PRIVATE EQUITY AND CAPITAL EXPENDITURES

WHAT HAPPENS AFTER THE IPO?

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Private Equity and Capital Expenditures: What Happens After the IPO?

Abstract:

Using a sample of 1023 Initial Public Offerings (IPOs) in Europe between 2007 to 2017, we analyse how capital expenditures (capex) change following an IPO for Private Equity backed (PE-backed) IPOs compared to other IPOs. We find that PE-backed IPOs experience significantly more positive change in capex from the third year and forward compared to other IPOs, and no significant difference the first two years. For the capex to sales ratio, we only observe this significant result in the third year. The motive for analysing this is the criticism PE-firms have received in the media, claiming that they "flatter the books" before an IPO. The result to some extent supports the criticism, but we cannot prove causally that the results originate from "flattering of the books", as the effect could be a result from other factors. This paper is relevant for both investors considering participating in PE-backed offerings, as the projected capex levels are important in the firm valuation, and for the further discussion about the governance of PE-backed firms.

Keywords:

Private Equity, Capital Expenditures, Initial Public Offering

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1. Introduction

This paper analyses differences in the change in capex following an IPO for PE-backed firms relative to other firms. We find that PE-backed IPOs experience a more positive change in capex from the third year and forward. For capex to sales, this is only true in the third year following an IPO. The absence of significant differences in the first two years might indicate some lag in the effects.

"I am not against private equity in general, but when it comes to IPOs they are in the business to get the highest price for their investors. This means there is a tendency to flatter the books to make the investments look a lot better than it is." - James Laing

Comments like James Laing's - deputy head of pan-European equities at Aberdeen Asset Management, one of the world's largest investment companies with EUR 574b under management (Aberdeen, 2020) - sparked our interest for private equity and long-term investments. He claimed in an interview with Financial Times (2014) that some investors believe that PE-firms "flatter the books" before an IPO - meaning that they claim the assets to be better than they in reality are - leading to some fund managers rarely buying PE-backed offerings. In the article, investment bankers disagree with Laing's view and instead claim that PE-backed IPOs are sensibly priced with the motivation that PE-firms otherwise would find it difficult to exit their other assets in the public market later on. In the academic literature, Laing's view has some support. Kaplan and Strömberg (2009) summarize many of the studies done on private equity firms and leveraged buyouts (LBO) and raise the question whether the decrease in capex following an LBO found in some studies increase immediate cash flows at the expense of future cash flows. The rationale being that companies choose to not invest in positive net present value projects as the investments would benefit the company after the PE-firm has left the firm.

We interpret two sides of the claim that PE-firms "flatter the books". First, that the PE-firm through their control of the company have systematically forced the company to "underinvest" in long-term investments in order to increase their own current cash flow. The consequence being that the companies need to increase capex in order to sustain their level or quality of output. Secondly, that the PE-firm sell a better business plan[1] than the assets actually can deliver and understate the required future capex investments required to realize that plan. To provide context to the discussion, we believe that the change in capex following an IPO would be an indicator that could capture some of these effects. We formalize our hypothesis as the following:

> *H: PE-backed firms experience a more positive change in capex following an IPO compared to IPOs backed by other owners.*

This paper tests the hypothesis by analysing the change in capex following an IPO for 1023 IPOs in Europe. We compare the logarithmic (log) change in capex and capex to sales before and five years after the IPO between PE-backed companies and other companies undergoing an IPO. The main statistical method used are Ordinary Least Square (OLS) regressions with controls for firm characteristics and fixed effects.

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[1]How the business will develop in the coming years with growth scenarios etcetera.

Relevant papers studying private equity and long-term investments have focused on the effect when a private equity firm takes ownership (Kaplan, 1989, Long and Ravenscraft, 1993, Kaplan and Strömberg, 2009 and Boucly, Sraer and Thesmar, 2011). Our paper studies the effect when PE-firms exit their investment through an IPO and thus focuses on the period that stakeholders such as Liang, an investor in the public market, are interested in. As the forecasted capex levels have a material impact on the free cash flow which is the base for company valuation when doing discounted cash flow analysis (Rosenbaum and Pearl, 2013), the result from our paper is relevant for investors in their projections, expectations and decision about PE-backed offerings.

When studying IPOs, we consider that they represent a selective sample since PE-firms can choose other exit strategies. The contribution from this paper is not intended to be applicable on all PE-owned firms due to this selectiveness, thus only applicable on PE-owned firms exiting through an IPO. An IPO is the process of selling equity to the public for the first time (Berk and DeMarzo, 2016) and represents a common exit route for PE-firms, accounting for around 14 percent of exits between 1970 to 2007[2] (Kaplan and Strömberg, 2009).

The paper is structured to begin with relevant literature that provides context. The section is followed by a description of the data our study is based on. We then present the method of analysis, a presentation of our results and finish the paper with a conclusion. In addition, a section of references and appendix are provided.

2. Literature Review and Contribution

The effects arising from different settings of governance has been of great interest for researchers, with specific focus on PE-firms and their structure with their LBOs that differs dramatically from how a firm normally is run. Kaplan and Strömberg (2009) show that PE-activity in the US has increased exponentially since its inception in the 1980s and today represent a fair proportion of overall market activities. For this paper, there are primarily three areas of relevance from existing literature. First, how PE-firms are structured, and the organizational differences compared to public firms. Secondly, regarding private equity and long-term investments. Thirdly concerning IPOs and the effects that arise from it.

2.1. Private Equity and Organizational Differences

Ever since Jensen (1989) argued that the public organization had outlived its usefulness in many sectors, there has been a discussion about which type of organization is superior for the long run performance of a firm. The privately held LBOs, Jensen argues, is superior due to its emphasis on concentrated ownership, strong management incentives, better corporate governance and a more efficient capital structure compared to the public organization. This type of investors Jensen calls "active investors" that often hold large equity or debt positions, sit on the boards of directors, are involved in the long-term direction of the firm and have the power to dismiss management. The main conflict between the management (agents) and the shareholders (principals) is over the free cash

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[2]Kaplan and Strömberg (2009): Type of exit 1970 to 2007: Bankruptcy (6%), IPO (14%), Sold to strategic buyer (38%), Secondary Buyout (24%), Sold to LBO-Backed firm (5%), Sold to management (1%) and Other/unknown (11%)

flow, the cash flow in excess of that required to fund all positive net present value projects, Jensen (1986) further explains. This agency cost of free cash flow is reduced in an LBO due the high proportion of debt and the construction of management incentives aligning the interests. With a high equity stake for management, usually about 15 to 20 percent of equity (Jensen, 1986), and the highly levered structure with equity subordinate to debt, the management shares both the upside and downside and are forced to avoid low return projects to generate cash flow to service the debt and increase the value of their equity. As Jensen (1989) explains:

> *"More than any other factor, these organizations' resolution of the owner-manager conflict explains how they can motivate the same people, managing the same resources, to perform so much more effectively under private ownership than in the publicly held corporate form." - Michael Jensen*

After Jensen, several papers have analysed the effect of different organizational forms and types of ownership. Kaplan and Strömberg (2009) explain how PE-firms and LBOs are structured. PE-firms are lean organizations organized as a partnership or limited liability corporation that raises capital through private equity funds to invest in private equity. The PE-firms are general partners who manage the fund and the limited partners - typically institutional investors - invest in the funds but have limited influence on the investments. The typical fund has a fixed life of around ten years, with some five years to invest and some five years to "exit" - realize the investment (Berk and DeMarzo, 2016) - and return capital to the investors. The typical LBO is financed with a debt proportion of around 60 to 90 percent, hence the name *leveraged buyout*. The remaining 10 to 40 percent is financed by equity from the private equity funds. This highly leveraged setup enables the PE-firms to control majority positions with less equity than it otherwise would have needed.

Cohn, Mills and Towery (2014) found that the highly leveraged capital structure in an LBO remains, even if they generate excess cash flow. This is based on a sample of 317 LBOs in the U.S. Accordingly, the initial highly levered structure of an LBO transaction is not only an initial, but a sustained change of capital structure. This highly leveraged setup combined with the decline in capex after an LBO found in some studies raise the question whether PE-firms in their LBOs increase current cashflow, but hurt future cash flows (Kaplan and Strömberg, 2009). To test if this truly is the case, one way is to consider the performance of PE-backed IPOs. Cao and Lerner (2009) looks at the performance of 496 LBOs after they have gone public again, named Reverse Leveraged Buyouts (RLBOs), and find that the industry-adjusted share performance of RLBOs outperforms other IPOs and the whole market. This indicates that the previous decreases found in capex after an LBO might not be due to unwillingness to invest long term and increase current cash flows at the expense of future cash flows, but rather an unwillingness to invest in low return or negative net present value projects, in line with the agency cost of free cash flows discussed by Jensen (1986 and 1989). In a report focusing on private equity, Bain & Company (2020) found that the previous premium returns the PE-firms have shown in their funds have converged in the U.S. to match the returns of the public market for the last decade, which is not what the investors expect and are paying for when they lock their investments for a period of years. In Europe, the ten-year performance for PE-firms is still overperforming compared to the public market.

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2.2 Private Equity and Long-term Investments

The shareholders of a firm exercise their control through electing the board of directors of a firm, which have the ultimate decision-making authority in a firm (Berk and DeMarzo, 2016). The shareholders with most voting rights have the most influence in electing the board of directors and could either choose to put themselves on the board of directors or appoint someone. The board of directors appoint managers and decide on their compensation as well as monitor their performance. The Chief Executive Officer (CEO), that has been appointed by the board, is responsible for and manages the day-to-day activity in the firm. The Chief Financial Officer (CFO) is the most senior financial manager in a firm and has three main responsibilities. Making investment decisions, making financial decisions and managing the firm's cash flow. Because the shareholders appoint the board, and the board appoints the management team who in turn make the investment decisions, it is actually the shareholders that are in control of the investments. As there are many shareholders in a public firm, there are also many different goals, interests and priorities on how these investments should be made, with the strongest shareholders in voting having the most influence. For PE-firms, this is different due to the more concentrated ownership (Jensen, 1989) with a more active monitoring from the board, lowering the agency costs between the shareholders and management.

The high level of debt in an LBO might imply that PE-firms need to prioritize service of the debt instead of long run investments (Kaplan, 1989). Kaplan (1989) analyses the effects on operating performance originating from 48 large management buyouts (MBOs) - which is a type of investment strategy for PE-firms - in the United States and concludes that MBO-targets increase their profitability by cutting down on capex, selling off assets and still increasing operating income, measured up to three years after the MBO. In addition to Kaplan, Long and Ravenscraft (1993) find that PE-firms cause research and development (R&D) intensity to drop by some 40 percent following an LBO. On the other hand, Boucly, Sraer and Thesmar (2011) based on 839 French LBOs, find that PE-firms relaxes credit constraints which allows the LBOs to take advantage of earlier unexploited opportunities. For these firms, the relaxed credit constraints increase capex the years after the LBO. Ivashina and Kovner (2011) found that PE-firms through their repeated transactions develop a favourable relationship with the banks, reducing inefficiencies from information asymmetries and allow more favourable terms with reduced cost and more favourable covenants, supporting the view that PE-firms rather could be a source for capital for additional investments.

For investors, historical levels of capex are often a general proxy for projecting future levels, but the company's strategy, sector or phase can lead to deviations from the historical pattern. Management often discuss future capex plans in the financial reports to investors, and analysts covering the firms also provide estimates for the near period. In absence of guidance, the capex is often forecasted as a percentage of sales from historical levels, as sales growth often needs to be supported by growth in the assets (Rosenbaum and Pearl, 2013).

Kaplan (1989) noted that it is not possible to determine whether increases or decreases in capex truly is value-creating or value-destructing for the firm. It could rather be dependent on the level of attractive investment projects available, or something else such as agency costs of free cash flow. In addition to Kaplan, Porter (1992) argues that some firms have

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efficiency difficulties regarding the capital investment systems. He argues that some firms invest too little, particularly in intangible assets and capabilities crucial for competitiveness, and that some firms waste capital on investments that have limited or no financial rewards as well as use a too high cost of capital in their capital planning. This variegates Kaplan's discussion regarding the role of capex as value-creating or value-destructing for a firm, as there is no clear answer.

As another form of long run investments, Lerner, Sorensen and Strömberg (2011) analyse investments in innovation, measured in patenting activity from 472 LBOs globally. They find no evidence that LBOs sacrifice long term investments in order to service debt or in any other way increase short term cash flows. Instead, they find that LBO firms patents are more cited, which is a proxy for economic importance. To conclude, there are different views on PE-firms and their effects on long term investments.

2.3 Initial Public Offerings

Why firms undergo an IPO differs. As an IPO is a way to raise capital, companies may undergo an IPO in order to raise funds for investing in capex, which is the primary motivation found by Kim and Weisbach (2008). However, other literature does not agree on the sentiment that firms undergo IPOs to fund future investments. Zingales, Panetta and Pagano (1998) studied Italian IPOs and concluded that companies appear to go public not to finance future investments and growth, but to rebalance their accounts after high investment and growth. A study of Swedish IPOs in the 1980s concluded that companies were taken public by their owners who wanted to liquidate their investment to finance personal consumption or portfolio diversification (Rydqvist and Högholm, 1995). In addition, a survey of CFOs concluded that the main motivation for going public is to create public shares in a liquid market for use in future acquisitions (Brau and Fawcett, 2006).

Following an IPO, the ownership becomes more dispersed and, in most IPOs, the pre-existing shareholders are subject to a (often) 180-day lockup period where they cannot sell their shares. This in order to reduce the moral hazard issues associated with the information asymmetry at the IPO (Brav and Gompers, 2003). Field and Hanka (2001) found that during the time of lookup, there is little selling by insiders, but immediately when the lookup expires the trading volume increases by some 40 percent and the following trading days are associated with a statistically significant abnormal negative share return. Also, after the lookup expires, it normally takes some years for the PE-firm to fully exit their investment, as Cao (2011) reports. Further, Cao shows that the pre-IPO ownership is around 60 percent of the equity for PE-firms in PE-backed IPOs, decreasing to around 40 percent immediately after the IPO and later decreasing subsequently until the "full exit" is finalized after some years. This implies that also the period after the IPO is important for the PE-firms return, with the IPO as only a "partial exit", and not as clear change in ownership as in an LBO that happens instantly.

2.2. Contribution

By analysing capex for PE-backed firms following an IPO we contribute to the research by expanding the scope from analysing what happens to long term investments when a company undergoes an LBO, to what happens when a PE-firm exits or are exiting their

investment through an IPO. We aim to provide further understandings of the different ownership-types implications on long run investments, which would both help investors in their projections for PE-backed offerings and give context to the general discussion.

3. Data

3.1. Data Construction

Our sample consists of 1023 IPOs reported by FactSet. To obtain the sample, we begin with a screen based on (1) all the IPOs (no spin-off, change of list etc.) in (2) Europe that (3) are priced[3] and (4) took place between January 2007 to December 2017. FactSet reports 3104 IPOs based on these parameters. Then, we exclude IPOs that either (A) did not take place during our timeline, even though they previously achieved the parameter (140 IPOs excluded), (B) have no capex the year before the IPO (1379 IPOs excluded). Then, (C) have total assets below EUR 10m the year before the IPO (1775 IPOs excluded) and (D) where firm age at IPO is below two years (1038 IPOs excluded). Finally, (E) the sector Miscellaneous is excluded as it is a residual capturing all companies that are not classified to a specific sector (154 IPOs excluded). Due to overlapping of the excluding parameters, we end up with 1065 as the total number of IPOs in our sample, and thus excludes 2081 IPOs. See the appendix for a more detailed table of the exclusions.

We chose these excluding parameters in order to be able to do a meaningful analysis of our hypothesis. In (A), we chose the parameter because we only want the IPOs to be within our timeframe. We chose 2007 to 2017 since it represents a recent and wide sample. In (B), because we want to analyse the effects of capex, in which we require data for capex before the IPO to calculate a change and the year immediately before the IPO is a good proxy for this. In (C), because we want to exclude the smallest firms in order to get the sample with different IPO-types more comparable since PE-firms are not interested in too small firms (due to the size of the funds) and the EUR 10m is similar to Cohn, Mills and Towery (2014) USD 10m as cut-off. There are no higher bound due to there not being a clear higher bound in practice for either PE-backed firms or Other firms. In (D), because we want to measure change in capex after an IPO, we require data points before the IPO which newly established firms do not have. In addition, recently founded firms do not compare to PE-backed firms as PE-firms invest in mature businesses (Kaplan and Strömberg, 2009). We acknowledge that an existing firm can be restructured in a new legal entity which in our data then appears as a recently founded firm even though they have existed before the restructuring. In (E) because we want to control for Sector Fixed Effects, which the residual sector Miscellaneous naturally do not have, as there are no inherent similarities between the firms. Also, when including the observations from the sector in the regressions, our model generates a missing F-value due to there being too few observations when clustering the standard errors on IPO-year-sector.

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[3]FactSet definition: Offering has closed and has been purchased by investors
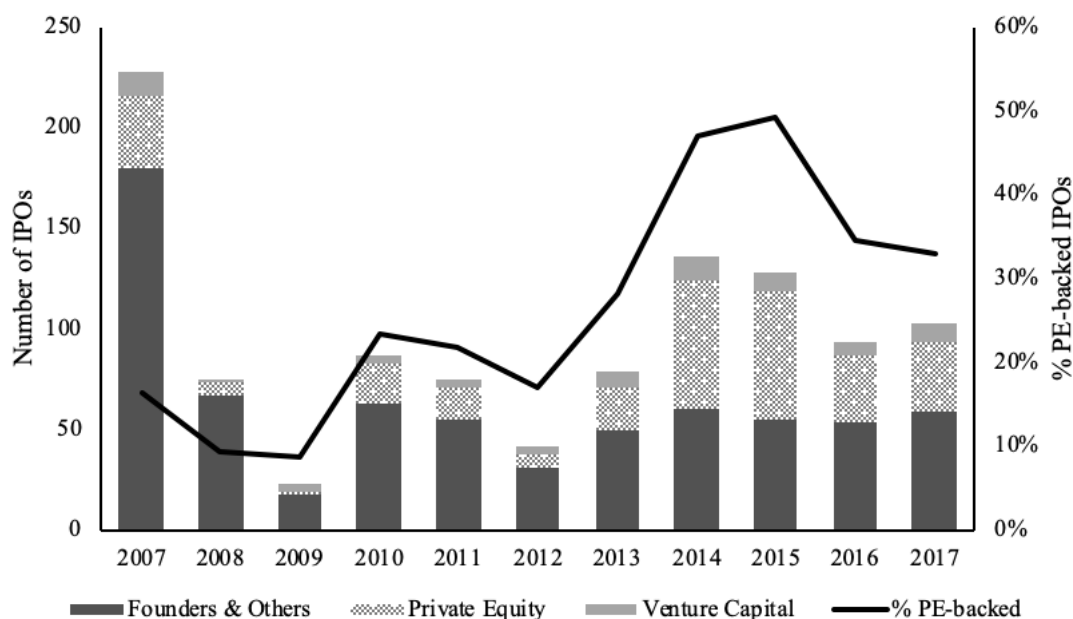
Figure 1. Number of IPOs (l.h.s.) and % PE-Backed IPOs (r.h.s) per year between 2007 to 2017.

Of these 1065 IPOs, 304 (29%) are labelled "Private Equity-Backed" by FactSet. The remaining is labelled "Founders & Others" and "Venture Capital-Backed" (VC), with 688 (65%) and 73 (7%) IPOs respectively[4]. These two types are bundled together and labelled "other firms", in the rest of the paper. Even if both PE- and VC-firms are sponsors, we focus on PE-backed IPOs in this paper. The arrangement of a PE-investment is, according to Kaplan and Strömberg (2009), distinct from a VC-investment considering the maturity of the business and share of ownership. In addition, PE-backed IPOs are the protagonist in the theme we analyse. Figure 1 shows the distribution of IPO-types for each year in our sample, with the proportion of PE-backed IPOs having an increased share over our time frame until a decline in the last two years. Notable from Figure 1, is how the proportion of PE-backed IPOs during different states of the economy changes, with a low in 2009 after the Great Recession and a high in 2015 when markets are booming. This is in line with the *Market Timing Hypothesis*, that Cao (2011) finds evidence for, where PE-firms seems to shorten the duration of the LBOs in order to take advantage of favourable IPO market conditions. As explained below in Section 4. regarding the Method, we use Year Fixed Effects in our regressions to account for the effects arising from the state of the economy.

3.2. Data Geography

Our data is gathered from all exchanges in Europe; thus, the conclusions are based on and should further be applied on European firms. Figure 2 shows the distribution between geographical areas, with the British Isles having most IPOs and Southern Europe the fewest. As the data covers a large area one can speculate about the differences of each

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[4]FactSet definition: Private Equity-Backed: Owned by or major sponsored by a private equity firm. Founders & Others: Company owned by founders and other investors, such as, hedge funds, government, other financing sources. This offer type excludes financing from venture capital and private equity firms. Venture Capital-Backed: Original financing provided by venture capital firms for new higher risk ventures such as start-up companies. Over time, the term has expanded to also include investment in management buyouts and other situations in which venture capitalists invest.

region, despite all being listed in Europe. Table 1 shows that there appears to be differences in the sample regarding the size of companies measured in capex, sales, assets and leverage at the year before IPO. We refrain from deep diving in each region since this is a European study. But when performing a robustness check controlling for the fixed effects from the geographical area within Europe, we show that this has no significant effect on the results (reported in the appendix).

Area	Capex		Assets		Sales		Leverage		IPOs
	Median	Average	Median	Average	Median	Average	Median	Average	
British Isles	4,9	47,0	107,7	1 510,7	79,0	826,5	27%	33%	242
Eastern Europe	2,1	27,0	79,7	670,9	56,7	346,8	23%	25%	239
Northern Europe	3,0	15,9	124,7	488,6	74,0	344,4	33%	33%	194
Southern Europe	4,9	42,5	130,6	3 442,9	86,1	691,9	33%	32%	127
Western Europe	3,4	57,3	79,2	2 521,2	62,8	817,4	28%	37%	221
Average area	**3,7**	**37,9**	**104,4**	**1 726,9**	**71,7**	**605,4**	**29%**	**32%**	**204,6**

Table 1. Key financials of different regions in the year before IPO. Capex, Assets and Sales in EURm. Leverage as Debt to Assets, in percentage. IPOs being the number of IPOs.
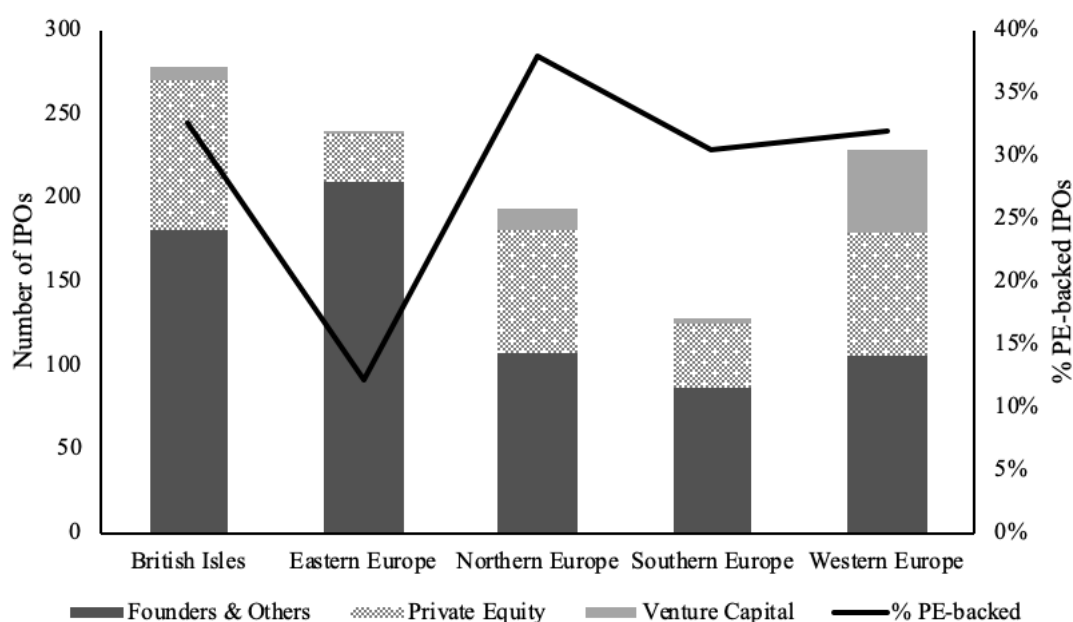
Figure 2. Number of IPOs (l.h.s.) and % PE-Backed IPOs (r.h.s) per region[5] between 2007 to 2017.

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[5]**British Isles:** UK, Ireland, Channel Islands. **Eastern Europe:** Poland, Estonia, Lithuania, Latvia, Belarus, Ukraine, Czech Republic, Slovakia, Hungary, Moldova, Russia, Romania, Slovenia, Croatia, Bosnia, Serbia, Montenegro, Kosovo, Bulgaria, Macedonia, Albania, Turkey. **Northern Europe:** Denmark, Sweden, Norway, Finland, Iceland. **Southern Europe:** Portugal, Spain, Malta, Cyprus, Italy, Greece. **Western Europe:** France, Belgium, Netherlands, Luxembourg, Switzerland, Austria, Germany

3.3. Data Panels

Variable	Median	Average	S.D.	Q1	Q3	IPOs
Panel A: PE-backed						
Capex	5,6	23,3	53,7	1,4	21,2	262
Assets	181,9	2 407,6	17 957,9	49,2	948,8	262
Sales	145,8	661,6	2 032,9	39,6	505,6	262
Debt	64,5	437,5	1 139,2	11,9	357,5	261
EBITDA	16,7	64,2	120,2	4,1	70,5	246
EBITDA-margin	12,2%	16,0%	16,9%	7,1%	23,2%	235
Leverage	38,0%	39,5%	28,1%	19,6%	56,6%	261
Age	15,0	25,1	31,7	6,3	28,0	262
Panel B: Other						
Capex	2,8	37,9	237,6	0,6	14,8	761
Assets	62,2	1 257,0	7 216,3	20,4	263,8	761
Sales	44,2	506,1	3 763,5	14,7	189,3	761
Debt	13,0	392,7	2 962,1	3,0	85,4	758
EBITDA	5,1	54,9	237,9	1,1	22,4	705
EBITDA-margin	11,7%	10,6%	37,1%	5,1%	22,8%	646
Leverage	24,6%	29,7%	38,2%	8,8%	43,8%	758
Age	14,0	23,2	30,4	7,0	23,0	761

Table 2. Sample of IPOs by IPO-type. For each firm in the sample, the three years prior to the IPO is averaged for the financial variables. The table shows the distribution for the variables Capex, Assets, Sales, EBITDA and Debt in EURm. The EBITDA-margin as EBITDA to Sales and Leverage as Debt to Assets, both in percentage. Firm age at IPO is the actual age at IPO. *Firms excluded in calculation if EBITDA-margin below -300%.

Table 2 provides the distribution of the variables that represent the three-year average before the IPO for both PE-backed firms (Panel A) and Other firms (Panel B). The median capex, assets, sales and EBITDA for PE-backed firms ranges about 2,0 to 5,0 times other firms. Also, leverage is 1,6 times other firms for the PE-backed firms. The median age of the firms that undergo an IPO differs by one year, and on average some two years, with PE-firms being older. The number of IPOs for each descriptive differs due to FactSet not having data for all measures, firms not having the financial measure (such as no Debt) and that firms with EBITDA-margins below -300 percent are excluded.

The differences in the descriptive originate from the bias in firm characteristics that PE-firms favour when it comes to their LBOs (discussed in section 4.3.). To check for robustness in our original model, we add dummy variables controlling for non-linear effects depending on the firm size and observe similar results as the original model.

3.4. Sector Classification

We use Sector Fixed Effects in the regression models to account for the differences in the sectors. For example, the Finance and Health Technology sectors are substantially more capital-intensive than other sectors such as the Retail Trade and Distribution sectors, measured as total assets over total sales, as Table 3 shows. Figure 3 shows the distribution of IPOs between FactSet's defined sectors, with Communications, Retail Trade and Health Services as the most PE-intensive sectors from the sample, with 53%, 52% and 42% respectively. Utilities, Transportation and Process Industries are the least PE-intensive sectors with 15%, 11% and 6% respectively.
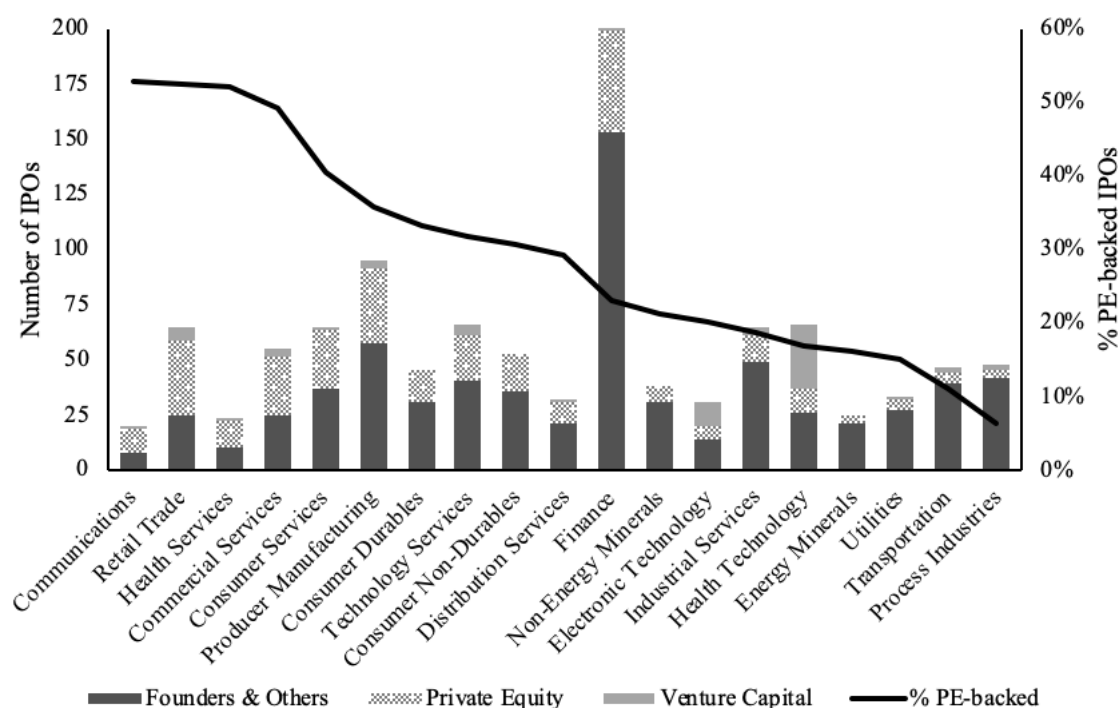
Figure 3. Number of IPOs (l.h.s) and % PE-backed IPOs (r.h.s) per sector between 2007 to 2017. Ranked in descending order based on % PE-backed IPOs.

3.5. Capital Expenditure Measures

We use FactSet's defined financial measures in our analysis[6]. The measure for Capex represents total capital expenditures for the period. This includes all new capex, both tangible and intangible, and excludes all acquisitions and disposals of assets. Following the financial forecast practices (Rosenbaum and Pearl, 2013), we also look at capex to sales. Sales represents sales of goods and services, earned from the company's core and recurring operations, reduced by cash and trade discounts, allowance for sales return and pass-through taxes, such as sales and excise taxes. The capex to sales ratio is the capex divided by sales the same year.

In practice there is a distinction between maintenance capex and growth capex, as some capex is only in order to maintain the firm's capabilities and output at their current level and some are in order to get new capabilities, expanding the asset base (Rosenbaum and Pearl, 2013). With our data, we cannot separate these two distinctions of capex and instead treat them as only one type.

Although long-run investments can be expressed in other measures, this paper focuses solely on capex. Other types of long run investments include, but are not limited to, acquisitions, R&D spending's, competence development for employees and other operational changes. PE-firms and the other firms have some different approaches to these activities, with a clear example in one of the widely used value creation strategy

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[6]FactSet Formulas: FF_CAPEX and FF_SALES. Also, the FF_ASSETS, FF_DEBT and FF_EBITDA_OPER formulas are used in the analysis.

Sector	Capital Intensive		Capex		Assets		Sales		Leverage		IPOs
	Median	Average	Median	Average	Median	Average	Median	Average	Median	Average	
Commercial Services	0,9	9,3	1,8	18,3	61,1	599,0	41,5	592,3	31%	34%	50
Communications	1,5	1,6	21,8	210,3	215,4	1 417,6	124,0	930,2	36%	39%	17
Consumer Durables	1,1	2,7	2,5	22,4	186,0	681,6	127,1	372,0	36%	37%	45
Consumer Non-Durables	1,0	14,1	3,0	9,4	114,1	323,1	92,5	271,1	34%	38%	49
Consumer Services	1,5	2,1	5,7	29,3	96,2	564,7	67,4	329,9	41%	43%	58
Distribution Services	0,6	0,8	2,6	10,2	113,2	598,7	187,2	769,1	32%	35%	30
Electronic Technology	1,1	1,3	2,3	11,5	28,9	170,7	33,8	120,3	24%	31%	28
Energy Minerals	2,1	24,3	12,2	42,8	105,5	452,8	12,3	228,2	19%	29%	25
Finance	6,4	38,1	1,7	53,1	278,1	4 933,8	63,6	630,8	25%	29%	194
Health Services	1,3	3,9	5,6	14,0	88,0	293,4	71,1	241,4	39%	74%	21
Health Technology	2,9	81,8	0,8	4,6	22,9	100,5	6,6	54,5	14%	24%	66
Industrial Services	1,0	1,3	4,4	28,3	95,9	499,3	104,2	538,0	22%	25%	63
Non-Energy Minerals	1,3	2,6	6,4	91,4	96,2	2 222,6	62,4	3 441,0	19%	22%	36
Process Industries	1,3	8,7	4,6	30,3	88,3	438,9	53,5	359,0	30%	34%	47
Producer Manufacturing	1,0	1,4	3,3	35,2	81,0	619,9	101,1	612,4	28%	31%	94
Retail Trade	0,6	1,6	4,9	32,6	108,2	353,4	238,0	563,2	30%	29%	59
Technology Services	1,0	12,8	1,8	9,3	32,8	299,5	35,4	168,5	18%	22%	62
Transportation	1,0	1,9	16,8	55,2	213,8	4 483,2	174,1	1 112,2	33%	38%	45
Utilities	2,0	5,8	25,8	113,8	200,7	1 283,7	111,7	993,2	31%	36%	34
Average sector	1,6	11,4	6,7	43,3	117,2	1 070,3	89,9	648,8	29%	34%	53,8

Table 3. Sample of IPOs by sector for the year before the IPO. Capital Intensive as total Assets to total Sales, in percentage. Capex, Assets and Sales in EURm. Leverage as Debt to Assets, in percentage. IPOs as count of IPOs.

PE-firms in a "Buy and Build" acquisition strategy for the portfolio companies, which is part of the value creation strategy in around 30 percent of the deals and not as frequent for other firms (Bain & Company, 2019).

4. Method

4.1. Statistical Tests

For both capex measures, we (1) begin by performing a two-tailed T-test comparing the mean log change for PE-backed and other IPOs. By performing this test, we can determine if the means differ, but since the statistical model is simple and does not account for fixed effects such as sector and year of IPO as well as other control variables, this is only our starting point for further analysis.

After the T-test, following Boucly, Sraer and Thesmar (2011), we (2) formalize the analysis with OLS regressions to analyse if the change in the post-IPO numbers to the pre-IPO numbers statistically differ for the two groups when including control variables. As Kaplan (1989) notes, these cash flow variables are reported before tax, which makes the analysis robust and puts the focus on managerial operational changes, unaffected by taxes and financial decisions. Unlike the previous authors Boucly, Sraer and Thesmar (2011), we use the pre-IPO average as the base for our regressions and not only the year immediately before the IPO (LBO in their case). This is due to the more volatile nature in capex compared to the return on assets, which is their main measurement. As Kaplan (1989) further notes, the year of the IPO (Management Buyout in his case) is difficult to interpret as a pre or post year and is therefore not presented or analysed. Furthermore, it is also affected by IPO related fees and preparations, which could bias the analysis. Later, we (3) compare the results with literature and (4) conduct a series of robustness checks to generalize and verify the results. Finally, we (5) draw conclusions.

4.2. Multivariate Regression

$$logCapexChangeMeasure_j = PE\text{-}backed + IPOyear_j + Sector_j + Assets_{n1} + Sales_{n1} + Debt_{n1} + EBITDA_{n1} + Leverage_{n1} + \varepsilon$$

We estimate the above OLS regression and adjust for IPO-year-sector-cluster standard errors to allow for within year-sector-correlations. When doing this, we handle possible intragroup correlation and relaxes the usual requirement that the observations be independent. Thus, the observations are still independent across clusters, but not necessarily within clusters. Since the different capital structures across the sectors vary systematically in a way that we likely do not fully capture in our model, we cluster the standard errors by sector. But since only clustering on sector's would not give us enough clusters, minimum 42 clusters (Angrist and Pischke, 2008), we cluster separately for each IPO-year-sector cluster. This approach allows for intragroup correlation within sectors in these specific years, but not across time. Therefore, we make the implicit assumption that our model does not suffer from any substantial serial correlation. Another approach, reported in the appendix, is to cluster by IPO-area-sector. With this approach, the standard error terms are allowed to covary within the sectors and across time, but not within geographical areas. Both approaches yield similar results, so we defer this other specification to the appendix and focus on the IPO-year-sector in the main analysis.

In the regression, j is a firm index and *n1* represents the "negative 1"-year relative to the IPO-year, thus the year before the IPO. Each section of the regression is further explained below.

4.2.1. Dependent Variables

Our dependent variables are log change in capex and log change in capex to sales. Thus, we perform two different types of regressions. We use log changes to reduce the effects from outliers. We motivate using log instead of dropping observations as we believe that each observation provides value for the analysis, despite being an outlier, and thus that log is a better approach than excluding these observations.

For log change in capex, the change is calculated as:

$$log\ capex\ change\ =\ log(Capex_{px}/\ Capex_{pre-avg}) \tag{1}$$

where *px* equals either the first, second, third, fourth and fifth year post the IPO and *pre-avg* represents the three-year pre-IPO average.

For log change in capex to sales, the change is calculated as:

$$log\ capex\ to\ sales\ change$$
$$= log(Capex_{px}/\ Sales_{px}) - log(Capex_{pre-avg}/\ Sales_{pre-avg}) \tag{2}$$

where *px* equals either the first, second, third, fourth and fifth year post the IPO and *pre-avg* represents the three-year pre-IPO average as with the log capex change.

4.2.2. Dummy Variable Representing Private Equity Ownership Before IPO

To analyse the effects originating from the IPO being either PE-backed or not, we use a dummy variable based on IPO-type labelled *PE-backed*. The dummy equals 1 for PE-backed and 0 for other firms.

4.2.3. Fixed Effects

Our regressions include fixed effects regarding both IPO-year and sector. The *Year Fixed Effects* is to reduce the differences originating from different states of the economy and the regression to only regress changes during the same years. With the *Sector Fixed Effects,* this reduces the fixed differences originating from the firm's different sectors and only compares firms within the same sectors.

4.2.4. Firm Control Variables

The regression includes firm control variables in order to control for differences amongst firms. The control variables include the *Assets, Sales, Debt, EBITDA* and *Leverage* for the year immediately before the IPO, year *n1*[7].

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[7] Due to the business model of Banks and some Insurance companies with no EBITDA in the profit and loss statement, these industries become excluded in the Finance sector in the regressions when controlling for EBITDA.

4.3. The Selection Bias Undermines the Causal Link

There is a selection bias in the choice of firms that undergo an LBO, which makes the causality difficult to link. PE-firms look for the typical LBO-firm characteristics in (1) a strong cash flow generation, (2) leading and defensible market positions, (3) growth opportunities, (4) efficiency enhancement opportunities, (5) low capex requirements, (6) a strong asset base and (7) a proven management team (Rosenbaum and Pearl, 2013).

In addition to the initial selection bias, PE-firms choose to exit only some of their investments through an IPO. Hence there may also be an additional selection bias in the "exit"-step. This eventual selection bias might indicate that the other firms are not fully comparable to the PE-firms since the PE-firms might be "over-characterized" by the above characteristics of a strong LBO-candidate compared to the overall firms. Thus, it would not be possible to estimate a single firm's capex investments post-IPO as if it would have been PE-backed due to the selection bias undermining the causal effects, that is, PE-firms are only interested in some type of firms. *However, our study aims to investigate if the change in capex differs for PE-backed and other firms after an IPO and not the underlying causal effects resulting in a potential difference.*

5. Results

5.1. Capex Change

We find a significant more positive change in capex for PE-backed IPOs the third, fourth and fifth year following the IPO.

5.1.1. T-test

T-Test: Capex Change (log)	P1 to Pre-AVG (1)	P2 to Pre-AVG (2)	P3 to Pre-AVG (3)	P4 to Pre-AVG (4)	P5 to Pre-AVG (5)
Absolute difference	**0,073**	**0,102**	**0,296****	**0,368****	**0,513****
PE-Backed	0,454	0,450	0,577	0,649	0,711
Other	0,528	0,348	0,281	0,281	0,198
Observations	989	903	783	662	515

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

Table 4: T-test for change in log capex. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Significance level reported for the absolute difference.

As a starting point, we begin the analysis by comparing the mean log change in capex before and one, two, three, four and five years after the IPO between PE-backed IPOs and other IPOs. The two-tailed T-test indicates a statistically significant positive difference between the means for the third, fourth and fifth year following an IPO. This indicates that PE-backed firms see a more positive change in capex. Although not tested in a statistical model, we observe different trends in the sample where the mean change for PE-backed companies increases each year while the change decreases for other companies.

The test acts as a starting point for our analysis since we cannot derive robust conclusions from it. The test is biased due to the natural differences between the groups in the sample,

which are outlined in section 3.3. Therefore, in the further analysis we use multivariate regression models to verify if the difference persists after including controls.

5.1.2. Multivariate Regression

Capex Change (log) Original	P1 to Pre-AVG (1)	P2 to Pre-AVG (2)	P3 to Pre-AVG (3)	P4 to Pre-AVG (4)	P5 to Pre-AVG (5)
PE-backed	**-0,139**	**0,020**	**0,279****	**0.338****	**0.377***
Robust standard error	*0,103*	*0,110*	*0,123*	*0,159*	*0,212*
Constant	0,968	0,317	0,660	0,976	0,719
Robust standard error	*0,175*	*0,293*	*0,270*	*0,255*	*0,222*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	915	835	723	608	473
R-squared	0,063	0,062	0,091	0,116	0,147

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 5. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Significance level reported for the PE-backed dummy variable.

As observed in Table 5, applying an OLS regression and controlling for IPO year, sector and firm characteristics yield a similar result to the earlier T-test. For the third, fourth and fifth year after an IPO, the dummy variable representing PE-backed IPOs is significant and has a positive coefficient which indicates that when compared to IPOs backed by other owners, the log capex change is more positive for PE-backed companies. Also, we observe the same absence of significant difference between the groups the two first years following an IPO.

All observations do not have data for the full five-year period post IPO, partially due to a large share of observations not having been listed for the whole five-year period. Companies listed in 2014 and forward are not represented in all years. The consequence is that the number of observations drop for each year after the IPO, thus leading to a smaller sample the longer after the IPO. Year five has 473 observations compared to year one with 915. The effect observed is that the standard error doubles from year one to year five, likely due to the reduced number of observations which weakens the statistical strength, potentially leading to a lower P-value in the later years. This complication is present in all our original tests, but we do a robustness check using only firms that underwent an IPO before 2014 to see if including IPOs from 2014 and after affect our results in the earlier years. This yields similar results as when using all the observations.

5.2. Capex to Sales Change

We find a significant more positive change in the capex to sales ratio for PE-backed IPOs the third following the IPO.

5.2.1. T-test

T-Test: Capex to Sales Change (log)	P1 to Pre-AVG (1)	P2 to Pre-AVG (2)	P3 to Pre-AVG (3)	P4 to Pre-AVG (4)	P5 to Pre-AVG (5)
Absolute difference	**0,048**	**0,118**	**0,307****	**0,312****	**0,388****
PE-Backed	0,037	-0,085	-0,048	-0,096	-0,107
Other	-0,011	-0,203	-0,355	-0,408	-0,495
Observations	957	877	759	640	495

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

Table 6. T-test for change in log capex to sales. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Significance level reported for the absolute difference.

The T-test presented in Table 6 indicates a significant difference the third, fourth and fifth year following an IPO. Because the change in the ratio for PE-backed companies is less negative than for other companies, this means that the capex to sales ratio decreases less for PE-backed companies, which is consistent with our findings in previous tests.

Similar to the T-test for capex change the results are biased and we perform multivariate regressions to produce more reliable results and then find that only the third year is significant.

5.2.2. Multivariate Regression

Capex to Sales Change (log) Original	P1 to Pre-AVG (1)	P2 to Pre-AVG (2)	P3 to Pre-AVG (3)	P4 to Pre-AVG (4)	P5 to Pre-AVG (5)
PE-backed	**-0,010**	**0,056**	**0,309*****	**0,216**	**0,198**
Robust standard error	*0,092*	*0,103*	*0,110*	*0,138*	*0,168*
Constant	0,283	-0,151	-0,065	0,176	0,111
Robust standard error	*0,158*	*0,239*	*0,184*	*0,209*	*0,254*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	883	809	699	587	454
R-squared	0,056	0,069	0,095	0,129	0,142

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

Table 7. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Significance level reported for the PE-backed dummy variable.

When analysing the change in the capex to sales ratio we observe no difference in the change between the groups the first two years as the dummy variable for a company being PE-backed is not significant. The third year we observe a significant positive dummy variable which imply that PE-backed IPOs see a more positive change in the capex to sales ratio compared to other IPOs. The coefficient in the fourth and fifth year is positive, indicating the same previous mentioned implication, but not significant (P-value 0,120 and 0,242) which implies that we cannot observe a significant difference between the groups.

The findings are mostly in line with previous tests for the change in capex as the significant observations in both tests imply that PE-backed companies experience a more positive change in respective capex measure whether it is stand-alone capex or as a

fraction of yearly sales. A contrast between the regressions of the measures is that in the capex to sales regressions we do not observe a significant result the fourth and fifth year. This does not necessarily pose a problem as it only implies that dividing the capex with sales diminishes the effects. Also, as previously mentioned the statistical strength decreases each year following the IPO as the number of observations decrease which may affect our result.

The multivariate regression differs some from the T-test regarding capex to sales. In the T-test, the difference is significant in the fourth and fifth year, but when controlling for fixed effects and firm characteristics the difference is not significant.

5.3. Discussion

The significant positive change in capex for the PE-backed firms from the third year and forward supports our hypothesis: the PE-backed firms see a significantly more positive increase in capex following an IPO. This could be a result of "flattering of the books" before an IPO, as the new investor would need to increase the investments, either in order to uphold the business plan or to uphold competitiveness. However, there can be other explanations such as increased agency costs of free cash flow following the more dispersed ownership when the PE-firm are completing their exit (Jensen, 1986). Another reason could be the bias for PE-backed firms discussed earlier, because they are characterized by being more competitive and less risky since PE-firms mostly are interested in firms with certain characteristics (Rosenbaum and Pearl, 2013). If PE-backed firms are more competitive and less risky, there might be a bias where capex would increase more for these firms because they are healthier, and not because they have been managed by a PE-firm, which could be the reason for the results.

Under an assumption that capex relative to sales remains at a fixed ratio, as is a common assumption in financial modelling, this could be a reason for the less significant results related to the capex to sales ratio (Rosenbaum and Pearl, 2013). If both groups of firms indeed grow their capex in line with the sales growth, there would not be a significant difference in the ratio, but the change in capex by itself could differ.

As the differences between the groups appear significantly only from the third year and forward, this indicates that there might be a lag for the effects of capex following an IPO. The reason for this lag may partially be explained by the process that shareholders through their voting rights influence the board to convince or replace the management in order to change the firm's behaviour, which is a formal process that takes time (Berk and DeMarzo, 2016). Another reason could be that the PE-firms still own shares for a period after the IPO (Cao, 2011), hence having significant control and the effects of being PE-backed may remain.

Another possibility for the lag is that the insignificant differences the first years occur because some firms undergo an IPO to fund future investments (Kim and Weisbach, 2008) while PE-firms mostly use IPOs as vehicles for liquidating investments (Kaplan and Strömberg, 2009). Liquidating investments should not increase capex, while raising funds in order to finance investments would. The findings of Zingales, Panetta and Pagano (1998), Rydqvist and Högholm (1995) and Brau and Fawcett (2006) does however not support Kim and Weisbach's (2008) findings. But as none of the authors

separate their argument for different types of owners, we cannot be certain that other firms have differing motives without further investigation.

5.4. Robustness Checks

When performing robustness checks on the results (reported in section A.3. in the appendix), we end up with similar results as in the original model. The differences are described below for each section of robustness check. We perform four robustness checks. (1) Including IPO-area fixed effects. (2) control for nonlinear effects of asset size using dummy variables. (3) Perform the original regression using only observations from 2007 to 2014. (4) Perform the regressions with IPO-area-sector clustered standard errors.

With (1) IPO-area Fixed Effects included in the regressions, the results support the robustness in the original model. We do this to account for fixed differences in the different geographical areas within Europe. We observe identical results regarding the sign of the coefficient and significance of the dummy variable PE-backed for both capex and capex to sales change with the exception of the fourth-year capex to sales change. This year the result is however not that different from the original model, with a weak significance only just under the 10% level including IPO-area Fixed Effects (P-value 0,096) compared to the original model (P-value 0,120).

When (2) including dummy variables to control for nonlinear effects of size we observe identical results regarding if the dummy variable PE-backed is significant and has a positive coefficient. This check is made to also consider non-linear effects related to company's size.

Using only firms that underwent an IPO before 2014 (3), the results are identical to the original regressions in all but the fourth and fifth year for the log capex change. These results have a weaker significance than in the original mode but are still significant. Since our sample consists of firms that underwent an IPO between 2007 and 2017, only firms that underwent an IPO before 2014 have financials for all five years in the analysing period. Hence, with this sample there are the same observations included throughout the whole period of analysis, and not like the original model where some observations drop out.

Finally, the (4) robustness check using IPO-area-sector clustered errors yields similar results as the original model with IPO-year-sector clusters. As there is a possibility that there could be serial correlation when clustering on IPO-year-sector, we cluster on IPO-area-sector which allow the error terms to covary within sectors and across time, but not geographical areas.

6. Conclusion

The changes in the operational settings following an LBO does seem to lead to necessary increases in capex investments in the future when the PE-firm exits their investment through an IPO. Our results confirm the hypothesis that PE-backed firms experience a more positive change in capex following an IPO. This is true from the third year after an IPO and forward when only looking at the change in capex, but only true in the third year considering the capex to sales ratio. We observe a lag in the effects on capex changes

following an IPO the first two years. This could support Laing's claim about PE-firms "flattering of the books" before an IPO, and that an investor should consider this when projecting capex and pricing the offering. But our result is not strong enough evidence to support the claim as it cannot prove the causal link since there could be several other reasons for this result, the most critical being the inherent selection bias related to which companies PE-firms choose to invest in.

To collect more and stronger evidence for the claim that PE-firms "flatter the books", we suggest further research to (1) see if the effects we observe remain further in time. (2) Control for changes in private equity ownership post-IPO and test if the lag is a result from PE-firms remaining as a significant shareholder during the lagging period. (3) Perform analysis on the company's mediated message in the prospectus to more clearly separate the effects from the different motives in an IPO. (4) Lastly, because of the inherent selection bias in which companies PE-firms invest in, try to perform experiments that include both PE-owners and other owners and adjust for the bias by for example randomly distributing companies for the different groups to manage. Suggestions (1), (2) and (3) would likely not prove a causal link but increase the understanding of capex development after IPOs. However, an experiment like in (4) would be more likely to prove causality but would be difficult to design.

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Appendix

A.1. Supplemental Information

A.1.1. Key Definitions

Expression	Definition
IPO	Initial Public Offering
LBO	Leveraged Buyout
MBO	Management Buyout
PE	Private Equity
PE-firm	Private Equity Sponsor
PE-backed IPO	IPO backed by a Private Equity Sponsor
PE-owned	Owned by a Private Equity Sponsor
PE-fund	A fund with a fixed life managed by a Private Equity Sponsor
EBITDA	Earnings Before Interest Taxes Depreciation and Amortization

Table A.11. Key Definitions

A.1.2. Number of Years with Capex for Each Firm

Number of years with capex pre-IPO	1	2	3
Proportion of firms	15,0%	20,2%	64,8%

Table A.1.2. Proportion of firms with Capex in one, two or three years before the IPO.

Table A.1.2. reports that 91,8% of the firms had capex for at least two years before the IPO. The pre-IPO average is calculated as the average for the years that have a value. If there are values for all three years before the IPO, the average is a three-year average. If there are values in two or one year before the IPO, the average is calculated on those years.

A.1.3. Detailed Data for Excluding's

Excluding parameter	Total excludings	Excluded due to	
		Not meeting criteria	No data
(A) IPOs that did not took place during our timeline	140	115	25
(B) Firms that have no capex the year before the IPO	1 379	99	1 280
(C) Fims with total assets below EUR 10m the year before the IPO	1 775	663	1 112
(D) Firms with age at IPO below two years	1 038	834	204
(E) Firms in the *Miscellaneous* sector	154	154	0
Total	4 486	1 865	2 621

Due to overlapping of the excluding parameters, total number of excludings are 2081 IPOs

Table A.1.3. Firms excluded per excluding parameter, shown in total and excluded due to either not meeting criteria or FactSet not having data. Total number of exclusions also included in the table.

A.2. Detailed Data for the Figures

A.2.1. Table with values in Figure 1

IPO-year	Founders & Others	Private Equity	Venture Capital	Total	% PE-backed
2007	179	37	12	228	16%
2008	66	7	2	75	9%
2009	17	2	4	23	9%
2010	63	20	3	86	23%
2011	55	16	3	74	22%
2012	31	7	3	41	17%
2013	49	22	7	78	28%
2014	60	64	12	136	47%
2015	55	63	10	128	49%
2016	54	32	7	93	34%
2017	59	34	10	103	33%
Total	688	304	73	1065	29%

Table A.2.1. Values as input to Figure 1. IPO-year as year of IPO. Founder & Others, Private Equity and Venture Capital as IPO-type. Total as sum of IPOs. % PE-backed as % PE-backed out of total IPOs per year.

A.2.2. Table with values in Figure 2

IPO-area	Founders & Others	Private Equity	Venture Capital	Total	% PE-backed
British Isles	180	90	7	277	32%
Eastern Europe	209	29	1	239	12%
Northern Europe	107	73	13	193	38%
Southern Europe	86	39	3	128	30%
Western Europe	106	73	49	228	32%
Total	688	304	73	1065	29%

Table A.2.2. Values as input to Figure 2. IPO-area as geographical area of IPO. Founder & Others, Private Equity and Venture Capital as IPO-type. Total as sum of IPOs. % PE-backed as % PE-backed out of total IPOs per area.

A.2.3. Table with values in Figure 3

Sector	Founders & Others	Private Equity	Venture Capital	Total	% PE-backed
Communications	8	10	1	19	53%
Retail Trade	24	34	7	65	52%
Health Services	10	12	1	23	52%
Commercial Services	24	27	4	55	49%
Consumer Services	37	26	1	64	41%
Producer Manufacturing	57	34	4	95	36%
Consumer Durables	30	15	0	45	33%
Technology Services	40	21	5	66	32%
Consumer Non-Durables	36	16	0	52	31%
Distribution Services	21	9	1	31	29%
Finance	153	46	1	200	23%
Non-Energy Minerals	30	8	0	38	21%
Electronic Technology	14	6	10	30	20%
Industrial Services	49	12	3	64	19%
Health Technology	26	11	29	66	17%
Energy Minerals	21	4	0	25	16%
Utilities	27	5	1	33	15%
Transportation	39	5	2	46	11%
Process Industries	42	3	3	48	6%
Total	688	304	73	1065	29%

Table A.2.3. Values as input to Figure 3. IPO-sector as the sector of the firm that undergoes an IPO. Founder & Others, Private Equity and Venture Capital as IPO-type. Total as sum of IPOs. % PE-backed as % PE-backed out of total IPOs per sector.

A.3. Robustness Check Regressions

A.3.1. Overview of the PE-backed Dummy Variable

Regression	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
Overview PE-backed dummy variable	(1)	(2)	(3)	(4)	(5)
Capex Change					
Original	**-0,139**	**0,020**	**0,279****	**0.338****	**0.377***
With IPO-area Fixed Effects	-0,136	-0,002	0.280**	0.338**	0.369*
With AssetsN1 EUR 50m dummy	-0,071	0,083	0.333**	0.367**	0.384*
With AssetsN1 EUR 100m dummy	-0,088	0,056	0.319**	0.353**	0.374*
Only IPOs before 2014	0,013	0,228	0.372**	0.336*	0,377*
With IPO-area-sector clustered errors	-0,139	0,020	0,279**	0,338**	0,377*
Capex to Sales Change					
Original	**-0,010**	**0,056**	**0,309*****	**0,216**	**0,198**
With IPO-area Fixed Effects	0,004	0,060	0.333***	0.239*	0.225
With AssetsN1 EUR 50m dummy	0,028	0,078	0.319***	0,219	0,187
With AssetsN1 EUR 100m dummy	0,002	0,053	0.301***	0,214	0,199
Only IPOs before 2014	0,075	0,129	0.342**	0,129	0,198
With IPO-area-sector clustered errors	-0,010	0,056	0,309**	0,216	0,198

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.1. Overview of the PE-backed dummy variable's coefficient. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Significance level reported for the PE-backed dummy variable.

A.3.2. With IPO-area Fixed Effects

Capex Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With IPO-area Fixed Effects	(1)	(2)	(3)	(4)	(5)
PE-backed	**-0,136**	**-0,002**	**0.280****	**0.338****	**0.369***
Robust standard error	*0,107*	*0,114*	*0,130*	*0,166*	*0,217*
Constant	1,043	0,412	0,857	1,416	0,911
Robust standard error	*0,199*	*0,329*	*0,304*	*0,277*	*0,281*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	915	835	723	608	473
R-squared	0,065	0,069	0,099	0,134	0,150

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.2.1. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes IPO-area Fixed Effects. Significance level reported for the PE-backed dummy variable.

Capex to Sales Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With IPO-area Fixed Effects	(1)	(2)	(3)	(4)	(5)
PE-backed	**0,004**	**0,060**	**0.333*****	**0.239***	**0.225**
Robust standard error	*0,095*	*0,106*	*0,116*	*0,143*	*0,172*
Constant	0,245	-0,190	-0,072	0,370	0,159
Robust standard error	*0,186*	*0,274*	*0,221*	*0,260*	*0,307*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	883	809	699	587	454
R-squared	0,060	0,073	0,098	0,134	0,147

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.2.2. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes IPO-area Fixed Effects. Significance level reported for the PE-backed dummy variable.

A.3.3. With Assets the Year Before IPO over EUR 50m Dummy Variable

Capex Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With AssetsN1 EUR 50m dummy	(1)	(2)	(3)	(4)	(5)
PE-backed	**-0,071**	**0,083**	**0.333****	**0.367****	**0.384***
Robust standard error	*0,106*	*0,111*	*0,128*	*0,158*	*0,209*
Constant	1,090	0,420	0,752	1,057	0,747
Robust standard error	*0,182*	*0,302*	*0,275*	*0,261*	*0,215*
Assets more than EUR 50m	-0.380***	-0.334***	-0.303**	-0.322**	-0,136
Robust standard error	*0,190*	*0,121*	*0,144*	*0,151*	*0,173*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	915	835	723	608	473
R-squared	0,078	0,071	0,098	0,123	0,147

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.3.1. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes a dummy variable for AssetsN1 equal to 1 for IPOs over EUR 50m and 0 otherwise. Significance level reported for the PE-backed and Asset dummy variables.

Capex to Sales Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With AssetsN1 EUR 50m dummy	(1)	(2)	(3)	(4)	(5)
PE-backed	**0,028**	**0,078**	**0.319*****	**0,219**	**0,187**
Robust standard error	*0,094*	*0,105*	*0,119*	*0,138*	*0,172*
Constant	0,352	-0,115	-0,047	0,181	0,083
Robust standard error	*0,162*	*0,245*	*0,183*	*0,212*	*0,258*
Assets more than EUR 50m	-0.210**	-0,112	-0,057	-0,021	0,148
Robust standard error	*0,103*	*0,130*	*0,154*	*0,152*	*0,170*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	883	809	699	587	454
R-squared	0,061	0,070	0,095	0,129	0,143

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.3.2. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes a dummy variable for AssetsN1 equal to 1 for IPOs over EUR 50m and 0 otherwise. Significance level reported for the PE-backed and Asset dummy variables.

A.3.4. With Assets the Year Before IPO over EUR 100m Dummy Variable

Capex Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With AssetsN1 EUR 100m dummy	(1)	(2)	(3)	(4)	(5)
PE-backed	**-0,088**	**0,056**	**0.319****	**0.353****	**0.374***
Robust standard error	*0,109*	*0,115*	*0,126*	*0,158*	*0,209*
Constant	1,012	0,362	0,705	0,996	0,727
Robust standard error	*0,177*	*0,293*	*0,270*	*0,253*	*0,218*
Assets more than EUR 100m	-0.270**	-0,204	-0.241*	-0,190	-0,163
Robust standard error	*0,109*	*0,130*	*0,135*	*0,151*	*0,183*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	915	835	723	608	473
R-squared	0,071	0,065	0,095	0,119	0,148

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.4.1. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes a dummy variable for AssetsN1 equal to 1 for IPOs over EUR 100m and 0 otherwise. Significance level reported for the PE-backed and Asset dummy variables.

Capex to Sales Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With AssetsN1 EUR 100m dummy	(1)	(2)	(3)	(4)	(5)
PE-backed	**0,002**	**0,053**	**0.301*****	**0,214**	**0,199**
Robust standard error	*0,097*	*0,109*	*0,116*	*0,139*	*0,171*
Constant	0,294	-0,155	-0,064	0,174	0,106
Robust standard error	*0,160*	*0,239*	*0,184*	*0,210*	*0,255*
Assets more than EUR 100m	-0,064	0,018	-0,005	0,024	0,122
Robust standard error	*0,105*	*0,133*	*0,135*	*0,144*	*0,177*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	883	809	699	587	454
R-squared	0,056	0,069	0,095	0,129	0,142

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.4.2. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes a dummy variable for AssetsN1 equal to 1 for IPOs over EUR 100m and 0 otherwise. Significance level reported for the PE-backed and Asset dummy variables.

A.3.5. Including only IPOs before 2014

Capex Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
Only IPOs before 2014	(1)	(2)	(3)	(4)	(5)
PE-backed	**0,013**	**0,228**	**0.372****	**0.336***	**0.377***
Robust standard error	*0,147*	*0,155*	*0,163*	*0,181*	*0,212*
Constant	1,033	0,156	0,729	1,003	0,719
Robust standard error	*0,195*	*0,374*	*0,339*	*0,288*	*0,222*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	634	607	586	556	473
R-squared	0,104	0,095	0,105	0,122	0,147

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.5.1. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes only IPOs before 2014. Significance level reported for the PE-backed dummy variable.

Capex to Sales Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
Only IPOs before 2014	(1)	(2)	(3)	(4)	(5)
PE-backed	**0,075**	**0,129**	**0.342****	**0,129**	**0,198**
Robust standard error	*0,134*	*0,152*	*0,148*	*0,151*	*0,169*
Constant	0,295	-0,300	0,031	0,163	0,111
Robust standard error	*0,148*	*0,318*	*0,231*	*0,217*	*0,254*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	610	587	566	535	454
R-squared	0,091	0,091	0,103	0,134	0,142

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table A.3.5.2. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-year-sector-clusters. Regression includes only IPOs before 2014. Significance level reported for the PE-backed dummy variable.

A.3.6. With IPO-area-sector Clustered Standard Errors

Capex Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With IPO-area-sector clustered errors	(1)	(2)	(3)	(4)	(5)
PE-backed	**-0,139**	**0,020**	**0,279****	**0,338****	**0,377***
Robust standard error	*0,113*	*0,108*	*0,134*	*0,150*	*0,202*
Constant	0,968	0,317	0,660	0,976	0,719
Robust standard error	*0,144*	*0,201*	*0,223*	*0,339*	*0,262*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	915	835	723	608	473
R-squared	0,063	0,062	0,091	0,116	0,147

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

Table A.3.6.1. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-area-sector-clusters. Significance level reported for the PE-backed dummy variable.

Capex to Sales Change (log)	P1 to Pre-AVG	P2 to Pre-AVG	P3 to Pre-AVG	P4 to Pre-AVG	P5 to Pre-AVG
With IPO-area-sector clustered errors	(1)	(2)	(3)	(4)	(5)
PE-backed	**-0,010**	**0,056**	**0,309****	**0,216**	**0,198**
Robust standard error	*0,108*	*0,101*	*0,119*	*0,144*	*0,165*
Constant	0,283	-0,151	-0,065	0,176	0,111
Robust standard error	*0,159*	*0,155*	*0,184*	*0,295*	*0,238*
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of IPOs	883	809	699	587	454
R-squared	0,056	0,069	0,095	0,129	0,142

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

Table A.3.6.2. Sample of IPOs. Sample period: 2007 to 2017. OLS estimates of an IPO on log change in Capex to Sales. All regressions include Sector Fixed Effects and Year Fixed Effects. PE-backed is a dummy variable, equal to 1 for PE-backed firms and 0 otherwise. P1, P2, P3, P4 and P5 as first, second, third, fourth and fifth years after the IPO. Pre-AVG as three-year average before the IPO. Regressions include robust standard error calculated within the combined IPO-area-sector-clusters. Significance level reported for the PE-backed dummy variable.