006). With panel data we can control for stable characteristics (i.e. characteristics that do not change across time) whether they are measured or not. The panel data's models imply two important structures - the fixed effects model and the random effects model. If the possible omitted variables are not correlated with the explanatory variables that are in the model then a random effects model is probably better. It will produce unbiased estimates of the coefficients, use all the data available, and produce the smallest standard errors. Otherwise, if one supposes that the omitted variables are correlated with the independent ones used in the model it is better to use fixed effects model.

We use the Hausman test to evaluate the choice of an appropriate model for our data. In all our models, the null hypothesis implying that the difference in coefficients issued from fixed and random effects models are not systematic was rejected. This means, that the unobserved individual level effects are correlated with the other covariates. This implies that we should use the fixed-effects estimator instead of the random-effects estimator.

One should note that in the fixed effects model the dependent variable must be measured on at least two occasions for each company. The independent variables must change across time for some substantial portion of the individuals. In our sample, many firms did not have CEO turnover during the study period and, thus, the value of the dependent variable - CEO turnover - does not change over time for these firms. For this reason, we present in Appendix a random-effects logit model to test our hypotheses (**see Table A5 in Appendix**).

4. Results

4.1 Descriptive statistics

Table A3 in Appendix reports the descriptive statistics of relevant variables for the full sample of 135 PE-backed companies, which is then split into two subsamples. The first subsample contains the companies whose CEOs are replaced within five years after going private transaction. The second subsample includes the companies whose CEOs are not replaced within five years after going private transaction.

The one-year lagged unadjusted return on assets is 0.139 for companies with CEO turnover, and 14.623 for those without turnover. The difference is significant at 5% level

(t=2.24). The change in unadjusted RoA is 0.226 for companies with CEO turnover, and -0.148 for companies without CEO turnover. The difference is not statistically significant. The one-year lagged industry-adjusted RoA is -7.205 for companies with CEO turnover, and 8.628 for companies without turnover. The difference is significant at 5% level (t=2.42). The industry-adjusted change in RoA is 0.186 for companies where CEO was changed, and -0.164 for companies where no CEO turnover is observed. The difference is not statistically significant.

The mean CEO tenure is significantly (at 0.1% level) shorter for PE-backed companies with CEO turnovers than those without CEO turnovers (3.894 versus 9.408, t=12.53). The mean age of CEOs that are replaced is 50.61, while that of continuing CEOs is 49.059. The difference is significant at 1% level (t=-2.81). Number of sponsors is significantly (at 1% level) different for companies with CEO turnover (1.58), and companies without CEO turnover (1.33). We also find significant differences on value of the targets between the two subgroups. The value of the companies in turnover subgroup is 1751.25; the value of the companies in non-turnover subsample is 451.63. The difference is statistically significant at 0.1% level (t=-6.29). PE firm specialization and PE firm's prior experience do not vary significantly between the two subgroups.

A significant difference exists across the two subsamples in proportions of the binary variable that reflects whether the CEO belongs to the founding family of the target company and the binary variable that equals to one if the CEO is also the chairman of the corporate board of the targeted company.

4.2 Correlation Matrix

Table A4 in Appendix presents the correlation coefficients among our independent variables. The industry-adjusted return on assets is highly correlated with non-adjusted return on assets (correlation coefficient is 0.998). Similarly, the annual growth in RoA and industry-adjusted growth in RoA have a correlation coefficient of 0.986. Due to the high correlations, we place these variables in our models separately.

4.3 The effect of specialization

To examine the effect of PE firm's specialization on the performance-CEO turnover relation we first separate the full sample into two groups: target firms acquired by non-

specialized firms and the targets acquired by specialized PE firms[43]. The firm specialization is calculated following the methodology of Cressy et al. (2007) (see Methodology). The PE firm is defined to be industrially specialized if the Index of Competitive advantages (ICA) is superior to 1.

Table 7. Industry-adjusted returns on assets (ROA) and CEO tenure of the acquired firms

Sample	Number of firms	Industry-adjusted RoA (p-values are in parentheses)	CEO tenure (p-values are in parentheses)
Panel A: full sample (135)			
Targets without CEO turnover	82	1.629%	8.573
		(0.46)	(0.0000)
Targets with CEO turnover	53	-3.304%**	4.2283
		(0.02)	(0.0000)
Difference		4.933%**	4.345****
		(0.049)	(0.0000)
Panel B: backed by non-specialized firms (44)			
Targets without CEO turnover	12	5.813%	10.03
		(0.46)	(0.0000)
Targets with CEO turnover	32	-3.888%	3.666
		(0.12)	(0.0000)
Difference		9.702%	6.363****
		(0.11)	(0.0000)
Panel C: backed by specialized firms (91)			
Targets without CEO turnover	41	10.626%	9.164
		(0.31)	(0.0000)
Targets with CEO turnover	50	-7.881%***	3.995
		(0.001)	(0.0000)
Difference		18.508%**	5.168****
		(0.049)	(0.0000)

Notes : ****, ***, **, * indicate significance at the level 0,1%, 1%, 5%, 10% respectively

The **Table 7** contains the results of T-test of difference on post-buyout returns on assets (RoA) and CEO tenure of the companies taken private by specialized and non-specialized private equity firms. The RoA means are calculated for the period from the year of buyout till 5 following years or till investment exit in cases where the exit took place before the 5 year period. The firm's specialization is calculated following the methodology of Cressy et al. (2007) (see Methodology).

[43] We use the definition of a specialized firm as such who has a competitive advantage in the industry of the targeted company. For simplicity we call a firm with competitive advantages as a specialized one.

We then test whether there is a significant difference between the financial performance and CEO tenure in the firms with vs. without CEO turnover. The test shows that the industry-adjusted returns on assets as well CEO tenure are significantly higher in the firms without CEO turnover.

The procedure of dividing the full sample into two groups (specialized vs. non-specialized firms as acquirers) results in two unequal sub-groups. There are 44 companies taken private by the firms that have no industrial specialization in the industry of acquired companies (non-specialized firms) and 91 backed by the firms with industrial specialization in the field of the targeted company (specialized firms).

For each of these groups, we repeat our previous tests, splitting each of the groups of firms acquired by specialized vs. non-specialized firms into those with and without CEO turnover subsequent to the buyout. The average industry-adjusted RoA and CEO tenure are computed for each subgroup and reported in Panels B and C of **Table 7**.

The results for targeted firms acquired by the firms without competitive advantages in the industries of the target firms are shown in Panel B. The average RoA for firms without CEO turnover is 5.813% (insignificantly different from zero). The average RoA for firms with CEO turnover is -3.888% (insignificantly different from zero). The difference between the two means is 9.702% (insignificantly different from zero).

Panel C indicates the results for target firms acquired by the firms with competitive advantages in the industries of the acquired companies. Average RoA for targets without CEO turnover is not significantly different from zero. Average RoA for targets with CEO turnover is -7.881% and significant at 1% level. The difference between the two means is 18.508% and significant at the level of 5%.

Concerning the CEO characteristics the mean tenure of CEOs is significantly shorter for the firms with CEO turnover than those without CEO turnover. For the full sample, mean CEO tenure is 6.04 years. For the firms without CEO turnover, mean CEO tenure is 8.57 years. Mean CEO tenure is 4.23 years for firms with CEO turnover. The differences in the mean values of this variable are significant at the 0.0001% level.

4.4 Fixed effects estimation

We continue by examining how the firm's performance–turnover relation evolves over time and run panel logit analysis with fixed effects. **Table 8** contains coefficient estimates for the models in which the dependent variable equals to one if there is turnover at time t and zero if there is no turnover. The models include besides the financial performance measures the variables that reflect CEO tenure at the position of CEO, CEO age, a binary variable that reflects whether the CEO is a member of the founding family (Founder), a binary variable that reflects whether the CEO is also a chairman of the corporate board (Duality), the index of competitive advantages of the PE firm that acquired the targeted company (PE specialization) and the experience of the PE firm, measured as number of transactions realized by the firm as a buyer (PE experience).

Columns (1) and (2) present the tests where not-adjusted measures of financial performance were used. As it is shown on the model (1), not adjusted change in RoA has negative and significant impact on the CEO turnover. CEO tenure at the position of CEO has positive and significant impact on the likelihood of CEO replacement. The index of specialization of PE firm has negative and significant impact (at 5% level) on CEO turnover. This confirms our Hypothesis 1a that the PE firm's specialization decreases the probability of CEO turnover.

In the Model (2) we test our hypothesis that higher industrial specialization of the PE firm that takes the company private decreases the negative relation between the measures of financial performance and the probability of CEO turnover. Model (2) does not provide any evidence of this indirect effect of PE firm's specialization on CEO turnover. The interaction terms of PE firm's specialization and the not adjusted measures of financial performance are not significant.

Columns (3) and (4) present the results of the tests that use industry-adjusted measures of financial performance. Similarly to the Models (1) and (2), we find that the CEO turnover is negatively related to industry-adjusted change in RoA. We cannot find support of our hypothesis of an indirect effect of PE firm's specialization on the CEO turnover. The relation between industry-adjusted financial performance and likelihood of CEO turnover is not moderated by the index of specialization of PE firm. We find, however, similarly to the Models

(1) and (2), that PE firm's specialization per se decreases the likelihood of CEO turnover. The coefficients for PE specialization are negative and significant confirming our Hypothesis 1a.

Table 8. Logistic regression results (fixed effects)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
RoA	-0.03036	-0.02954			
	(-1.24)	(-0.92)			
ΔRoA	-0.08418*	-0.03722			
	(-1.94)	(-0.49)			
Roa_i			-0.0255	-0.01928	-0.029
			(-1.04)	(-0.60)	(-1.16)
ΔRoA_i			-0.07022*	-0.01218	-0.0666*
			(-1.75)	(-0.16)	(-1.72)
CEO tenure	0.9732****	0. 9584****	0.95249****	0. 9380****	0. 8769****
	(4.62)	(4.52)	(4.66)	(4.52)	(3.91)
PE specialization	-0.1281**	-0. 13768**	-0.12528**	-0.13453**	-0.3928
	(-2.39)	(-2.10)	(-2.37)	(-2.14)	(-1.01)
PE experience	0.00678	0. 00638	0.00681	0.00627	0.00665
	(1.27)	(1.20)	(1.28)	(1.18)	(1.25)
CEO age	0.06591	0.06385	0.0658	0.0639	0.06122
	(1.41)	(1.37)	(1.41)	(1.38)	(1.33)
Founder	-2.3099	-2.085	-2.283	-1.9632	-2.354
	(-1.16)	(-1.05)	(-1.16)	(-1.00)	(-1.18)
Duality	-1.8946	-1.8486	-1.8701	-1.854	-1.8854
	(-1.60)	(-1.57)	(-1.61)	(-1.58)	(-1.65)
PE_spec*RoA		0.0009			
		(0.18)			
PE_spec*ΔRoA		-0.02568			
		(-0.67)			
PE_spec*RoA_i				0.000016	
				(-0.00)	
PE_spec*ΔRoA_i				-0.03319	
				(-0.80)	
PE_spec*Tenure					0.03319
					(0.70)
N	216	216	216	216	216
LR χ^2	60.66	61.29	59.34	60.24	59.93

Notes: This table provides the results of logit estimation based on the entire sample of 135 LBO-backed going private transactions observed within 5 years after the buyout decision. The dependent variable is the probability that the acquired firm's CEO is replaced. The independent variables include measures of financial performance (returns on assets, industry-adjusted return on assets, annual change in return on assets, industry-adjusted annual change in return on assets), CEO tenure at the position of CEO. PE specialization is the Index of Competitive Advantages of the PE firm that acquired the firm, PE experience of the PE firm is measured as number of transaction realized by the firm as a buyer within last 5 years. The other control variables include the incumbent CEO age, a dummy variable that takes the value of one if the incumbent CEO is a founder of the company or a member of the founding family, a dummy variable that takes the value of one if the incumbent CEO is also chairman of the corporate board. The coefficients are estimates of the marginal effect on the probability of departure of an increase in the independent variable. Z-statistics are presented in the parentheses. Number of observations is the actual number of firm/year observations. **Table A2** in Appendix contains the variables' description. ****, ***, **, * indicate significance at the level 0.1%, 1%, 5%, 10% respectively.

In addition to our analysis, Model (5) also examines the indirect effect of PE specialization. We test, particularly, whether more specialized PE firms are more likely to replace CEOs with longer tenure. As it is shown in the model, the interaction term of PE specialization index and CEO tenure is not significant.

4.5 Discussion

This study was motivated by increasing incidence of leveraged buyouts transactions realized by private equity firms. A growing literature studies the ways in which PE firms contribute to corporate governance of acquired companies. A particular attention is paid to the disciplinary effects of PE firms (Wright et al., 2009). After buyouts, PE firms are actively involved in monitoring managers. They scrutinize the performance of the incumbent management team and replace CEOs if necessary (Gong and Wu, 2011). The prior research on CEO turnover in PE-backed companies was, however, focused, mainly, on the effects of poor firm performance and organizational structure of corporate boards (Cornelli and Karakas, 2015). We address the role that PE firm's industrial specialization may have on decision to replace or retain a CEO of the targeted company. Specifically, we calculate the index of comparative advantages (Cressy et al., 2007) of PE firm and analyze its role in the governance of acquired companies. Our results are first to show that companies acquired by more specialized PE firms experience a lower probability of CEO turnover. In addition, we study an indirect effect of PE firms' specialization on the relation between prior target firm performance and CEO turnover. In other words, how PE firm's specialization may moderate the relation between target's financial performance and CEO replacement.

Thus, our study contributes to the CEO turnover literature by examining the role of an important characteristic of an institutional investor – the PE firm's industrial specialization. The new sponsors that take the company private face the necessity to evaluate a CEO in the context of complicated conditions of the market. An important problem is to determine the degree to which a CEO is responsible for firm's past performance and his ability to lead the company in the future. Our main hypothesis implies that high industrial specialization of PE firms makes the true CEO quality more visible and his evaluation less costly for the new owners. Thus, the PE specialization serves to reduce the evaluative uncertainty surrounding CEO's past performance. As consequence, more specialized investors have more abilities to

isolate the factors that could impact the targeted company's past performance but are beyond the CEO's control.

There exists considerable heterogeneity in how private equity firms are organized. While some firms specialize in making investments within a particular industry, others take a more generalist approach, diversifying their investments across industries (Gompers et al., 2009). Some authors have already examined the role that PE investor's specialization on the post-buyout performance of acquired companies (Cressy et al., 2007). In our essay we find that PE firm's specialization has an impact on the governance of the acquired companies by reducing CEO turnover. Since replacing or retaining a CEO is likely to be critical to successful firm functioning, the PE firm's capacity to limit CEO turnover could be considered as a reason of the financial success of PE-backed companies.

We acknowledge some limitations of our study that, in turn, suggest interesting avenues for future research. First of all, our empirical model suffers from lack of a control sample. What's more we are focused only on the public-to-private transactions where a public company is targeted by an investment firm. It would be interesting to add to our sample private-to-private transactions and analyze the impact of PE firm specialization on the CEO turnover in rather small private companies that initially have fewer agency problems (Jensen, 1989).

Second, our financial performance measures were only presented by accounting statistics (return on assets as well as annual change in return on assets). Alternative performance measure could include Jensen's alpha (Jensen's Performance Index) that determines the abnormal return of a security or portfolio of securities over the theoretical expected return.

Third, we do not distinguish between voluntary or forced turnover. Unfortunately, identification of forced departures is difficult because press releases often do not describe them as such. Thus, for example, a stated retirement may really be a forced departure (Denis and Denis, 1995). We consider, thus, all the turnovers as forced and this is one of the limits of our paper. However, if a press report does indicate that a management change is forced or that it is due to poor performance, we can be confident that the change is indeed forced. We, however, check whether the replaced CEO takes then a higher position in the holding or in parent

company or is hired by the PE fund that financed the buyout. Such turnover should not be associated with poor prior performance and we do not consider such cases as CEO turnovers.

5. Conclusion

The literature on CEO turnover in public firms interprets a high CEO turnover as a demonstration of an effective board. At the same times the boards of public firms are sometimes criticized for an overreaction to bad performance due to factors beyond the CEO's control. A superior corporate governance model should be able to avoid such mistakes. This paper studied the CEO turnover in the companies that were taken private by private equity firms. PE firms sponsor public-to-private transactions through, usually, LBO mechanisms and are considered by some researchers as value generators in the companies they acquire. This paper provided empirical tests of hypotheses about the governance of private equity-backed investments. We test, particularly, the impact of the PE firm's specialization on the probability of CEO turnover in the companies taken private.

Some papers have already examined the impact of PE firm's specialization on the financial performance of the acquired companies. For instance, Cressy et al. (2007) find a positive impact of PE firm's specialization on the profitability of the acquired companies in post-buyout period. We calculated a measure of PE firm specialization following the methodology of Cressy et al. (2007). For our sample of 135 PE-backed companies, we documented a high rate (51.4%) of CEO turnover within two years after going private transaction. We find, however, that PE firm's specialization decreases the probability of turnover. We interpreted this result as evidence that more specialized PE firms provide expertise ability that can be considered as complement to the CEO quality. We find also an inverse relation between financial performance and CEO turnover. We find no moderation of this relation by PE firm specialization.

We suggest that an interesting suggestion for future research is to study a model where CEO turnover will mediate the impact of the PE firm's specialization on the financial performance of the acquired company. In fact, existing studies documenting the impact of the PE firm's specialization on the performance of the PE-backed companies seem to bypass the issue of causality, i. e. whether the financial success of the PE targets is due to the monitoring

improvement and the expertise provided by the investors or due to the fact that PE firms pick the targets with initially higher growth potential.

References

Acharya, V., Kehoe, C., Reyner, M., 2009. 'Private equity vs. PLC boards in the UK: A comparison of practices and effectiveness'. Journal of Applied Corporate Finance, 21(1), 45-56.

Bebchuk, L., Cohen, A., Ferrell, A., 2008. "What matters in corporate governance?". Review of Financial studies, 22(2), 783-827.

Bottazzi L., Da Rin M., and Hellmann T. F., 2004. 'Active financial intermediation: Evidence on the role of organizational specialization and human capital'. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=569602

Brickley J., 2003. 'Empirical research on CEO turnover and firm-performance: a discussion'. Journal of Accounting and Economics 36 (2003) 227–233.

Cornelli F., Karakas O., 2012. 'Corporate governance of LBOs: The role of the boards'. http://ssrn.com/abstract=1875649 or http://dx.doi.org/10.2139/ssrn.1875649

Cornelli, F., Karakaş, O., 2015. 'CEO turnover in LBOs: The role of boards'. Available at SSRN 2269124.

Cressy R., Malipiero A., Munari F., 2007. 'Playing to their strengths. Evidence that specialization in the Private Equity industry confers competitive advantage', Journal of Corporate Finance, Special Issue on "Private equity, Legeraged Buyout and Corporate Governance", 13(4): 647-669.

Coughlan, A. T., Schmidt, R. M., 1985. 'Executive compensation, management turnover, and firm performance: An empirical investigation'. Journal of Accounting and Economics, 7(1-3), 43-66.

Da Rin M., Nicodano G., and Sembenelli A., 2006. 'Public policy and the creation of active venture capital markets'. Journal of Public Economics, 90(8), 1699-1723.

Denis, D. J., Denis, D. K., 1995. 'Performance changes following top management dismissals'. The Journal of finance, 50(4), 1029-1057.

Edmans, A., 2011. 'Short-term termination without deterring long-term investment: A theory of debt and buyouts'. Journal of Financial Economics, 102(1), 81-101.

Eisfeldt, A. L., Kuhnen, C. M., 2013. 'CEO turnover in a competitive assignment framework'. Journal of Financial Economics, 109(2), 351-372.

Fama, E. F., Jensen, M. C., 1983. "Separation of ownership and control". The Journal of Law & Economics, 26(2), 301-325.

Gao H., Harford J., Li K., 2013. 'CEO Turnover-performance sensitivity in private firms'. Working paper.

Gibbons R., and Murphy K. J., 1990. 'Relative performance evaluation for chief executive officers'. Industrial and Labor Relations Review, 43(3), 30-S.

Gompers, P., Kovner, A., Lerner, J., Scharfstein, D., 2005. 'Venture capital investment cycles: The role of experience and specialization'. Journal of Financial Economics, forthcoming.

Gong J., Wu S., 2011. 'CEO turnover in Private Equity Sponsored Leveraged Buyouts'. Corporate Governance: An International Review, 2011, 19(3): 195-209.

Hellmann, T., and Puri, M., 2002. 'Venture capital and the professionalization of start-up firms: Empirical evidence'. The journal of finance, 57(1), 169-197.

Hirshleifer, D., Thakor, A. V., 1994. 'Managerial performance, boards of directors and takeover bidding'. Journal of Corporate Finance, 1(1), 63-90.

Hölmstrom, B., 1979. 'Moral hazard and observability'. The Bell journal of economics, 74-91.

Holmstrom, B., 1982. 'Moral hazard in teams'. The Bell Journal of Economics, 324-340.

Huson, M. R., Malatesta, P. H., Parrino, R., 2004. « Managerial succession and firm performance". Journal of Financial Economics, 74(2), 237-275.

Huson M. R., Parrino R., Starks L. T., 2001. 'Internal Monitoring Mechanisms and CEO Turnover: A Long-Term Perspective'. The Journal of Finance, Vol. LVI, No. 6.

Jensen M., 1986. 'Agency costs of free cash flow, corporate finance and takeovers'. American economic review 76, 323-329.

Jensen M., 1989. 'The eclipse of public corporation'. Harvard business review 67, 61-74.

Jensen M., 1993. 'Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems'. Journal of Finance, (July, 1993), pp. 831-880.

Jenter, D., Kanaan, F., 2015. 'CEO turnover and relative performance evaluation'. The Journal of Finance, 70(5), 2155-2184.

Kaplan S., 1989, 'The Effects of Management Buyouts on Operating Performance and Value', Journal of Financial Economics 24, 217-254.

Kaplan, S. N., Minton, B., 2012. "How has CEO turnover changed?". International review of Finance, 12(1), 57-87.

Kaplan, S. N., Strömberg, P., 2009. 'Leveraged buyouts and private equity'. The Journal of economic perspectives, 23(1), 121-146.

Kasperczyk M., Clemens S., Zheng L., 2005. 'On the Industry Concentration of Actively Managed Equity Mutual Funds'. The Journal of Finance, Vol. LX N 4.

Kini, O., Kracaw, W., Mian, S., 1995. 'Corporate takeovers, firm performance, and board composition'. Journal of Corporate Finance, 1(3), 383-412.

Lehn, K. M., and Zhao, M., 2006. 'CEO turnover after acquisitions: are bad bidders fired?'. The Journal of Finance, 61(4), 1759-1811.

Lerner J., Sorensen M., Stromberg P., 2009. 'What Drives Private Equity Activity and Success Globally'? The Global Economic Impact of Private Equity Report 2009, pp. 65-98.

Meuleman M., Amess K., Wright M., Scholes L., 2009. 'Agency, Strategic Entrepreneurship, and the Performance of Private Equity-Backed Buyouts'. Entrepreneurship Theory and Practice, volume 33, Issue 1, pages 213–239, January 2009.

Murphy, K. J., Zimmerman, J. L., 1993. "Financial performance surrounding CEO turnover". Journal of Accounting and Economics, 16(1), 273-315.

Murphy K. J., 1999. 'Executive compensation'. Handbook of labor economics, 3, 2485-2563.

Tykvova T., and Borell M., 2012. 'Do private equity owners increase risk of financial distress and bankruptcy?'. Journal of Corporate Finance, 18(1), 138-150.

Weisbach M., 1988. 'Outside directors and CEO turnover'. Journal of Financial Economics 20 (1988) 431-460. North-Holland.

Weisbach, M. S., 1995. 'CEO turnover and the firm's investment decisions'. Journal of Financial Economics, 37(2), 159-188.

Wright, M., Amess, K., Weir, C., & Girma, S., 2009. 'Private equity and corporate governance: Retrospect and prospect'. Corporate Governance: An International Review, 17(3), 353-375.

Appendix

Methodological challenges of the going private context

As it was mentioned in the chapter 3, the methodological issues posed serious difficulties while we were collecting data of the companies that were taken private. We address these issues by case-by-case checking the data reliability and performing verification of the consistency between two databases used for data collection – Capital IQ and a Bureau van Dijk's database Orbis. We check the reported financial data in the annual reports, buyout deals' synopses, and on the targeted companies' websites.

Our experience indicates that this process is crucial to obtain reliable data. One of the main problems was to properly identify the target company and not to confuse the companies with similar names. We developed several algorithms to deal with this problem. The first idea was to look at the business identification number, such as a SIREN number for France or similar analogues for UK and other countries in our sample. We searched the unique registration number in the annual reports of a company before buyout and then compare it with the number after the going private. The problem mentioned above was that sometimes the companies re-register after the buyout. Sometimes the post-buyout history is even harder. Gondola Holdings PLC is a good example – the annual report of this company taken from the Capital IQ gives us the registration number GB0595316. The search in ORBIS using this number shows the company Gondola Group Limited. BUT when we search by the name "Gondola Holdings PLC" (the name given in the synopsis of the buyout deal in CIQ) we go another company called "Gondola Holdings Limited" whose profile in ORBIS mentions the previous name "Gondola Holdings Plc until 13/02/2007" (the date of buyout). This example demonstrates the ambiguity of cross-checking both by registration number and by the name of the company.

Another example of the registration number ambiguity is the case of Anglian Water Services Limited. The number GB02366656 is taken from CIQ annual report and corresponds to a company in ORBIS. But when we search in ORBIS using the name of the company we go to another company, whose financial data sort much better with those presented in CIQ.

The example of the Quick Restaurants S.A. shows another difficulty – in fact, the profile of this company determines the sector of activity as the financial one, while the backed

company is surely a restaurant. The search in ORBIS by the registration number taken from the annual report from CIQ leads to a financial company that wholly possesses the buyout target.

To deal with this ambiguity we developed another algorithm that implies comparing the financial data of the acquired companies before and after the buyout. We compare, particularly, the data on total assets, net income and number of employees of the targeted companies provided by Capital IQ for the period before the buyout. Actually, Capital IQ contains, mainly, the information on publicly traded companies, and once a company is taken private there are much fewer firms whose data are still reported in CIQ after the going private decision. ORBIS database provides information financial data of private companies and was used to collect the data on post-buyout period for the targeted companies.

To properly detect whether the financial data for the post-buyout period belongs to our targeted company we applied following criteria, similar to those used by Gaspar (2012). We look whether the reported targeted company's total assets (whenever available) are within +/– 10% of the data reported in ORBIS, for either the year of the deal or the previous year. If not, we take the total assets of the last year (before the buyout) available in CIQ and compare with the first year (after the buyout) available in ORBIS. Obviously, after a buyout the targeted company may begin (and usually does begin) a restructuring process that may imply divesture transaction. This is the reason why we tolerate larger span for our matching criteria and facilitate the interval till 30%. This algorithm helped us to define the proper acquired firms and to avoid confusing the targets with their subsidiaries or parent company.

In order to combine the financial data of two databases we needed also to standardize the financial measures used in our empirical analysis. In fact, CIQ presents EBIT after having excluded some unusual terms such impairment of goodwill, gain (or loss) on sale of assets, and after having included some unusual terms such interest payable and similar charges. ORBIS does not realize this restatement. Thus, we needed to perform the reverse operation to harmonize the financial records.

Table A1. Industry classification of the acquired companies

Ten industry classification	Weight (%)	Initial screening's classifications	Weight (%)
Consumer Discretionary	32.85	Advertising	0.73
		Apparel, Accessories and Luxury Goods	2.19
		Apparel Retail	1.46
		Auto Parts and Equipment	0.73
		Broadcasting	0.73
		Department Stores	0.73
		Education Services	0.73
		Homebuilding	1.46
		Home Furnishings	0.73
		Home Furnishing Retail	0.73
		Home Improvement Retail	0.73
		Hotels, Resorts and Cruise Lines	3.65
		Household Products	0.73
		Housewares and Specialties	0.73
		Leisure Facilities	5.11
		Movies and Entertainment	2.19
		Publishing	0.73
		Restaurants	5.11
		Retailing	0.73
		Specialized Consumer Services	0.73
		Specialty Stores	2.19
Consumer Staples	3.65	Food Distributors	1.46
		Packaged Foods and Meats	1.46
		Personal Products	0.73
Energy	1.46	Oil and Gas Drilling	0.73
		Oil and Gas Equipment and Services	0.73
Financials	14.60	Asset Management and Custody Banks	3.65
		Investment Banking and Brokerage	1.46
		Multi-Sector Holdings	1.46
		Property and Casualty Insurance	0.73
		Real Estate	6.57
		Specialized Finance	0.73
Healthcare	8.03	Healthcare Distributors	0.73
		Healthcare Equipment	2.92
		Healthcare Services	0.73
		Life Sciences Tools and Services	1.46
		Pharmaceuticals, Biotechnology and Life Sciences	2.19
Industrials	18.98	Aerospace and Defense	0.73
		Air Freight and Logistics	1.46
		Building Products	1.46

		Construction and Engineering	0.73
		Diversified Support Services	2.92
		Electrical Components and Equipment	0.73
		Environmental and Facilities Services	2.19
		Human Resource and Employment Services	1.46
		Industrial Machinery	0.73
		Marine Ports and Services	1.46
		Office Services and Supplies	1.46
		Research and Consulting Services	1.46
		Trading Companies and Distributors	1.46
		Trucking	0.73
Information Technology	10.22	Application Software	4.38
		Data Processing and Outsourced Services	0.73
		Electronic Equipment and Instruments	0.73
		Internet Software and Services	1.46
		IT Consulting and Other Services	1.46
		Technology Distributors	1.46
Materials	5.11	Commodity Chemicals	1.46
		Diversified Metals and Mining	0.73
		Metal and Glass Containers	0.73
		Paper and Forest Products	0.73
		Specialty Chemicals	0.73
		Steel	0.73
Telecommunication Services	1.46	Alternative Carriers	1.46
Utilities	3.65	Electric Utilities	0.73
		Water Utilities	2.92

Notes: This table presents the distribution of our LBO sample across different industries. The statistic table represents the weights of the industries submitted in the sample, The analysis aggregates the initially screened industries into 10 main industry groups as proposed by Kacperczyk et al. (2005) (Kasperczyk M,, Clemens S,, *Zheng L,, 2005, 'On the Industry Concentration of Actively Managed Equity Mutual Funds', The Journal of* Finance, Vol, LX N 4).

Table A2. Variables description (CEO turnover and PE's characteristics)

Name	Variable's description
Dependent variable	
CEO turnover	Equals to one if there was a CEO turnover at t; zero - otherwise
Theoretical independent variables	
RoA	Return on assets. The main profitability measure computed as (EBIT/Total assets)*100 and one year lagged.
RoA_i	Industry-adjusted RoA and one year lagged
ΔRoA	RoA annual growth rate
ΔRoA_i	Industry-adjusted annual growth rate of RoA
PE specialization	Index of industrial specialization of the PE firm (Cressy et al., 2007)
PE spec_b	Binary variable that equals to one if the PE firm is a specialized one; 0 - otherwise
Control variables	
CEO tenure	Number of years the incumbent CEO had worked in the company as CEO
Founder	The CEO is the founder of the company
Duality	The CEO is also chairman of the board
CEO age	Age of the incumbent CEO
Sponsors	Number of PE sponsors backing the firm
PE expericence	PE's experience measured as the total number of transaction within last 5 years
Bank	Equal to 1 of at least one of the PE sponsor is a bank or bank-affiliated investment fund; 0 - otherwise
Value	The total value of the PTP transaction

Notes: The table represents the variables' description.

Table A3. Descriptive statistics: Turnover vs. Non-Turnover companies

	Full Sample					Companies with CEO Turnover					Companies without CEO Turnover					Diff.
	N	Mean	Std. Dev	Min	Max	N	Mean	Std. Dev	Min	Max	N	Mean	Std. Dev	Min	Max	
RoA	510	5.773	70.67	-402.41	1515.4	307	0.139	27.06	-402.41	28.32	197	14.623	108.16	-16.04	1515.46	14.483**
ΔRoA	496	0.083	5.405	-32.58	51.85	301	0.226	5.853	-29.451	51.85	189	-0.148	4.706	-32.585	36.966	-0.374
Roa_i	509	-1.032	71.324	-425.4	1512.15	307	-7.205	28.695	-425.40	21.48	196	8.628	108.658	-24.845	1512.15	15.834**
ΔRoa_i	495	0.0403	5.561	-32.42	51.95	301	0.186	6.043	-29.377	51.94	188	-0.164	4.750	-32.415	37.41	-0.351
Tenure	611	6.168	5.999	0	34	359	3.894	3.869	0	24	252	9.408	6.941	1	34	5.514****
PE_spec	745	2.799	5.245	0	67.48	447	2.845	4.616	0	41.07	286	2.809	6.186	0	67.481	-0.035
Spec_b	742	0.7061	.4558	0	1	446	0.674	0.468	0	1	284	0.764	0.425	0	1	0.0891***
PE exper	745	43.347	69.82	0	542	447	43.78	74.32	0	542	286	44.094	63.476	0	420	0.309
CEO age	591	49.996	6.60	33	70	356	50.61	6.771	33	70	235	49.059	6.238	36	64	-1.555***
Sponsors	745	1.480	0.933	1	6	447	1.58	0.99	1	6	286	1.332	0.828	1	5	-0.256***
Bank	745	0.176	0.3809	0	1	447	0.16	0.37	0	1	286	0.203	0.403	0	1	0.039
Value	745	1224.80	2780.3	0.42	21467.4	447	1751.25	3449.93	2.68	21467.4	286	451.63	678.08	0.42	3286.98	-1299****
Founder	604	0.09	0.299	0	1	351	0.056	0.23	0	1	253	0.15	0.36	0	1	0.101****
Duality	604	0.284	0.452	0	1	351	0.207	0.4	0	1	253	0.39	0.48	0	1	0.183****

Notes: This table shows descriptive statistics of variables for our full sample and subsamples with/without CEO turnover within **5** years after the buyout deal. The variables' description is presented in the **Table A2**. RoA is return on assets computed as (EBIT/Total assets)*100 and one year lagged. RoA_i is industry-adjusted RoA and one year lagged. ΔRoA is RoA annual growth rate. ΔRoA_i is industry-adjusted annual growth rate of RoA. CEO tenure is number of years the incumbent CEO had worked in the company as CEO. PE spec is Index of industrial specialization of the PE firm (Cressy et al., 2007). PE spec_b is binary variable that equals to one if the PE firm is a specialized one; 0 – otherwise. PE exper is PE's experience measured as the total number of transaction within last 5 years. CEO age is the age of the incumbent CEO. Sponsors is number of PE sponsors taking the target company private. Bank is binary variable that equals to 1 of at least one of the PE sponsor is a bank or bank-affiliated investment fund; 0 – otherwise. Value is total value of the PTP transaction. Founder is binary variable that equals to one if CEO is the founder of the company (or a member of the founding family); 0 – otherwise. Duality is binary variable that equals to one is CEO is also chairman of the board; 0 – otherwise.

In the last column, we present the comparisons between the two subsamples (Turnover subsample – non-turnover subsample) and the significance of the differences. For the continuous variables the T-test of means (two-tailed) was used. For the binary variables the test on the equality of proportions was performed. **, ***, **** means significance at 5%, 1% and 0.1% levels respectively.

Table A4. Correlation Matrix of the variables used in the empirical analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	RoA	1.000													
2	ΔRoA	0.237*	1.000												
3	Roa_i	0.998*	0.236*	1.000											
4	ΔRoa_i	0.232*	0.986*	0.232*	1.000										
5	Tenure	0.035	-0.022	0.041	-0.023	1.000									
6	PE_spec	-0.006	-0.054	-0.011	-0.050	-0.053	1.000								
7	Spec_b	0.015	-0.082	0.017	-0.080	0.016	0.286*	1.000							
8	PE experience	-0.002	0.002	-0.005	-0.007	-0.050	-0.144*	-0.185*	1.000						
9	CEO age	0.022	0.032	0.040	0.039	0.137*	0.028	-0.088*	-0.113*	1.000					
10	Sponsors	0.032	-0.005	0.039	-0.010	0.078	0.086*	0.066	0.070	0.093*	1.000				
11	Bank	-0.017	-0.055	-0.011	-0.064	0.053	0.194*	0.033	0.062	0.061	0.246*	1.000			
12	Value	-0.016	-0.019	-0.025	-0.021	-0.174*	0.176*	-0.073*	0.025	0.099*	0.549*	0.093*	1.000		
13	Founder	0.007	-0.080	0.009	-0.079	0.551*	-0.049	0.064	-0.032	0.019	-0.016	0.009	-0.129*	1.000	
14	Duality	0.105*	0.059	0.111*	0.060	0.344*	-0.069	0.182*	-0.056	0.089*	-0.021	-0.093*	-0.167*	0.306*	1.000

Notes: This table presents the correlation coefficients between independent variables. Variable definitions are provided in Table 2. * means significance at 5% level.

Panel logistic estimates of the of the likelihood of CEO turnover

We provide additional support for the results shown in **Table 8** by performing a panel logistic regression analysis of the relation between financial performance and CEO turnover using the model with random effects. The dependent variable is CEO turnover, which takes the value of one if a firm changes its CEO in year t, and zero otherwise. The firms are observed within 5 years after going private decision is taken or until investment exit (reversed IPO, secondary buyout, bankruptcy). The logistic regression specifies the probability of CEO turnover during the post-buyout period as a function of the industry-adjusted returns on assets (RoA) for the target firm, the CEO tenure, CEO age, whether the CEO is also a chairman of the board and whether the CEO belongs to the founding family of the targeted firm or is a founder, PE firm's Index of Competitive advantages and the experience of PE firms, the number of sponsors, whether one of the sponsors is a bank, the size of the targeted firms.

In **Table A5** we run the panel logistic regression with random effects – the most common way to estimate the CEO turnover in scientific literature.

In Columns (1) we test the probability of CEO turnover with not adjusted measures of financial performance. We show that acquired companies' CEO turnover responds significantly to bad performance as captured by significant and negative coefficient of both RoA and annual change in RoA, confirming prior evidence as first shown in Coughlan and Schmidt (1985) and recently by Cornelli and Karakas (2015). Further, PE firm's experience is associated with higher CEO turnover, suggesting that more experienced PE firms intervene more in governance. The significant and positive coefficients of CEO age suggest that in the firms with older CEOs there exist a higher probability of CEO replacement. At the same time, CEO tenure does not increase the likelihood of CEO replacement. In the companies where the CEOs who are founders or chairmen of the corporate boards there is no higher probability of turnover. Finally, targeted firms' sizes are associated with higher CEO turnover. This result might suggest that larger companies are more able to attract talented CEOs.

There is no evidence that in the firms acquired by more specialized PE firm the probability of CEO turnover is higher. No evidence found that the PE firm affiliated with a bank impacts the probability of CEO turnover. Finally, the coefficients of the variable that reflect the number of sponsors that finance the going private decision are not significant.

To determine whether the results from the regressions in columns (1) are held after controlling for possible indirect effect of independent variables we estimate logit regression model in which the PE firm's specialization moderates the relation between financial performance and CEO turnover. Column (2) contains the results of the estimates.

We do not observe significant sensitivity of CEO turnover to firm performance moderated by PE firm's specialization. We cannot confirm our hypothesis that CEO turnovers in the firms acquired by more specialized firms are less sensitive to financial performance: the coefficient estimate of the interaction term of RoA and PE firm's specialization is not significant.

Columns (3) and (4) present the tests where we use industry-adjusted measures of financial performance (both RoA and change in RoA). In the model (3) we find that industry-adjusted RoA

decreases the probability of CEO turnover – the coefficient is negative and significant at 5% level. The coefficients of PE firm's experience and CEO age are both positive and significant at 5% level. The column (3) also shows that bigger the size of the targeted company higher the likelihood of CEO turnover.

Column (4) presents the results of the model that tests the indirect effect of PE firm's specialization on the likelihood of CEO turnover. The interaction terms of the industry-adjusted measures of financial performance and PE firm's specialization are not significant. This result shows no evidence that PE firm's specialization moderates the relation between industry-adjusted financial performance and the

Column (5) presents the additional investigation of the indirect effect of PE specialization. Particularly, we find that more specialized PE firms are more likely to replace the CEOs with longer tenure.

Table A5. Logistic regression results (random effects)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
RoA	-0.018378**	-0.02113			
	(-2.01)	(-1.37)			
ΔRoA	-0.04872*	-0.016188			
	(-1.81)	(-0.39)			
Roa_i			-0.01633**	-0.0175	-0.01760**
			(-2.00)	(-1.19)	(-2.12)
ΔRoA_i			-0.0361	0.0023	-0.03543
			(-1.45)	(0.06)	(-1.44)
CEO tenure	-0.00674	-0.00891	-0.0077	-0.01007	-0.04749
	(-0.22)	(-0.29)	(-0.25)	(-0.33)	(-1.26)
PE specialization	0.00527	-0.00237	0.00512	0.00292	-0.11102
	(0.20)	(-0.08)	(0.19)	(0.10)	(-1.60)
PE experience	0.003138**	0.00312**	0.00305**	0.003041**	0.00282*
	(2.13)	(2.12)	(2.07)	(2.06)	(1.90)
CEO age	0.047191**	0.04639**	0.04711**	0.04635**	0.0464**
	(2.23)	(2.17)	(2.23)	(2.17)	(2.18)
N. of sponsors	-0.15524	-0.15581	-0.13763	-0.13968	-0.1232
	(-0.96)	(-0.95)	(-0.84)	(-0.84)	(-0.77)
Bank sponsor	.2004	0.17053	0.2079	0.18431	0.1538
	(0.57)	(0.47)	(0.59)	(0.51)	(0.43)
Target's size	0.000094**	0.00009**	0.00008*	0.000082*	0.000086*
	(2.06)	(1.97)	(1.90)	(1.77)	(1.88)
Founder	-0.5155	-0.4865	-0.48920	-0.46933	-0.45961
	(-0.86)	(-0.81)	(-0.82)	(-0.79)	(-0.77)
Duality	0.0072	0.01135	0.01395	0.01977	-0.02299
	(0.02)	(0.03)	(0.04)	(0.06)	(-0.07)
PE_spec*RoA		0.00095			
		(0.38)			
PE_spec*ΔRoA		-0.01697			
		(-0.89)			
PE_spec*RoA_i				0.00069	
				(0.29)	
PE_spec*ΔRoA_i				-0.02165	
				(-0.97)	
PE_spec*Tenure					0.01841*
					(1.94)
Intercept	-4.0377****	-3.9612****	-4.1548****	-4.0936****	-3.8577****
	(-3.67)	(-3.56)	(-3.75)	(-3.68)	(-3.45)
N	432	432	432	431	431
Wald χ^2	21.00	20.21	19.90	19.38	23.26
Hausman test sig.	****	****	****	****	****

Notes: This table provides the results of logit estimation based on the entire sample of 135 LBO-backed going private transactions observed within 5 years after the buyout decision. The dependent variable is the probability that the acquired firm's CEO is replaced. The independent variables include measures of financial performance (returns on assets, industry-adjusted return on assets, annual change in return on assets, industry-adjusted annual change in return on assets), CEO tenure at the position of CEO, the Index of Competitive Advantages of the PE firm that acquired the firm that we consider as a measure of industrial specialization, the experience of the PE firm that acquired the firm measured as number of transaction realized by the firm as a buyer within last 5 years, the incumbent CEO age, number of sponsors backing the deal, a dummy variable that takes the value of one if at least one of the sponsors that finance the going private transaction is a bank affiliated fund, the size of the acquired company measured as total value of the going private deal, a dummy variable that takes the value of one if the incumbent CEO is a founder of the company or a member of the founding family, a dummy variable that takes the value of one if the incumbent CEO is also chairman of the corporate board. The coefficients are estimates of the marginal effect on the probability of departure of an increase in the independent variable. Z-statistics are in the parentheses. Number of observations is the actual number of firm/year observations. **Table A2** in Appendix contains the variables' description. ****, ***, **, * indicate significance at the level 0.1%, 1%, 5%, 10% respectively.

III. Formal institutions, R&D expenditures and Venture capital investments

1. Introduction

Recent research has tried to explain the nature of the VC industry and the diversity of VC markets across nations. Because VCs play a key role in the financing of innovative entrepreneurial companies and are potential contributors to economic growth and job creation (EVCA public policy priorities), an important question concerns the factors that can stimulate the development of VC investments.

Since venture capital is an American invention[44] (Hege et al, 2009), most of the literature on the VC industry has focused on the success of the US VC market, highlighting the factors that are associated with the development of Silicon Valley (Gompers and Lerner, 1998; Hege et al, 2009; Armour and Cumming, 2006). More specifically, Armour and Cumming wonder whether the success of Silicon Valley is only explained by the particular specificities of the US entrepreneurial culture and, thus, is hardly to be replicated or whether there exist some financial, economic or legal measures (e.g., pension funds regulation, tax subsidies, increasing funds supply) that have influenced the development of the VC investments in the US. In other words: can the policy makers, in principle, elaborate the instruments to replicate Silicon Valley's success and stimulate VC markets in other regions (for example, in Europe), or is the VC industry a purely American economic phenomenon? Given that the factors underlying the development of the VC market in the US may not be present in other economic systems, a rigorous assessment of the determinants of VC investments is needed (Da Rin et al, 2006).

[44] Moreover, US still represents the world's largest VC market.

The question about the determinants of VC development is important for policy makers: what are the most appropriate instruments to develop a VC market? These instruments may be direct mechanisms focused on increasing governmental support of the VC market or indirect mechanisms that aim to improve the opportunities for investors and/or entrepreneurs to acquire the benefits from a VC market. These indirect mechanisms can include, for example, better investor protection, measures that aim to improve the characteristics of the social and economic environment and/or and the quality of public institutions.

In Europe, discussions related to the determinants of the VC industry coincide with 'mainstream' research literature (Da Rin et al., 2006)[45], documenting the importance of the venture capital market for long-run economic growth (EVCA's Public Policy Priorities) and confirming the necessity of the rigorous assessment of the effectiveness of public policy towards venture capital markets (Botazzi and Da Rin, 2002; Da Rin et al., 2006).

More concretely, the recommendations for public policy towards VC are expressed by the European Private Equity and Venture Capital Association (EVCA)[46] and imply three main mechanisms: (1) fostering an entrepreneurial environment through ameliorating the regulatory framework and through educational programs for entrepreneurs; (2) boosting innovation through creating a favorable environment for research; (3) easing the raising of private equity and venture capital firms through deploying public efforts to facilitate the economic environment, creating pan-European trading platforms, etc. (EVCA – Public Policy Priorities[47]).

Among these different measures, fostering innovations by improving the conditions for innovative activity is considered by the EVCA's experts as a crucial measure for stimulating the VC market. To achieve this goal, it is recommended that governments, among other steps, increase

[45] Da Rin et al (2006), however, note that the European context of the venture capital development contains some specific features. For instance, the European venture capital markets have developed only recently, there exist particular differences in the legal and regulatory environment across European countries, etc.

[46] http://www.evca.eu/about/default.aspx?id=402.

[47] http://www.cnel.gov.pt/document/private_equity_venture_capital.pdf.

the level of total R&D[48] expenditures, one-third of which should be funded directly by the governments[49].

Thus, the increase of R&D expenditures (including the part financed by governments) is considered a measure stimulating the elaboration of innovative environments and is supposed to positively influence the development of VC markets. In the academic literature, the effect of such a 'friendly' innovative environment is usually defined as the arrival of technological opportunities, and the amount of R&D expenses (governmental or private or both) is considered an appropriate measure of the level of these technological opportunities (Gompers and Lerner, 1998; Da Rin et al., 2006). The nature of the linkage between the innovative environment and VC investments is explained by the idea that the arrival of technological opportunities leads to an increase in the number of entrepreneurs with innovative ideas who seek VC financing (Gompers and Lerner, 1998).

At the same time, academics and VC professionals have addressed the question of the influence of the institutional environment on venture capital activity and the private equity industry as a whole (The Global Economic Impact of Private Equity Report 2008; Lerner et al., 2009). A growing body of research (e.g., Bonini and Alkan, 2012) emphasizes the casual link between the development of the private equity industry and the quality of formal institutions (e.g., control of corruption, government's bureaucracy quality, political stability, etc.).

Within the context of public policy for active VC markets, an interesting question concerning the relationship between the technological environment and VC investments is the extent to which VC markets are responsive to an increase in the governmental spending on R&D. Moreover, can this relationship between governmental R&D and venture capital investments be influenced by public institutions, i.e., by the quality of the institutional environment?

[48] Research and experimental development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (Frascati Manual, 2002).

[49] Particularly, the target of 3% of GDP to be invested in R&D is set for the European Union (EU) members (http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm; http://ec.europa.eu/europe2020/pdf/targets_en.pdf).

Building on these issues, we outline several hypotheses concerning the impact of governmental R&D, the institutional environment, and their interaction on VC investments. Controlling for a set of VC determinants that have already been documented in prior research (e.g., market capitalization, IPO frequency, taxation and labor market rigidities), we first test whether the arrival of technological opportunities (proxied by various measures of governmental R&D expenditures) has a positive impact on the level of VC investments across European countries.

We then examine the impact of institutional factors on VC investments. As a measure of institutional development, we use an index that includes several variables that reflect government effectiveness, control of corruption, regulatory quality, rule of law, political stability and voice and accountability.

Finally, we test the hypothesis about the moderation effect of institutions on the relationship between governmental R&D spending and VC investments, i.e., whether a higher development of formal institutions strengthens the relationship between governmental R&D expenditures and VC investments.

The results show that a higher level of governmental R&D expenditures is associated with a higher level of VC investments. These results hold for both early-stage and total VC investments. The quality of institutions positively influences early-stage VC investments. We find, however, that a higher quality of institutions weakens the positive relationship between public R&D expenditures and VC investments. A possible interpretation of this result is that in the presence of highly developed formal institutions, the technological opportunities measured by governmental R&D expenditures have no stimulating effect on venture capital development. In other words, a sufficiently advanced institutional environment makes direct governmental intervention less necessary to stimulate the VC market. Venture capital investments, coupled with a proper institutional environment, represent an effective mechanism to finance technology-oriented projects, while other supplementary financing in the form of public R&D may crowd out venture capital. This interpretation, however, is only suggestive.

Our study contributes to research on the determinants of VC development by taking into account both economic and institutional variables. Moreover, we study the interaction effect of governmental R&D expenses and the quality of formal institutions on VC investments. In so doing, our study complements previous studies that have examined the development of VC markets and their determinants (Armour and Cumming, 2006; Da Rin et al., 2006; Jeng and Wells, 2000; Li and Zahra, 2011).

Our results confirm the idea that formal institutions are important for VC development (especially for early-stage VC investments), and they explain the diversity of VC activity across European countries. The results thus suggest that policy makers should pay attention to formal institutional norms when they try to promote VC activity.

The rest of the essay is organized as follows. Section 2 presents the theoretical background and the hypotheses. Section 3 presents the variable descriptions and the empirical approach used in the essay. Section 4 presents the empirical results. Section 5 concludes.

2. Literature review

2.1 The role of venture capital and traditional VC determinants

New technology-oriented entrepreneurial projects are generally very risky but can provide a substantial yield, since technological novelties have the highest added value (Hellmann and Puri, 2000). Scholars and professionals typically argue that VC is more suitable to finance entrepreneurs with innovative ideas and that the VC industry thus contributes to the development of new technologies and to economic growth (Hellmann and Puri, 2000; Kortum and Lerner, 2000). Hence, given the importance of VC in the financing of innovative ideas, a large body of research has examined the factors that may stimulate the development of an active VC industry.

A first set of research has identified deep and liquid financial markets[50] (Black and Gilson, 1998; Jeng and Wells, 2000) as well as listing and exit opportunities for entrepreneurial companies (Michelacci and Suarez, 2004; Da Rin, 2006) as important conditions for the development of VC investments[51].

Other factors related to entrepreneurial activity have been associated with the development of VC industry, in particular, tax rates (Gompers and Lerner, 1998) and the reduction of barriers to hiring and firing, i.e., labor market rigidities (Jeng and Wells, 2000).

Some authors have also stressed the influence of the legal and institutional environment on the volume of VC investments. For instance, Armour and Cumming (2006) found that the 'investor friendliness' of a country's legal and fiscal environment[52] leads to a higher supply of VC investments. 'Investor friendliness' also positively influences VC fundraising and the exit activity of venture capitalists.

Lerner and Schoar (2005) focused on the features of financing contracts between private equity firms and entrepreneurs in developing countries and emphasized the role of a country's legal origin and legal enforcement on contract design. The authors argue that better legal enforcement and more-complicated forms of contracts (e.g., using convertible preferred stock instead of straight debt[53]) are associated with a country's law tradition[54]. They find that private equity investors benefit from greater contractual protections in countries with a common law tradition and better legal enforcement. Moreover, firms' valuations are significantly higher in

[50] The "depth" of a financial market is usually measured empirically by the market capitalization normalized by GDP (e.g., Jeng and Wells, 2000; Cumming et al., 2006), the ratio of the level of private credit to GDP (e.g., Rajan and Zingales, 1996), or the sum of these two variables (e.g., Aghion et al., 2007). See Levine (2005) for a review of the empirical proxies that can reflect the development of financial markets.

[51] On the other hand, Lerner et al. (2009) note that private equity may thrive in relatively less-liquid financial markets and create value by making illiquid investments.

[52] The authors present the EVCA index, a composite of various legal and fiscal indicators, as a significant determinant of venture capital and private equity investment.

[53] Using straight debt instead of convertible stocks is considered by the authors as an option that is harmful for VC investments (Lerner and Schoar, 2005).

[54] Discussions about the influence of the origin of countries' legal systems, i.e., common or civil law, on the financial development were initially launched by La Porta et al. (1998), who suggested that whether a country's Commercial Code is based on the French, German, Scandinavian or English law tradition determines the particularities (and the development) of that country's financial market.

nations with a common law tradition and superior legal enforcement, and private equity funds investing in common law countries enjoy higher returns.

Cumming et al. (2006) find that legality plays an important role in the exiting activity of venture capitalists in the Asia-Pacific region.[55] The authors studied the impact of the Legality index on VC, arguing that a higher index value leads to a higher propensity of VC-backed firms to be exited through an IPO. Since the IPO is considered the most effective and profitable exit type for investors and entrepreneurs, Cumming et al.'s (2006) findings suggest that higher legality promotes VC market development[56]. Likewise, Li and Zahra (2011) suggest that variation in VC activity across countries depends on the quality of formal institutions[57]. They find that more-developed institutions are likely to reduce transaction problems and encourage VC funding.

Finally, a last strand of research on the determinants of VC development is devoted to "technological opportunities". For instance, it is assumed that the venture capital market will develop the most when the environment is favorable to the emergence of a generation of innovative entrepreneurs (Armour and Cumming, 2006). The impact of these technological opportunities on the development of VC markets in Europe is the main focus of our analysis. Therefore, we will discuss more precisely in the next section the relation between a country's technological environment and the size of its VC market. We will also explain why governmental R&D expenditures can be used as a proxy for the level of technological opportunities.

2.2 R&D as a measure for technological opportunities and its impact on VC

In a broad sense, 'technological opportunities' is an unobservable variable that reflects various favorable conditions for innovation (Da Rin et al., 2006). The definitions of these so-called technological opportunities differ in the research literature, but they usually suggest a favorable environment where agents can develop technological solutions and design innovative projects that

[55] The authors use the Berkowitz index (Berkowitz et al., 2003), which consists of the weighted sum of the efficiency of the judicial system, rule of law, corruption, risk of expropriation, and risk of contract repudiation.

[56] The authors explain the positive effect of legality through the prism of information asymmetry. Better legality alleviates information asymmetry, making it easier for investors to observe the real value of an entrepreneurial firm that is intending to go public.

[57] The authors measure the level of formal institutional development using the World Governance Index constructed by Kaufmann et al. (2011).

are subsequently financed by investors. Armour and Cumming (2006) suggest that such a 'friendly' environment for the elaboration of innovative products is one of the determinants that can explain the comparatively high level of VC market development in the US.

In empirical papers, measuring technological opportunities is a complicated problem, since these opportunities are related to various features of the economy, business culture, legal system, etc.[58]. Some variables, however, are interpreted by researchers as appropriate proxies for measuring technological opportunities. In particular, expenditures in research and development (R&D) are commonly used to measure innovation inputs (Gompers and Lerner, 1998; Da Rin at al., 2006).

Gompers and Lerner (1998), studying VC investment determinants in the US showed, strong empirical evidence that the arrival of technological opportunities measured by R&D spending either by the government or by corporations positively influences the country's level of VC investments[59]. They suggest that higher R&D expenditures can be interpreted as evidence for a demand effect on VC investments, influencing the desire of entrepreneurs to apply for VC investments **(see Figure 1)**. In other words, higher R&D is supposed to reflect a greater number of potential entrepreneurs who have promising ideas and who are looking for investors.

Figure 1. Link between technological opportunities and VC

Note: The figure is a graphical illustration of Gompers and Lerner's (1998) findings. According to the authors, technological opportunities, measured by R&D expenditures, lead to a higher number of entrepreneurs with potentially innovative ideas. The increased number of innovative entrepreneurs will lead to a higher demand for VC investments.

[58] In addition, there exist numerous methodological challenges for studying the impact of the technological environment, especially within the context of a cross-country analysis. For instance, Da Rin et al. (2006) explore difficulties in assessing the impact of technological spill-overs on VC. In particular, they mention the problems of unobserved time-varying factors such national reforms that can be correlated jointly with the VC market and with innovative activity.

[59] The authors suppose the same impact of R&D on VC at the national level as well, but Hellmann (1998), commenting Gompers and Lerner's paper, wonders why the authors did not report the regression at the US national level.

Thus, financing educational and scientific programs and the creation of business incubators and science parks will promote technological spillovers and will consequently influence the demand side of VC by increasing the number of entrepreneurs with innovative ideas. Given that venture capital is more suitable for innovative projects, it is likely that stimulating the arrival of technological opportunities via increasing R&D expenditures will positively influence VC investments. This is consistent with the European Venture Capital Association's (EVCA) recommendations for the European VC market development. The EVCA highlights the necessity to increase public spending on R&D and to stimulate corporations to invest more in research and development. The latter can be achieved by providing tax credits for companies engaged in investment projects.[60]

The first objective of this essay is to test empirically whether a higher level of governmental expenditures on R&D influences their nation's level of VC activity. Our first hypothesis suggests that by increasing their R&D expenditures, governments can foster an innovative environment, increase technological opportunities and, finally, spur demand for VC financing. Thus, a higher level of governmental R&D expenditure is likely to positively influence the level of VC investments.

Hypothesis 1. The higher the level of governmental R&D expenditure, the higher the level of VC investment in a country.

Governmental R&D expenditures are thus expected to reflect the arrival of technological opportunities, and we can measure the extent to which VC investments are responsive to the governmental effort aimed at stimulating an innovative environment.

Although R&D activities take place throughout the economy, we can derive from the OECD Database[61] detailed statistics according to different sectors (government, business, higher

[60] Nevertheless, the expenditures on R&D in Europe remain relatively weak. In 2007, R&D intensity (R&D expenditure as a share of GDP) stood at 1.85 % in the EU 27, which is more than 1 percentage point below the 3 % target set for 2010 by the Lisbon strategy and below that of Japan, 3.40 % (2006 figure), South Korea, 3.00% (2006 figure) and the United States, 2.67 % (Science, Technology and Innovation in Europe 2010). http://ec.europa.eu/internal_market/finances/docs/actionplan/index/green_en.pdf

[61] http://www.oecd-ilibrary.org/science-and-technology/science-and-technology-key-tables-from-oecd_2075843x

education, other non-profit) as well as different sources of funds (governments, business enterprises, university funds, etc.). Since our purpose is to estimate the impact of governmental R&D expenditures, we first need to isolate the R&D funds financed directly by governments.

According to the Frascati manual (2002)[62], the criteria for identifying flows of R&D funds are the following:

- there must be a direct transfer of resources;
- the transfer must be both intended and used for the performance of R&D.

Such transfers may take the form of contracts, grants or donations and may take the form of money or other resources (e.g., staff or equipment lent to the performer).

In the case of the R&D financed by governments, expenditures refer to direct rather than indirect expenditures. We can thus estimate the direct effort of public spending. We then derive the statistics concerning the R&D performed in the governmental sector but financed by all sources of funds. Finally, we are interested in testing the extent to which VC investments are responsive to the governmental spending on R&D performed only in non-governmental sectors. Intuitively, this type of R&D should be more influential for VC investments, since such R&D is focused directly on stimulating the innovative activity of the business sector.

In our empirical model, we use three measures to capture the effect of governmental effort at stimulating technological opportunities and VC investments: (1) the R&D realized only in the governmental sector (but financed by all the funding sources); (2) R&D expenditures financed by the government (in both the governmental and business sectors); and (3) the R&D financed by the government but that concerns only the business sector (**see Table A1 in the Appendix**).

2.3 The relation between formal institutions and VC investments

Another objective of the essay is to explain variations in VC activity across countries by the quality of formal institutions. There exist various theoretical arguments about why institutional variables impact economic growth generally and the private equity industry particularly (Lerner et

[62] The Frascati Manual is a document setting forth the methodology for collecting statistics about research and development. The Manual was prepared and published by the Organization for Economic Co-operation and Development (OECD).

al., 2009). North (1990) notes that the major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessarily efficient) structure for human interaction. Institutions thus influence economic development by shaping formal and informal rules for economic and business actors.

Bruton et al. (2005) summarize the academic views of the role of institutional theory in the management literature and distinguish three aspects through which institutional forces act: normative, regulatory, and cognitive. North (1990) defines regulative rules as forming a rational and confirmative behavior. These rules are primarily delineated by the official legislation and general standards. The normative pillar of institutional theory is described as social obligations dictated by professional and organizational interactions. Bruton et al. (2010) explain that normative systems usually form values and norms. Finally, the cognitive pillar represents the subjective rules of individuals, reflecting their personal beliefs. Bruton et al. (2010) note that these categories can hardly be demarcated but are nevertheless widely recognized as explaining the diversity of entrepreneurial motives and organizational actions around the world.

Another stream of institutional theory develops the idea of moral and cognitive legitimacy, i.e., the socially defined way of performing an entrepreneurial activity. In other words, the mechanisms of entrepreneurial activity must be 'approved' by the social and formal institutions (Aldrich and Fiol, 1994). Entrepreneurial activity is thus impacted by sociopolitical components and can be sanctioned in case of deviating from the accepted norms. In the same manner, formal institutions introduce and monitor the rules for the actors of the private equity industry.

Thus, less-developed public institutions impede the functioning of the other major institutions, e.g., entrepreneurship, competition, and legal enforcement, and can negatively influence venture capital development. On the other hand, well-developed formal institutions create a proper business environment, promoting VC investments (Li and Zahra, 2011). For instance, governments can formulate and implement policies and regulations that foster and promote private sector development through adequately rewarding risk-taking by investors (Li and Zahra, 2011).

Hence, given that formal institutions, as a set of political, regulatory and contractual rules, can provide proper incentives for VC investment promotion, we expect that more-developed institutions positively affect the amount of venture capital investments.

Hypothesis 2. The more developed the formal institutions, the higher the level of venture capital investments.

2.4 The moderating effect of formal institutions on the relation between governmental R&D expenses and VC investments

We suggest also that formal institutions can impact VC development indirectly by moderating the relation between governmental effort on R&D and VC investments. Since governmental expenditures on R&D capture the arrival of technological opportunities, they may stimulate VC investments. However, there exists an alternative point of view concerning the effectiveness of governmental R&D expenditures (The Global Economic Impact of Private Equity Report 2010): the effectiveness of the government's effort in stimulating the arrival of technological opportunities may be reduced in the presence of underdeveloped formal institutions.

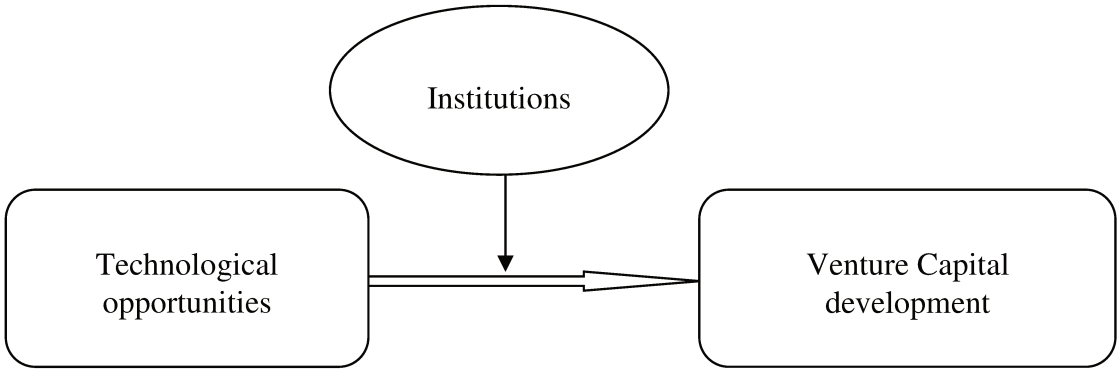
In line with this idea, Jensen (1993) has suggested that many corporate research expenditures are wasteful and yield a low return because of problems with the internal control system. The impact of public R&D expenditures can also be affected by the quality of formal institutions. Skepticism about the effectiveness of publicly designed programs aimed at providing support to VC markets was highlighted by Lerner (2002), who reviewed the government's motivation for these efforts[63]. The author argues that venture capitalists are better than governments at alleviating the problems of information asymmetry. Hence, it is recommended that policy makers improve the general conditions for the development of financial markets (e.g., improve regulatory quality) rather than intervene directly in the financing of innovation. At the same time, well-developed formal institutions can strengthen the relationship between governmental R&D and VC development. Thus, our moderation hypothesis implies that formal institutions positively influence the relation between R&D expenditures and VC investments. This

[63] The paper is focused mainly on the experience of the United States.

accounts for the idea that formal institutions provide a necessary environment for R&D effectiveness.

Hypothesis 3. The more developed the formal institutions, the stronger the positive relationship between governmental R&D expenditures and the level of venture capital development.

Figure 2. The indirect effect of the institutional variables on VC



Note: The figure represents the indirect effect of institutions on the VC market through influencing the relationship between technological opportunities and VC investments. Empirically, the arrival of technological opportunities is measured by governmental R&D spending. Better institutions are expected to increase the positive impact of governmental R&D expenditures on VC investments, i.e., technological opportunities should affect VC development more positively when institutions are highly developed (lack of corruption, effective bureaucracy, etc.)

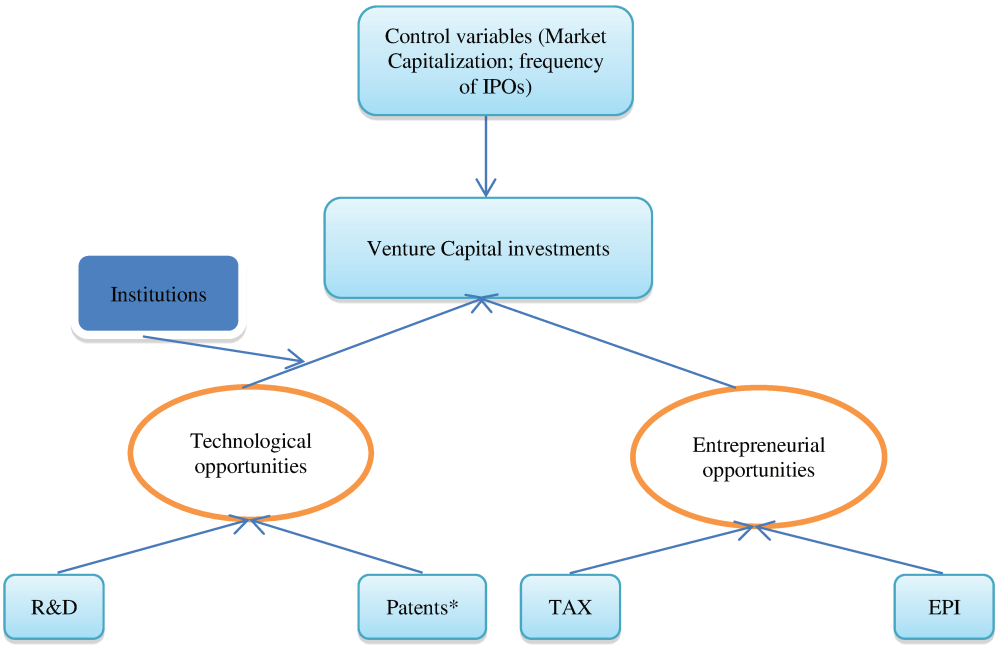
3. Data and Methodology

The sample contains a strongly balanced panel dataset of venture capital investments in 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Switzerland, Sweden, and the UK). The period studied is 1996-2009; the VC activity is thus observed over more than a decade. The data cover a relatively homogeneous set of developed countries, most of which are members of the European Union. The homogeneity of the sample has some methodological advantages, since it permits one to better identify the variables that can

explain the diversity of venture capital investments over the groups of countries with a high level of financial market development and R&D spending propensity (Da Rin et al., 2006).

The empirical model is presented schematically in **Figure 3**.

Figure 3. The interaction among venture capital determinants



Notes: The schema illustrates graphically the general empirical model tested in the essay.
* Since we suppose that R&D expenditures reflect the arrival of technological opportunities, we also need to control for other factors that can be associated with a friendly technological environment, e.g., the number of patent applications (Armour and Cumming, 2006). However, introducing patent applications as a determinant of VC investments requires a strict causality assumption, i.e., patent applications must influence VC investments, but VC investments should not impact the number of patent applications. We tested this assumption by performing the Granger causality method and found mixed evidence that does not reveal the causality direction. The inclusion of patent applications (in addition to R&D expenditures) to better measure the arrival of technological opportunities was thus abandoned.

The schema presented in Figure 3 graphically illustrates our empirical model. The unobservable variable – technological opportunities – is proxied by R&D expenditures. The institutions act by moderating the impact of technological opportunities on VC development. Another unobservable variable – entrepreneurial opportunities – is proxied by Taxation (Corporate

income tax rate) and the Employment protection index (EPI). The model is controlled for IPO frequency and market capitalization.

We use two measures of VC investments – early-stage (seed + start-up) and total VC investments. The DataStream[64] database was used to construct the sample of VC investments.

The variable description is **presented in Table A2 in the Appendix.** The main variables of interest (R&D and institutional factors) require a more detailed discussion.

3.1 R&D statistics

The source of the R&D statistics is the OECD's Main Science and Technology Database. This database provides a set of indicators that reflect the level and structure of the efforts undertaken by OECD member countries and select non-member economies in the field of Science and Technology[65].

Gross domestic expenditures on R&D available in the OECD Database represent different sectors of performance (business, government, higher education, private non-profit, and total intramural), fields of science (natural sciences, engineering, medical sciences, agricultural sciences, social sciences, and humanities), etc. (see **Table A1 in the Appendix**).

We are interested in detailed R&D statistics to study, in particular, the government's effort to stimulate technological opportunities and, thus, VC investments. Our empirical model employs total R&D expenditures that are supposed to be a general proxy for technological opportunities as well as R&D expenditures engaged by official authorities to support research in the governmental sector and in the business sector. In our empirical model, we use three measures to capture the governmental effort in promoting R&D: (1) R&D financed by the government (that is, realized in both the governmental and the business sector), (2) R&D realized in the governmental sector (but

[64] https://forms.thomsonreuters.com/datastream/

[65] http://www.oecd-ilibrary.org/science-and-technology/data/oecd-science-technology-and-r-d-statistics_strd-data-en;jsessionid=vr9wtem970xf.delta

financed by all the funding sources), and (3) R&D realized in the business sector but financed by the government.

3.2 Institutions

To measure the quality of formal institutions, we use the Worldwide Governance Indicators (WGIs) constructed by Kaufmann et al (2011). The WGI is a long-standing research project to develop cross-country indicators of the development of formal institutions. The WGI consists of six composite indicators of broad dimensions of governance covering over 200 countries since 1996: Voice and Accountability (va), Political Stability and Absence of Violence/Terrorism (ps), Government Effectiveness (ge), Regulatory Quality (rq), Rule of Law (rl), and Control of Corruption (cc). These indicators are based on several hundred variables obtained from 31 different data sources. For instance, Kaufmann (2011) use a wide range of sources, including surveys of households and firms, commercial business information providers, non-governmental organizations and public sector organizations[66].

The variables reflecting the institutional factors, however, were highly correlated, which represented a methodological problem. Table 1 represents the correlation matrix of the institutional variables.

Table 1. The correlation matrix of the institutional variables

	va	ps	cc	ge	rq	rl
va	1.0000					
ps	0.6635*	1.0000				
cc	0.8725*	0.6620*	1.0000			
ge	0.8811*	0.6507*	0.9468*	1.0000		
rq	0.8195*	0.6117*	0.8698*	0.8821*	1.0000	
rl	0.8973*	0.6515*	0.9643*	0.9518*	0.8888*	1.0000

Notes: * means significance at the 0.05 level.

To resolve the multicollinearity problem, we construct a composite index reflecting the formal institutions' quality. The index is constructed using a principal component analysis that

[66] http://info.worldbank.org/governance/wgi/resources.htm

includes the variables reflecting Government effectiveness (ge), Regulatory quality (rg), Rule of law (rl), Control of corruption (cc), Political stability and absence of violence (ps), and Voice and accountability (va) (Kauffmann et al., 2010). The institutional variables were also rescaled to vary from 0 to 1. Initially, these variables were presented as a rating whose values are defined from -2.5 to 2.5, which poses the problem of a zero centered variable.

The principal component analysis (PCA) technique is usually used for data reduction. It is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components (**Table 2**).

Table 2. The construction of the composite index 'Institutions' using principal component analysis

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Unexplained
ge	0.4279	-0.1690	-0.0207	-0.3027	0.8338	0.0322	0
cc	0.4280	-0.1434	-0.0463	-0.4771	-0.4465	0.6058	0
rq	0.4082	-0.1990	0.7371	0.4927	-0.0552	0.0682	0
rl	0.4313	-0.1777	-0.0720	-0.2486	-0.3192	-0.7833	0
va	0.4126	-0.0491	-0.6629	0.6121	-0.0203	0.1133	0
ps	0.3329	0.9366	0.0973	-0.0381	0.0087	-0.0296	0

Notes: The table presents the PCA analysis of the institutional variables. The number of observations is 294. The order of the variables is important. For instance, government effectiveness explains 85% of the variance.

Finally, we construct the variable Institutions as **inst = 0.4279*ge + 0.4280*cc + 0.4082*rq + 0.4313*rl + 0.4126*va + 0.3329*ps.**

3.3 Orthogonalization procedure

Another methodological problem met in our empirical estimations is that the variables measuring governmental R&D are also highly correlated, which can create an endogeneity problem.

RD	Total intramural expenditure on R&D performed in the national territory during a given period; t; t-1
RDGOV	Total performed R&D in the governmental sector, including all funding sources

RDGOVF Total domestic R&D performance financed by the government; t; t-1

RDBUSFG Total domestic R&D performed in the business sector but financed by the government; t; t-1

Table 3. The correlation matrix of R&D variables

	rd	rdgov	rdgovf	rdbusfg
rd	1.0000			
rdgov	0.2815*	1.0000		
rdgovf	0.8789*	0.5303*	1.0000	
rdbusfg	0.4552*	0.3552*	0.4959*	1.0000

Notes: * means significance at the 0.05 level.

We perform Stata's **orthog** command to orthogonalize a set of variables, and we create a new set of orthogonal variables using a modified Gram-Schmidt procedure (Golub and Van Loan 1989).

Table 4. The correlation matrix of the orthogonal R&D variables

	rd	rdgov	rdgovf	rdbusfg
rd	1.0000			
rdgov	-0.0000	1.0000		
rdgovf	0.0000	-0.0000	1.0000	
rdbusfg	0.0000	0.0000	0.0000	1.0000

Notes: the table presents the correlation matrix of the orthogonalized variables obtained using the Gram-Schmidt method.

Finally, the R&D expenditures are also correlated with the variable measuring the quality of formal institutions. To deal with this problem, we also orthogonalized these two variables.

3.4 Control variables

Initial public offerings (IPOs)

Generally, venture capitalists hold their investments for a period of around 3-7 years, during which time they provide 'hands-on' governance and business advice (Armour and Cumming, 2006). The main risk faced by investors is the risk of not getting their money back.

Thus, a viable exit mechanism is extremely important to the development of a venture capital industry (Jeng and Wels, 2000).

There are five principal venture capital exit vehicles (Black and Gilson, 1998): (1) initial public offerings (IPOs) - the entrepreneurial firm is listed on a stock exchange for the first time; (2) acquisitions (or 'trade sales') - the company is purchased by a larger firm, typically a strategic acquirer; (3) secondary sales - the venture capital fund sells its interest to another firm or venture capital fund; (4) buybacks - the entrepreneurs repurchase their interest from the venture capital fund; and (5) write-offs (or 'liquidation') - the investors 'walk away' from the investment with little or no return (Cumming et al., 2006). IPO is considered the most profitable option for both venture capitalists and venture-backed companies. The IPO variable must therefore affect both the supply and demand side of venture capital investments.

Financial market capitalization (MCAP)

The successful exit of venture capital investments through an IPO can only occur through a stock market (Black and Gilson, 1998). This evidence indicates a strong link between the size and liquidity of a nation's stock market and the size of its VC investment market (Jeng and Wells, 2000). Moreover, it has been argued that the stock market facilitates the recycling of capital by allowing sufficiently mature companies to go public and investors to redirect their resources towards new start-ups (Michelacci and Suarez, 2004).

Entrepreneurial environment (taxation, labor market rigidities)

According to Bonini and Alkan (2012), three variables can reflect the entrepreneurial activity of a country: the corporate income tax rate (CITR), labor market rigidities (Employment protection index), and the level of total entrepreneurial activity (Total entrepreneurship activity). The literature has documented that tax levels affect entrepreneurship by reducing the attractiveness of expected cash flows; this reduces cash flows to investors, thus reducing both the demand and the supply of VC (Bonini and Alkan, 2012). In their empirical analysis, Gompers and Lerner (1998) showed that the commitments by taxable and tax-exempt investors seem equally sensitive to changes in capital gains tax rates. Armour and Cumming (2006) also showed that a nation's

level of entrepreneurial activity (as represented by self-employment rates) is a significant determinant of the demand for venture capital finance. Unfortunately, we had to drop the variable reflecting the level of self-employment (TEA)[67] because of the lack of data.

Labor market rigidity should negatively impact the demand for venture capital investments, i.e., the higher the labor market rigidity, the less the expected demand for venture capital funds. Strict labor laws make hiring employees difficult for companies because they deprive the company of the flexibility to let people go later on, should this become necessary. In addition, large benefits payments, which typically accompany more-rigid labor markets, make it more expensive to hire in the first place (Jeng and Wells, 2000). We use the OECD indicator of employment protection (Employment protection index). It measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. The index is employed as a proxy of labor market rigidities.

3.5 Regression model

Panel regression analysis has an advantage over cross-sectional empirical models due to the possibility to measure both the time and time-invariant variables. Panel data allow one to control for unobservable variables such as cultural factors or differences in business practices across companies or variables that change over time but not across entities (e.g., national policies, federal regulations, international agreements).

The regression model of the panel data differs from time series model or multiple cross-section regression due to the double subscript index. More precisely:

$$y_{it} = \alpha + X_{it}^{'}\beta + \nu_{it}, i = 1,....., N; t = 1,....., N,$$

where i is the country index, α is a free term, β is a vector of the coefficients of the K×1 dimension, and $X'_{it} = (X_{1,it}; X_{2,it} .....X_{k,it})$ is the matrix vector of *K'*s explanatory variables.

[67] http://www.gemconsortium.org/key-indicators

Like most of the panel regression models, the one above uses a one-component random error model ν_{it} : $\nu_{it} = u_i + \varepsilon_{it}$, where u_i presents unobservable individual effects, and ε_{it} is residual disturbance. Hence, u_i does not depend on the time dimension and is responsible for the countries' characteristics that are not included in the model, while ε_{it} varies across time and countries and can be considered an ordinary random component.

The estimation model is the random effects generalized least squares (GLS) model. The GLS model allows one to test the diversity across countries and to explain the differences between the markets by identifying the factors that have an impact on the panel variable. The GLS model allows the variances to differ across countries and controls for unobservable country characteristics. The GLS model also permits inclusion of the variables in the estimation that do not vary significantly across time, such as the Employment protection index and the Corporate Income Tax Rate. Table 5 presents the summary statistics.

Table 5. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Early-stage investments (EARLY)	278	0.0238	0.0274	0	0.218
Total VC investments (VC)	278	0.0953	0.0829	0	0.613
Frequency of Initial public offerings (IPO)	294	45.05	120.15	0	997
Market capitalization (MCAP)	294	66.98	58.18	0.16	317.03
Total R&D expenditures (R&D)	275	1.6370	0.8987	0.37	4.13
Governmental sector's R&D (RDGOV)	290	0.1998	0.0936	0.02	0.46
R&D financed by government (RDGOVF)	241	0.5530	0.2118	0.15	0.99
Governmental R&D performed in business sector (RDBUSFG)	252	0.0724	0.0444	0.00	0.23
Corporate income tax rate (CITR)	280	30.28	7.67	12.50	56.8
Employment protection index (EPI)	262	2.09	0.77	0.60	3.67
Voice and accountability	294	0.7564	0.0692	0.5479	0.9463
Political stability and absence of violence	294	0.6837	0.0853	0.4073	0.8326
Control of corruption	294	0.7712	0.1704	0.3626	1.0182
Government effectiveness	294	0.7781	0.1339	0.3754	0.9676
Regulatory quality	294	0.7561	0.0885	0.4766	0.9116
Rule of law	294	0.7564	0.1198	0.4476	0.9028
Institutions (INST)	294	1.8376	0.2579	1.1220	2.1974

Notes: The table presents summary statistics of the variables used in the empirical tests. The Institutions variable is the compound variables constructed with principal component analysis from the variables reflecting the institutional environment: voice and accountability, political stability and absence of violence, control of corruption, government effectiveness, regulatory quality, and rule of law. Various measures of the R&D statistics presented in the table are not orthogonalized, while in some tests, the models use the orthogonal values, which are constructed with the Gram-Schmidt procedure (see the orthogonalizing procedure for more information).

4. Results

4.1 The impact on early-stage VC investments

Table 6 presents the results of the empirical tests concerning the determinants of early-stage VC investments. The table summarizes the results of different models that test the impact of total R&D expenditures as well as the direct and indirect effects of institutions on early-stage investments.

Table 6. The determinants of early-stage venture capital investments

	Model 1	Model 2	Model 3	Model 4
Constant	-0.01881	-0.102480***	0.0067	0.0069955
	(0.271)	(0.001)	(0.688)	(0.672)
IPO (lagged 1 year)	0.000025**	0.000017	0.000018	0.000012
	(0.043)	(0.187)	(0.122)	(0.299)
MCAP	0.000129***	0.000085*	0.00013****	0.0001328***
	(0.003)	(0.070)	(0.000)	(0.001)
R&D (lagged 1 year)	0.01317****		012374****	0.0098046****
	(0.000)		(0.000)	(0.000)
EPI	0.000324	0.000330	-0.00022	-0.003371
	(0.907)	(0.928)	(0.921)	(0.181)
CITR	0.000098	0.000529	0.000129	0.0004205
	(0.743)	(0.116)	(0.627)	(0.142)
INST		0.054314****	0.004357**	0.0047751***
		(0.000)	(0.013)	(0.006)
RD*INST				-0.005306***
				(0.009)
Countries	20	20	20	20
Observations	235	250	235	235
Year dummies	yes	yes	yes	yes
Wald chi square	164.30	135.32	213.53	226.06

Notes: The table presents the results for the determinants of early-stage VC investments for 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Switzerland, Sweden, UK) for the period 1996-2009. The dependent variable is early-stage (seed + start up) VC investments, normalized by the GDP. The independent variables are R&D expenditures, the variables reflecting the entrepreneurial opportunities (Employment protection index, EPI, and Corporate income tax rate, CITR) and the variable reflecting the institutional environment (INST), constructed from Worldwide Governance Indicators using principal component analysis (the index includes variables reflecting Government effectiveness, Control of corruption, Regulatory Quality, Rule of Law, Voice and Accountability, Political Stability and Lack of Violence), financial market capitalization (MCAP) and the frequency of IPOs (IPO). The estimation method is generalized least squares with random effects. The p-values are in parentheses. *, **, ***, **** indicate significance at the 10%, 5%, 1%, and 0.1% levels, respectively. The null hypothesis for Wald tests is that all coefficients of the interest variables are zero. Model 3 and Model 4 employ the orthogonalized values of R&D measures and Institutions. The orthogonal values are obtained using Gram-Schmidt procedures.

Model 1 tests the impact of the 'traditional' variables that are considered in the research literature as the most important factors of VC market development - financial market capitalization and the intensity of IPOs. We find a significant positive influence of market capitalization and IPO intensity on early-stage VC investments. The model also shows that total R&D expenditures (including all the sources of funds, whether governmental, private or other) positively impact early-stage VC investments. The coefficient of the R&D variable is highly significant at the 0.1% level. The variables that are supposed to capture the effect of entrepreneurial opportunities - Employment protection index (EPI) and Corporate income tax rate (CITR) - have no impact on early-stage VC investments.

Model 2 tests the influence of institutions on early-stage venture capital investments controlled for market capitalization, IPO frequency, Employment protection index and Corporate Income tax rate. The Model shows a highly significant positive impact of the quality of institutions on early-stage venture capital investments (at the 0.1% level). This result supports Hypothesis 2 – in countries with higher-quality formal institutions, we observe a significantly higher amount of early-stage venture capital investments. Market capitalization still has a positive and significant impact on early-stage VC investments (at the 10% level).

Models 3 and 4 use orthogonal values of total R&D expenditures and institutions. The orthogonalizing procedure was applied to address the high level of collinearity between these two variables. Model 3 shows that both variables have a positive and significant impact on early-stage venture capital investments. The total R&D variable is significant at the 0.1% level, and the variable measuring the quality of institutions is significant at the 5% level.

Finally, Model 4 tests the moderation hypothesis, i.e., whether the quality of institutions impacts the relation between R&D expenditures and early-stage venture capital investments. Surprisingly, the results show that the coefficient of the interaction term of the total R&D expenditures and the quality of institutions has a negative sign; the interaction per se is significant at the 1% level. The interpretation is that a higher level of development of public institutions has a negative impact on the relationship between total R&D spending and the VC investments. Since we use the R&D expenditures as a proxy for the arrival of technological opportunities, this result

signifies that better formal institutions impede the relationship between technological opportunities and the VC markets. This could mean that in the presence of highly developed formal institutions, the R&D expenditures no longer have a stimulating effect on the venture capital development. The venture capital might be more responsive to R&D expenditures in the absence of a well-developed institutional environment, but sufficiently advanced formal institutions make direct governmental intervention less necessary to stimulate the venture capital market. As we mentioned above, we consider R&D expenditures as a proxy for technological opportunities. Naturally, spending on R&D has other purposes besides venture capital development, but the test results could imply that fostering venture capital via R&D expenditures may not have the expected results in the countries where institutions are well-developed.

Table 7 presents the results of the models that test the impact of different types of governmental R&D expenditures on early-stage VC investments. We use several R&D measures: R&D realized only in the government sector (RDGOV), R&D realized in all sectors of performance but financed only by the government (RDGOVF), and R&D performed in the business sector but financed by the government (RDBUSFG). The models also estimate the impact of the formal institutions on VC investments and the interactions between the governmental spending on R&D and the institutional factors.

Model 1 tests the impact of the R&D performed in the government sector, including all the funding sources (government, business, etc.), on the early-stage VC investments. The coefficient of the governmental sector's R&D is not significant. The results also show that market capitalization has a positive and highly significant impact on early-stage VC investments. The coefficient of Corporate income tax rate is also significant at the 10% level and has a positive sign.

Model 2 tests the interaction between the R&D realized in the governmental sector and the R&D realized in the institutional environment. The results show no evidence that better institutions strengthen the relationship between the governmental sector's R&D and early-stage VC investments. The impact of institutions is, however, highly significant at the 0.1% level. The coefficient of market capitalization is positive and significant at the 5% level.

Table 7. The determinants of early-stage venture capital investments (Detailed R&D)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-0.005651	0.0039207	-0.0153153	-0.00055	-0.0069	-0.0911
	(0.756)	(0.817)	(0.399)	(0.975)	(0.707)	(0.000)
IPO (lag)	0.000019	0.0000152	0.0000127	9.75e-06	0.0000112	7.71e-06
	(0.137)	(0.210)	(0.328)	(0.428)	(0.390)	(0.522)
MCAP	0.00018****	0.000088**	0.0002****	0.0001606****	0.0002****	0.000124****
	(0.000)	(0.012)	(0.000)	(0.000)	(0.000)	(0.001)
EPI	-0.001661	-0.0012529	-0.0034625	-0.0022799	-0.0026915	-0.00185
	(0.607)	(0.623)	(0.159)	(0.349)	(0.329)	(0.442)
CITR	0.000548*	0.000458	0.0004398	0.0004925*	0.0004824	0.000480*
	(0.097)	(0.103)	(0.138)	(0.086)	(0.135)	(0.097)
RDGOV (lag)	0.000686	0.0004689				
	(0.976)	(0.801)				
RDGOVF (lag)			0.023084**	0.0075267***		
			(0.011)	(0.000)		
RDBUSFG (lag)					0.0414819	0.00752
					(0.316)	(0.717)
INST		0.0131737****		0.0074999****		0.05158****
		(0.000)		(0.000)		(0.000)
RDGOV*INST		0.0026514				
		(0.233)				
RDGOVF *INST				-0.0017289		
				(0.342)		
RDBUSFG*INST						0.000951
						(0.670)
Countries	20	20	20	20	20	20
Observations	247	247	200	200	213	213
Year dummies	yes	yes	yes	yes	yes	yes
Wald chi square	109.71	165.99	121.82	163.25	120.26	186.64

Notes: The table presents the early-stage venture capital determinants for 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Switzerland, Sweden, UK) for the period 1996-2009. The dependent variable is early-stage venture capital investments (seed + start up), normalized by the GDP; independent variables are various measures of the R&D expenditures, normalized by the GDP, i.e., R&D realized in the government sector (RDGOV), R&D realized in all sectors of performance but financed only by the government (RDGOVF), R&D performed in the business sector but financed by the government (RDBUSFG), the variables reflecting entrepreneurial activity (Corporate income tax rate, CITR, and Employment protection index, EPI), the variable reflecting the institutional environment (INST) constructed from Worldwide Governance Indicators using principal component analysis (the index includes variables reflecting Government effectiveness, Control of corruption, Regulatory Quality, Rule of Law, Voice and accountability, Political stability and lack of violence), and control variables generally supposed to have an impact on the venture capital investments, i.e., the number of IPOs (IPO) and market capitalization (MCAP). The estimation method is the generalized least squares method with random effects (with year dummies). *, **, ***, **** indicate significance at the 10%, 5%, 1%, and 0.1% levels, respectively. P-values are in parentheses. The null hypothesis for the Wald test is that all coefficients of the interest variables are zero. Models 2, 4, and 6 use orthogonal values of the R&D measures and of the institutions.

Model 3 tests the impact of the R&D expenditures realized in all the sectors of performance (governmental, business, private non-profit and higher education) but financed only by the

government. This variable has a positive and significant (at the 5% level) impact on the early-stage VC investments. Thus, the R&D financed by the government but realized in all sectors of performance may stimulate the venture capital market. Market capitalization is highly significant (at the 0.1% level).

When we test whether the relationship between the R&D financed by the government and early-stage VC investments is impacted by the institutions (Model 4), we find no significant impact of the interaction term. The quality of institutions and market capitalization are highly significant (at the 0.1 % level).

Model 5 tests whether the governmental expenditures on R&D directed in the business sector influence the early-stage VC activity and finds no significant influence of this variable. The coefficient of market capitalization is positive and significant at the 0.1% level.

In Model 6, we find no moderation effect of institutions on the relation between R&D financed by the government but realized in the business sector and early-stage VC investments. However, the institutions have a positive and significant influence on early-stage VC investments (at the 0.1% level). The coefficient of market capitalization is positive and significant at the 0.1% level.

Summarizing our results concerning early-stage VC investments, our first hypothesis (H1) about the impact of governmental R&D spending on VC investments is partly confirmed. The R&D financed by the government, whatever the sector of performance, positively impacts the development of VC investments. The higher the governmental spending on R&D, the higher the amount of early-stage VC investments.

Our second hypothesis (H2) is supported. Institutions have a strong positive impact on VC markets. The higher the level of development of formal institutions, the higher the amount of early-stage VC investments.

According to H3, highly developed institutions represent a variable that should strengthen the relationship between R&D intensity and the size of the VC market. Concerning early-stage

investments, we find no evidence that the relationship between governmental R&D and early-stage investments is impacted by formal institutions. However, the relationship between total expenditures on R&D (including all the sectors of performance and all the sources of financing) and early-stage VC investments is negatively impacted by the level of development of the formal institutions.

4.2 The impact on total VC investments

Table 8 presents the results concerning the determinants of total stage venture capital investments (early- and late-stage).

Model 1 tests the impact of financial market capitalization, frequency of IPOs, total R&D expenditures, Employment protection index, and Corporate income tax rate on total venture capital investments. We find a highly significant positive influence of market capitalization and IPO frequency (at the 1% level). Total R&D expenditures (including all sources of funds, whether governmental, private or other) positively impact total VC investments (this variable is significant at the 1% level). The model also shows that Corporate income tax rate has a significant and positive influence on the total level of VC investments. This result is rather unexpected, since tax levels affect entrepreneurship negatively by reducing the attractiveness of expected cash flows.

Model 2 tests the influence of the institutional environment on total VC investments when controlling for market capitalization, IPO frequency, Employment protection index and Corporate Income tax rate. The model shows no significant impact of the quality of institutions on total venture capital investments. The result does not confirm Hypothesis 2. Market capitalization has a positive and highly significant impact on total VC investments (at the 0.1% level). IPO frequency is significant at the 1% level. The model also shows that Employment protection index has an expected negative sign (significant at the 5% level). Like in Model 1, Corporate income tax rate is significant at the 10% level.

Models 3 and 4 use orthogonal values of total R&D expenditures and institutions. The orthogonalizing procedure was applied to address the high level of collinearity between these two

variables. We find no significant impact of these two variables on total VC investments. IPO frequency and market capitalization are significant at the 1% and 0.1% levels, respectively.

Model 4 tests the moderation hypothesis, i.e., whether the quality of institutions impacts the relation between R&D expenditures and total venture capital investments. Similar to Model 4 of Table 4, where we tested the impact on early-stage VC investments, we find that the coefficient of the interaction term of total R&D expenditures and the quality of institutions has a negative sign; the interaction per se is highly significant (at 0.1%). We propose the same explanation as for the results found for early-stage VC investments, i.e., when formal institutions are well-developed, the impact of R&D expenditures no longer stimulates VC investments.

Table 8. The determinants of venture capital investments (Total investments)

	Model 1	Model 2	Model 3	Model 4
Constant	-0.06703*	-0.02717	-0.02667	-0.03746
	(0.066)	(0.390)	(0.441)	(0.252)
IPO	0.000097***	0.000099***	0.0001***	0.000089**
	(0.009)	(0.004)	(0.006)	(0.017)
MCAP	0.000403***	0.000856*****	0.00088*****	0.000559*****
	(0.003)	(0.000)	(0.000)	(0.000)
R&D (lagged 1 year)	0.02661***		-0.00015	0.01283**
	(0.002)		(0.978)	(0.050)
EPI	-0.00847	-0.01567**	-0.01526**	-0.02043**
	(0.369)	(0.033)	(0.034)	(0.010)
CITR	0.00161*	0.00149*	0.00143	0.00223**
	(0.089)	(0.071)	(0.108)	(0.012)
INST		0.01041	0.00947	0.01541***
		(0.184)	(0.218)	(0.006)
RD*INST				-0.0236****
				(0.000)
Countries	20	20	20	20
Observations	235	235	235	235
Year dummies	yes	yes	yes	yes
Wald chi square	115.57	160.27	167.53	187.21

Notes: The table presents the determinants of total VC investments for 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Switzerland, Sweden, UK) for the period 1996-2009. The dependent variable is total VC investments, divided by GDP. The independent variables are total R&D expenditures, the variables reflecting entrepreneurial opportunities (Employment protection index, EPI, and Corporate income tax rate, CITR) and the variable reflecting the institutional environment (INST), constructed from Worldwide Governance Indicators using principal component analysis (the index includes variables reflecting Government effectiveness, Control of corruption, Regulatory Quality, Rule of Law, Voice and accountability, Political stability and lack of violence). The estimation method is generalized least squares with random effects. The p-values are in parentheses. Year dummies are included in all regressions. *, **, ***, **** indicate significance at the 10%, 5%, 1%, and 0.1% levels, respectively. The null hypothesis for Wald tests is that all coefficients of the interest variables are zero.

Table 9 presents the results of the models that test the impact of different types of governmental R&D expenditures on total VC investments.

Table 9. The determinants of venture capital investments (Total investments, Detailed R&D)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-0.0447	-0.03146	-0.04903	-0.2877	-0.02182	-0.1531*
	(0.312)	(0.298)	(0.182)	(0.122)	(0.527)	(0.096)
IPO (lag)	0.000065*	0.000108***	0.000108***	0.00008**	0.00011***	0.00011***
	(0.069)	(0.001)	(0.006)	(0.024)	(0.002)	(0.002)
MCAP	0.00037***	0.00094****	0.00064****	0.00036**	0.00065****	0.0004****
	(0.005)	(0.000)	(0.000)	(0.012)	(0.000)	(0.001)
EPI	-0.00557	-0.01285*	-0.0143*	-0.01065	-0.0112	-0.00956
	(0.640)	(0.057)	(0.082)	(0.265)	(0.131)	(0.196)
CITR	0.00253**	0.00163**	0.00128	0.0018*	0.00110	0.00118
	(0.011)	(0.037)	(0.175)	(0.075)	(0.224)	(0.187)
RDGOV (lag)	-0.05235	-0.0047				
	(0.544)	(0.436)				
RDGOVF (lag)			0.06167**	0.09213		
			(0.046)	(0.792)		
RDBUSFG (lag)					0.16729	-0.7713
					(0.167)	(0.491)
INST		0.00682		0.1329		0.07332
		(0.364)		(0.187)		(0.126)
RDGOV*INST		-0.01411*				
		(0.072)				
RDGOVF *INST				-0.0407		
				(0.820)		
RDBUSFG*INST						0.46859
						(0.429)
Countries	20	20	20	20	20	20
Observations	248	248	200	200	211	211
Year dummies	yes	yes	yes	yes	yes	yes
Wald chi square	99.49	196.45	111.62	100.64	117.97	140.84

Notes: The table presents the results of the empirical tests of the venture capital determinants for 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Switzerland, Sweden, UK) for the period 1996-2009. The dependent variable is total venture capital investments, normalized by the GDP; independent variables are various measures of the R&D expenditures, normalized by the GDP, i.e., R&D realized in the government sector (RDGOV), R&D realized in all sectors of performance but financed only by the government RDGOVF, R&D performed in the business sector but financed by the government (RDBUSFG), variables reflecting entrepreneurial activity (Corporate income tax rate, CITR, and Employment protection index, EPI), a variable reflecting the institutional environment (INST) constructed from Worldwide Governance Indicators using principal component analysis (the index includes variables reflecting Government effectiveness, Control of corruption, Regulatory Quality, Rule of Law, Voice and accountability, Political stability and lack of violence), and control variables generally expected to have an impact on venture capital investments, i.e., the number of the IPOs (IPO) and market capitalization (MCAP). The estimation method is the generalized least squares method with random effects (with year dummies). *, **, ***, **** indicate significance at the 10%, 5%, 1%, and 0.1% levels, respectively. P-values are in parentheses. The null hypothesis for the Wald test is that all coefficients of the interest variables are zero. Models 2, 4, and 6 use orthogonal values of the R&D measures and of the institutions.

Model 1 tests the impact of the R&D performed in the government sector, including all the funding sources (government, business, etc.), on total VC investments. The coefficient of the governmental sector's R&D is not significant. The results also show that market capitalization has a positive and highly significant impact on total VC investments (at the 1% level). The IPO frequency coefficient is positive and significant at the 1% level. The Corporate income tax rate coefficient is also significant, at the 5% level, and has a positive sign.

Model 2 tests the interaction between the R&D realized in the governmental sector and in the institutional environment. The results show that the coefficient of the interaction term of governmental R&D and institutions is negative and significant at the 10% level. The model also shows that the coefficients of IPO frequency and market capitalization are both highly significant at 1% and 0.1%, respectively. The Employment protection index negatively impacts total VC investments (the coefficient is significant at the 10% level). The Corporate income tax rate coefficient is positive and significant at the 5% level.

Model 3 tests the impact of the R&D expenditures realized in all the sectors of performance (governmental, business, private non-profit and higher education) but financed only by the government. This variable has a positive and significant (at the 5% level) impact on total VC investments. This result is consistent with that found for early-stage VC investments and confirms Hypothesis 2. IPO frequency has a positive and significant impact (at the 1% level). Market capitalization is highly significant (at the 0.1% level) and has a positive impact. The Employment protection index coefficient is negative and significant at the 10% level.

Model 4 shows no significant moderation impact of institutions on the relation between R&D expenditures realized in all the sectors of performance financed by the government and total VC investments. Similarly, the coefficients of governmental R&D and institutions are not significant. The coefficients of IPO frequency and market capitalization are both positive and significant at the 5% level. The Corporate income tax rate coefficient is positive and significant at the 10% level.

Model 5 tests whether the governmental expenditures on R&D directed in the business sector influence total VC investments and finds no significant influence of this variable. The model also shows that IPO frequency has a positive and significant (at the 1% level) impact on total BV investments. The coefficient of market capitalization is positive and highly significant at the 0.1% level.

In Model 6, we find no moderation effect of institutions on the relation between R&D financed by the government but realized in the business sector and total VC investments. The coefficients of R&D and institutions are also not significant. The IPO frequency coefficient is positive and significant at the 1% level; the market capitalization coefficient is positive and highly significant at the 0.1% level.

Summarizing our results concerning total VC investments, our first hypothesis (H1) about the impact of governmental R&D spending on VC investments is partly confirmed. The R&D financed by the government and realized in all the sectors of performance positively impacts total VC investments (Model 2). Our second hypothesis (H2) is not supported. Institutions have no impact on total VC investments. Hypothesis 3 is rejected. A higher quality of institutions has a negative impact on the relation between governmental R&D and total VC investments. A possible explanation is that well-developed institutions represent a sufficient condition for venture capital development, and further stimulation might be less effective. In the presence of developed formal institutions, venture capital may play an independent role in financing technology-oriented projects, while other external financing may have a crowding-out effect.

5. Conclusion

The substantial importance of VC markets follows from evidence of the contribution of VC investments to the founding of various successful, innovative companies (Hellmann and Puri, 2000; Bottazzi and Da Rin, 2002). At the same time, the volume of VC markets remains moderate in comparison with the volume of funds invested in the financing of corporations (i.e., in the stock market and in later-stage private equity funds). This evidence is clear when considering European and American statistics (Black and Gilson, 1998; Landstrom, 2008).

The desire of governments to launch or to stimulate venture capital markets is motivated by the evidence of VC's substantial helpfulness in the creation of innovative firms. These aspirations oblige policy makers not only to provide tax and subsidy measures to encourage entrepreneurs to undertake risky innovative projects but also to offer direct governmental financial resources. Aside from creating government-backed venture capital funds, the authorities direct resources to create favorable conditions for technological progress (to stimulate the technological opportunities that are supposed to positively impact the demand for venture capital investments and, thus, increase the volume of VC investments).

This essay assesses how particular mechanisms of governmental support for innovation can impact the volume of VC investments and whether the quality of the institutional environment affects the relationship between governmental R&D and VC investments. Using a panel dataset for 20 European countries for the period 1996 to 2009, the essay empirically tests the extent to which venture capital investments are impacted by governmental R&D expenditures (which we consider as a measure for the arrival of technological opportunities). We focus particularly on the R&D expenditures realized in the governmental sector and the R&D financed by governments. We also tested the influence of formal institutions on the level of VC activity. Furthermore, we analyzed whether the quality of formal institutions is likely to moderate the relationship between R&D expenditures and VC activity.

We find that a higher level of governmental R&D expenditures leads to a higher level of VC investments. This result holds for both early-stage and total VC investments. This result contrasts with Da Rin et al. (2006), who found no evidence that public R&D has an impact on VC investments.

We also found that a higher quality of formal institutions is associated with a higher level of early-stage VC activity. This is consistent with Li and Zahra (2011), who found a significant positive impact of formal institutions on the total number and total amount of VC investments.

The hypothesis about a positive moderation effect of institutional variables on the relationship between governmental R&D expenditures and VC investments is rejected. In fact, the relation between R&D expenditures and VC activity is negatively influenced by a better institutional environment. A possible interpretation of this result is that in the presence of highly developed formal institutions, the technological opportunities measured by R&D expenditures no longer have a stimulating effect on VC development. A sufficiently advanced institutional environment makes it less necessary for the government to invest direct R&D expenses to stimulate the venture capital market. This suggests that a proper institutional environment is by itself an effective mechanism to finance technology-oriented projects, while direct governmental interventions in the form of public R&D may crowd out venture capitalists. This interpretation is, however, only suggestive.

Our findings are in line with the theory that formal institutional rules can produce economic outcomes (North, 1990). The results suggest that policy makers should prioritize institutional norms in order to promote VC activities. It is important to note that our study covers European countries where institutions are well-developed. In this context, we show that some factors that positively affect VC investments (governmental R&D expenditures and quality of institutions) may have a negative effect when they interact. This result might be of particular interest for emerging countries that want to implement public policies that foster the development of VC markets. This suggests that policy makers in these countries should give primary attention to the development of a high-quality institutional framework to promote entrepreneurship and the VC industry.

References

Aghion, P., Fally, T., Scarpetta, S., 2007. 'Credit constraints as a barrier to the entry and post-entry growth of firms'. Economic policy, 22(52), 732-779.

Aldrich H., Fiol M., 1994. 'Fools Rush in? The Institutional Context of Industry Creation'. The Academy of Management Review, Vol. 19, No. 4 (Oct., 1994), pp. 645-670.

Armour, J., Cumming, D., 2006. 'The legislative road to Silicon Valley'. Oxford Economic Papers, 58(4), 596-635.

Berkowitz, D., Pistor, K., Richard, J. F., 2003. 'Economic development, legality, and the transplant effect'. European economic review, 47(1), 165-195.

Black B. S., Gilson R. J., 1998. 'Venture Capital and the Structure of Capital Markets: Banks versus Stock Markets', Journal of Financial Economics Vol. 47, iss. 3, p243-77.

Bonini, S., Alkan, S., 2012. 'The political and legal determinants of venture capital investments around the world'. Small Business Economics, 39(4), 997-1016.

Bottazzi, L., Da Rin, M., 2002. 'Venture Capital in Europe and the financing of innovative companies'. Economic Policy 17, 229-265.

Bruton, G. D., Ahlstrom, D., Li, H. L., 2010. 'Institutional theory and entrepreneurship: where are we now and where do we need to move in the future?'. Entrepreneurship theory and practice, 34(3), 421-440.

Bruton, G. D., Fried, V. H., Manigart, S., 2005. 'Institutional influences on the worldwide expansion of venture capital'. Entrepreneurship Theory and Practice, 29(6), 737-760.

Cumming, D., Fleming, G., Schwienbacher, A., 2006. 'Legality and venture capital exits'. Journal of Corporate Finance, 12(2), 214-245.

Da Rin M., Nicodano G., Sembenelli A., 2006. 'Public policy and the creation of active venture capital markets'. Journal of Public Economics 90 (2006), 1699-1723.

EVCA Public Policy Priorities. http://www.gvpartners.com/web/pdf/EVCA_Policy_Paper.pdf

Frascati Manual, 2002. Proposed Standard Practice for Surveys on Research and Experimental Development. http://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2002_9789264199040-en

Gompers P., Lerner J., 1998. 'What drives venture capital fundraising?'. Harvard University and National Bureau of Economic Research.

Golub, G. H., Van Loan, C. F., 1989. 'Matrix computations'. Johns Hopkins series in the mathematical sciences. Johns Hopkins University Press, Baltimore, MD.

Hege, U., Palomino, F., Schwienbacher, A., 2009. 'Venture capital performance: the disparity between Europe and the United States'. Finance, 30(1), 7-50.

Hellmann T., 1998. 'Comment on What drives venture capital fundraising?'. Brookings Papers on Economic Activity: Microeconomics, 197-203.

Hellmann T., Puri M., 2000. 'The Interaction between product market and financing strategy: the role of venture capital market'. The Review of Financial Studies, vol. 13, No. 4, pp. 959-984.

Kaufmann, D., Kraay, A., Mastruzzi, M., 2011. 'The worldwide governance indicators: methodology and analytical issues'. Hague Journal on the Rule of Law, 3(2), 220-246.

Kortum S., Lerner J., 2000. 'Assessing the Contribution of Venture Capital to Innovation'. The RAND Journal of Economics, Vol. 31, No. 4 (Winter, 2000), pp. 674-692.

Porta, R. L., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. W., 1998. 'Law and finance'. Journal of political economy, 106(6), 1113-1155.

Landstrom H., 2008. 'Handbook of Research on Venture Capital'. Edward Elgar Publishing Limited.

Lerner J., 2002. 'When bureaucrats meet entrepreneurs: The design of effective 'Public Venture Capital' programmes'. The Economic Journal, 112 (February), F73-F84.

Lerner, J., Schoar, A., 2005. 'Does legal enforcement affect financial transactions? The contractual channel in private equity'. The Quarterly Journal of Economics, 120(1), 223-246.

Lerner J., Sorensen M., Stromberg P., 2009. 'What Drives Private Equity Activity and Success Globally'? The Global Economic Impact of Private Equity Report 2009, pp. 65-98.

Levine R., 2005. 'Finance and Growth: Theory and Evidence', in Handbook of Economic Growth, eds. P. Aghion and S. Durlauf (Netherlands: Elsevier Science).

Li Y., Zahra S., A., 2011. 'Formal institutions, culture, and venture capital activity: A cross-country analysis'. Journal of Business Venturing (2011), doi:10.1016/j.jbusvent.2010.06.003

Michelacci, C., Suarez, J., 2004. 'Business creation and the stock market'. The Review of Economic Studies, 71(2), 459-481.

North, D. C., 1990. 'Institutions, institutional change and economic performance'. Cambridge university press.

Rajan, R. G., Zingales, L., 1996. 'Financial dependence and growth' (No. w5758). National bureau of economic research.

The global economic impact of private equity report 2008. Gurung, A., Lerner, J. In World Economic Forum.

The global economic impact of private equity report 2010. https://www.weforum.org/reports/global-economic-impact-private-equity-report-2010-globalization-alternative-investments-working-papers-vol-3

Appendix

Table A1. Gross domestic expenditure on R&D

Funding sector	Sector of performance				Total
	Business enterprise	Government	Private non-profit	Higher education	
Business enterprise					Total domestic performance financed by the business enterprise sector
Government					Total domestic performance financed by the government sector
Public general university funds (GUF)					Total domestic performance financed by public general university funds (GUF)
Higher education					Total domestic performance financed by the higher education sector
Private non-profit (PNP)					Total domestic performance financed by the private non-profit sector
Abroad • Foreign enterprises – Within the same group – Other • Foreign government • European Union • International organisations • Other					Total domestic performance financed by abroad
Total	Total performed in the business enterprise sector	Total performed in the government sector	Total performed in the private non-profit sector	Total performed in the higher education sector	GERD

Source: OECD.

Notes: The Table presents the schema of the R&D expenditures. The columns contain the sector of performance of the R&D projects; the lines define the sources of the funds used to perform an R&D activity. The empirical tests of the essay employ three particular R&D variables: total R&D expenditures performed in the government sector; R&D expenditures financed by the government but realized in all the sectors of performance; and R&D expenditures performed in the business sector but financed only by the government.

Table A2 Variable descriptions

Variable	Label	Description	Sources (availability)
Dependent variables			
Early-stage investments	**EARLY**	Venture capital early-stage investments (seed + start up) divided by average GDP	DATASTREAM, 1991- 2009
Total VC investments	**VC**	Total amount of VC investments divided by GDP	DATASTREAM, 1991- 2009
Independent variables			
Initial public offerings	**IPO**	Frequency of IPOs; t; (t-1); (t+1)	**see IPO full VC - ipo**
Market capitalization	**MCAP**	Market capitalization of listed companies as percentage of GDP	World bank, 1990-2011; Eurostat, 1991-2010
Technological opportunities			
Total R&D expenditures	**RD**	Total intramural expenditure on R&D performed in the national territory during a given period; t; t-1	OECD; Eurostat
Governmental sector's R&D	**RDGOV**	Total R&D performed in the government sector, including all funding sources	OECD; Eurostat
R&D financed by government	**RDGOVF**	Total domestic R&D performance financed by the government; t; t-1	OECD; Eurostat
Governmental R&D performed in business sector	**RDBUSFG**	Total domestic R&D performed in the business sector but financed only by the government; t; t-1	OECD; Eurostat
Entrepreneurial opportunities			
Capital income tax rate	**CITR**	Corporate income tax rate; t	OECD Tax Database; 1990-2010
Employment protection index	**EPI**	Index reflecting the strictness of employment protection; t; t-1	OECD; 1991-2009

Institutional environment			
Voice and accountability	**VA**	The extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association and a free media. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Political stability and absence of violence	**PS**	The likelihood that the government will be destabilized by unconstitutional or violent means, including terrorism. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Control of corruption	**CC**	The extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Government effectiveness	**GE**	The quality of public service, the capacity of the civil service and its independence from political pressure, and the quality of policy formulation. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Regulatory quality	**RQ**	The ability of the government to provide sound policies and regulations that enable and promote private sector development. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Rule of law	**RL**	The extent to which agents have confidence in and abide by the rules of society, including the quality of contract enforcement and property rights, the police and the courts, and the likelihood of crime and violence. Larger values indicate better institutions	Worldwide Governance Indicators 2011; 1996, 1998, 2000, 2002-2010
Institutions	**INST**	Index reflecting the institutional environment; the index is the pooled variables constructed using principal component analysis from Government effectiveness, Regulatory quality, Rule of law, Control of corruption, Political stability and absence of violence, and Voice and accountability	

Notes: The table presents the descriptions of the variables used in the empirical tests in this essay. The columns include the names of the variables, the labels, the descriptions and the data sources.

General Conclusion

The main contribution of this dissertation is to provide some original ideas about the consequences of private equity firms on the corporate governance of their portfolio companies (Chapters 1 and 2) and on the determinants of venture capital investments (Chapter 3).

The empirical study presented in Chapter 1 compares the CEO turnover-performance sensitivity in PE-backed companies' firms with that in similar public firms (i.e., that ex ante had the same probability of being taken private). Our results indicate that PE-backed companies are more likely to dismiss their CEO than public companies in the case of poor financial performance. Moreover, PE-backed companies are more likely to base their CEO turnover decision on industry-adjusted performance than public companies. Our findings contrast with Cornelli and Karakas (2015) who found a lower CEO turnover rate and CEO turnover-performance sensitivity in the companies taken private by private equity firms than in public companies. They interpret their results as supportive of the inside information theory of boards. This theory suggests that 'soft' (inside) information about a firm's operations and the CEO's competence plays a much larger role in the board's decision to fire the CEO than does 'hard' information in the form of the firm's performance relative to its peers. According to Cornelli and Karakas, the higher monitoring exerted by PE sponsors would allow them to rely more on inside information for their decision to dismiss the CEO and would lower the sensitivity of CEO turnovers to performance. In contrast, our findings of a higher CEO turnover rate and CEO turnover-performance sensitivity in PE-backed companies are rather supportive of a 'control hypothesis'. This hypothesis implies that concentrated illiquid ownership structure provides stronger shareholder monitoring, and given the greater ownership concentration and generally less severe agency problems in PE-backed firms, PE-backed firms provides a tighter control for poor performance.

We also investigated the reasons for the difference in turnover-performance sensitivity. We found that PE-backed firms tend to promote more external CEOs. These results support the hypothesis that companies with strong governance are more likely to select outside CEOs, as outside CEOs are more willing to break away from the failed policies of their predecessors (Huson et al., 2001). This result may also imply that private equity firms

that have a long experience in restructuring companies may have access to a larger pool of CEOs whose skills were already tested.

In Chapter 1, we also tried to improve the methodology of Cornelli and Karakas (2015) by employing a propensity score matching procedure developed by Rosenbaum and Rubin (1983) and Heckman et al (1993). The goal of this matching approach is to find 'twin' firms that have similar characteristics than those of PE-backed buyouts but that were not acquired. In fact, previous papers (e.g., Gao et al., 2013; Cornelli and Karakas, 2015) use only size and industry matching to construct their control sample. However, given that PE firms select companies non-randomly (Wright et al., 2009), PE-backed companies may have ex ante characteristics (e.g., financial results) that differ from the other firms operating in the same sector. Thus, given the clearly non-random PE target selection, using properly matched peers as a benchmark is crucial for evaluating the effect of PE investors on the governance of their portfolio companies. We identify an adequate benchmark via propensity score matching (Rosenbaum and Rubin, 1983; Heckman et al., 1998; Acharya et al., 2009[b] Gaspar, 2012; Tykvova and Borell, 2012).

Among the possible extensions of Chapter 1, we believe that it would be interesting to examine firm performance after CEO turnover in PE-backed and public firms. It would provide more insights on the optimality of the turnover decision across these two types of firms. If the higher turnover-performance sensitivity in PE-backed firms is driven by monitoring improvement, then we should observe a higher performance improvement in PE-backed firms following the CEO turnover. However, several issues concerning the impact of managerial turnover on subsequent firm performance improvement remain unresolved. In particular, an increase in firm performance following a turnover decision could be due rather to a mean reversion of accounting performance than to improved management quality (Huson et al., 2004). The possible research extension on post-turnover performance should thus take into account the potential impact of monitoring by influential shareholders, such as private equity sponsors, on post-turnover firm performance.

Chapter 2 contributes to the CEO turnover literature by examining the role of an important characteristic of an institutional investor – the PE firm's industrial specialization. The new sponsors that take the company private face the necessity of evaluating a CEO in the

context of complicated market conditions. An important problem is to determine the degree to which a CEO is responsible for a firm's past performance and his/her ability to lead the company in the future. Our main hypothesis implies that high industrial specialization of PE firms makes the true CEO quality more visible and its evaluation less costly for the new owners. Thus, PE specialization serves to reduce the evaluative uncertainty surrounding a CEO's past performance. As a consequence, more specialized investors have greater ability to isolate the factors that could impact the targeted company's past performance but are beyond the CEO's control. The empirical results showed that PE firm's specialization has an impact on the governance of the acquired companies by reducing CEO turnover. Since replacing or retaining a CEO is likely to be critical to successful firm functioning, the PE firm's capacity to limit CEO turnover could have a significant (and potentially positive) effect on the subsequent performance of PE-backed companies. The results of this chapter provide additional evidence on CEO turnovers after LBOs (Cornelli and Karakas 2015), and introduce a new variable (industrial specialization of the PE firm) that plays a key role in the governance of PE-backed companies.

Chapter 2 also extends the prior literature by studying CEO turnovers during the post-buyout period and observing the acquired companies during five years after a going private decision or until the investment exit. The PE firm's specialization variable also distinguishes this paper from previous studies. We also introduced interactions effects in order to test whether the PE firm's specialization impacts the relation between financial performance and CEO tenure (i.e., testing the moderation role of a PE firm's specialization on the CEO turnover-performance sensitivity in the PE-backed company).

Chapter 2 also attempted to improve the methodology of earlier studies by using a panel within regression controlling for firm-specific effects and thus alleviating selection bias. In a panel regression with fixed effects we estimated the impact of time-varying, firm-specific characteristics on the probability of CEO turnover and control for the unobserved time-invariant factors that could be correlated with our explanatory variables.

An interesting suggestion for future research would be to study a model where CEO turnover mediates the impact of the PE firm's specialization on the financial performance of the acquired company. In fact, existing studies documenting the impact of a PE firm's

specialization on the performance of the PE-backed companies seem to bypass the issue of causality, i.e., whether the financial success of PE targets is due to the monitoring improvement and the expertise provided by the investors or to the fact that PE firms pick the targets with initially higher growth potential. The suggested mediation model could allow these two effects to be disentangled.

Chapter 3 aims to assess how particular mechanisms of governmental support to innovation can impact venture capital (VC) investments, and whether the institutional environment affects the relationship between governmental R&D and VC investments. Using a panel dataset of 20 European countries for the period from 1996 to 2009, we empirically tested the extent to which VC investments are responsive to the increase in governmental R&D expenditures that we considered as a measure for the arrival of technological opportunities. The results showed the importance of governmental R&D spending only for the early stage. Only direct governmental spending on R&D (the expenditures on R&D financed by the government in all the sectors) has a positive impact on early stage VC investments. We found also that a higher quality of formal institutions is associated with higher level of early stage VC activity. This is consistent with Li and Zahra (2011), who found a significant positive impact of formal institutions on the total number and total amount of VC investments.

The hypothesis about a positive moderation effect of institutional variables on the relationship between governmental R&D expenditures and VC investments is rejected. In fact, the relation between R&D expenditures and VC activity is negatively influenced by a better institutional environment. A possible interpretation of this result is that in the presence of highly developed formal institutions the technological opportunities measured by R&D expenditures have no more stimulating effect on VC investments. In other words, a sufficiently advanced institutional environment makes direct governmental intervention less necessary to stimulate the VC market. Venture capital investments coupled with a proper institutional environment represent an effective mechanism to finance technology-oriented projects, while other supplementary financing in the form of public R&D may crowd-out venture capital. This interpretation is only suggestive, however.

Our findings are in line with the theory that formal institutional rules can produce economic outcomes (North, 1990). Our results suggest that policymakers should give priority to institutional norms in order to promote VC activity. Our study covers the European countries where institutions are well-developed and we found that the factors that have a positive direct impact on VC investments (R&D expenditures and quality of institutions)

negatively impact VC investments when they are considered in interaction. This result might be particularly interesting for emerging countries aiming to implement policies that stimulate the VC market. Policymakers in these countries should focus on developing the institutional framework rather than on direct intervention through governmental support for innovation.

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Résumé

Cette thèse aborde l'impact du private equity sur la gouvernance des entreprises (chapitres 1 et 2) et les déterminants du capital risque (chapitre 3). Les deux premiers chapitres examinent les changements que les capital-investisseurs introduisent dans la gouvernance des entreprises (en termes de remplacement du dirigeant) suite à une opération Public-to-Private. Les résultats empiriques montrent que (i) les entreprises soutenues par private equity exercent un suivi plus actif et sont plus susceptibles de licencier le dirigeant que les compagnies cotées (chapitre 1) (ii) les entreprises soutenues par des firmes de private equity plus spécialisées (en termes de secteur d'activité) ont moins tendance à licencier leur dirigeant que les entreprises soutenues par des firmes de private equity plus généralistes (chapitre 2). Du point de vue de la théorie, les résultats montrent que le taux de remplacement du directeur général et la sensibilité du départ du dirigeant à la performance sont plus élevés dans les entreprises soutenues par private equity que dans les compagnies cotées (chapitre 1). Ce résultat va dans le sens de l'hypothèse de contrôle, qui affirme que la structure de propriété plus concentrée des entreprises soutenues par private equity induit un contrôle plus fort des actionnaires et un remplacement plus fréquent du dirigeant en cas de faible performance que la structure de propriété dispersée des entreprises cotées. Pour les entreprises ayant des structures de propriété concentrées similaires (i. e., notre échantillon de compagnies soutenues par private equity du Chapitre 2), nos résultats empiriques confortent plutôt l'hypothèse de « l'information interne » avancée par Cornelli et Karakas (2015). Cette théorie suggère que les investisseurs sophistiqués (en particulier les firmes de private equity spécialisées) sont plus enclins à utiliser de l'information «soft» (interne) pour évaluer la compétence du directeur général et pour décider de son remplacement. A contrario, les investisseurs moins sophistiqués auraient tendance à privilégier de l'information «hard», par exemple la performance financière relative de l'entreprise (par rapport à des firmes similaires). Enfin, le Chapitre 3 est lié aux débats sur les déterminants du développement du capital-risque. Nous essayons d'évaluer la façon dont les mécanismes de soutien gouvernemental à l'innovation ont un impact sur les investissements en capital-risque. Nous examinons également l'effet modérateur de l'environnement institutionnel sur la relation entre les dépenses gouvernementales en recherche et développement (R&D) et le capital-risque. Nos résultats montrent qu'un niveau plus élevé de dépenses gouvernementales en R&D entraîne un niveau plus élevé d'investissements en capital-risque. Nous trouvons également une relation positive entre la qualité des institutions formelles et le montant des investissements en capital-risque early-stage. Contrairement aux résultats attendus, la qualité de l'environnement institutionnel a un effet modérateur négatif sur la relation entre les dépenses gouvernementales en R&D et le niveau des investissements en capital-risque. Ce résultat suggère qu'en présence d'institutions formelles hautement développées les opportunités technologiques mesurées par les dépenses gouvernementales en R&D n'ont aucun effet stimulant sur le développement du capital-risque.

Mots clés : gouvernance d'entreprises, départs des dirigeants, capital-investissement, LBO, capital-risque, institutions formelles, dépenses publiques en R&D

Abstract

This PhD thesis addresses the effects of private equity on corporate governance (Chapter 1 and 2) and the determinants of Venture Capital (VC) investments (Chapter 3). The first two chapters examine the changes that private equity investors introduce in the governance of their portfolio companies (in terms of CEO turnover) after a Public-to-Private (PTP) operation. Our empirical results show that (i) PE-backed companies exert a more active monitoring, and are more likely to dismiss their CEO than public firms (Chapter 1) (ii) PE-backed companies with more specialized investors are less likely to dismiss their CEO than other PE-backed companies (Chapter 2). From a theory perspective, the findings that CEO turnover rate and CEO turnover-performance sensitivity are higher in PE-backed companies comparing with public firms (Chapter 1) seem to support the 'control hypothesis', i.e., the contention that the concentrated (and illiquid) ownership structure of PE-backed companies provides stronger shareholder monitoring and a tighter control for poor performance than the dispersed ownership structure of public firms. For companies with similar concentrated ownership structures (i.e., our sample of PE-backed companies in Chapter 2), our results rather support the 'inside information hypothesis' of boards advanced by Cornelli and Karakas (2015). This theory suggests that sophisticated investors (e.g. specialized PE firms) are more likely to use 'soft' (inside) information when they evaluate the CEO's competence and the decision to dismiss the CEO. In contrast, less sophisticated investors are more likely to base their decision on 'hard' information, e.g., the firm's performance relative to its peers. Finally, Chapter 3 is related to debate on the determinants of venture capital development. We try to assess how particular mechanisms of governmental support to innovation impact VC investments, and whether the institutional environment moderates the relationship between governmental R&D and VC investments. Our results show that higher level of governmental R&D expenditures lead to higher level of VC investments. We found also that higher quality of formal institutions is associated with higher level of early stage VC activity. Contrary to what was expected, the quality of the institutional environment has a negative moderating effect on the relationship between governmental R&D expenditures and VC activity. A possible interpretation of this result is that in the presence of highly developed formal institutions the technological opportunities measured by governmental R&D expenditures have no stimulating effect on venture capital development.

Keywords : corporate governance, CEO turnover, private equity, LBO, venture capital, formal institutions, public R&D expenditures