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Private Equity and Firm Profitability: A Study on Medium and Long-Term Target Firm Performance

Author: Adham Zaineldin
Student number: 594955
Thesis supervisor: Dr. Fabrizio Core
Second reader: Dr.Thomas Mosk
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ABSTRACT

This study investigates the impact of private equity involvement on the performance of European target firms that went public from 2010-2019 via initial public offering (IPO). Return on assets three years and five years after the IPO are used to proxy medium and long-term profitability respectively. The model controls for size, industry, leverage, and country in the medium term in addition to year of the IPO in the long term. The results show a significant negative effect of private equity involvement on 5-year return on assets, which suggests that private equity may be offering short-term benefits to its targets at the cost of hindered long-term performance.

Keywords: Private Equity, Initial Public Offering (IPO), Venture Capital, Underperformance, Return on Assets.

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CHAPTER 1: Introduction

Despite the mean underpricing of initial public offerings (IPOs) (Ljungqvist, 2007; Chambers & Dimson, 2009; Katti & Phani, 2006), disappointing post-IPO performance, both for private equity and non-private equity backed firms, is not uncommon. It may seem intuitive to suggest that private equity and venture capital backed IPOs suffer from less underperformance relative to their non-private equity backed counterparts; however, this claim is more controversial than it seems (Jelic & Wright, 2011; Brav & Gompers, 1997; Meles et. al, 2014). Levingston's (2023) Financial Times article highlights three recent cases of private equity buybacks, driven by disappointing post-IPO results. These cases show the real and ever-present possibility of drops in share price or profits after an IPO. However, this short-term fluctuation in post-IPO price may simply be attributed to noise; it is thus more valuable to study long-term firm performance to better measure the actual value added by private equity. This paper will accordingly be concerned with the medium-and long-term performance of private equity-backed firms after their IPOs relative to non-private equity backed firms, looking to isolate the effect of private equity investment and exit on long-term target performance.

Although there is no lack of literature on the long-term value added by private equity, a limited amount of this literature uses European firm data. Furthermore, the majority of relevant research on the subject is outdated, using data from the 1990s and 2000s. There is thus a need for research using more recent data from the post-financial crisis era, to allow us to continue studying trends in the private equity industry. It is crucial that the strong reliance the world economy has on private equity only continues in so far as PE firms add significant value to their targets – if this added value is only temporary and fades in the medium or long-term, then it is possible that the industry is only serving to make its partners richer, which would call on significant need for policy intervention. Consequently, this subject is wanting of considerable research to ensure the reliance on private equity backing remains proportional to the value it adds. In light of the recent amendments by the European Union to the Alternative Investment Fund Managers Directive (AIFMD), it is also important for European lawmakers to have access to an extensive body of recent literature to guide and reflect on their policy decisions.

My research builds on past works on this subject, particularly those of Jelic & Wright (2011), Meles et. al (2014), Levis (2011), and Brav & Gompers (1997), looking to provide an extension to the literature using European data from the 2010s. Due to the lack of research using recent data, I believe that another round of extensive research, as done on the 2000s decade, is highly needed. Building on the methods used in previous works, this study aims to investigate whether private equity still adds value to its targets in both the medium and long-term, while controlling for firm specific factors and industry, country, and yearly fixed effects. I hope that this also paves the way for new research on the subject, using bigger datasets,

more control variables, and different techniques such as panel data or buy-and-hold returns to further investigate this question.

CHAPTER 2: Theoretical Framework

2.1 Background

During the past decade, the European private equity (PE) market has seen a significant yet inconsistent growth in raised capital (Caselli & Negri, 2020; Lerner & Leamon, 2023), growing by 86% from 2009 to 2019 despite sharp decreases in 2010 and 2012, followed by another sharp decrease during 2021 and 2022. This coincided with a trend of fund closures, resulting in increased concentration of capital into fewer, larger funds (Caselli & Negri, 2020). Considering that yearly capital raised by the European PE industry has been in excess of €100bn since 2019 (Invest Europe, 2024), coupled with the high volatility of the industry, it comes as no surprise that there is an extensive body of literature on the performance of both PE funds and their owned private companies (VBCs), both in Europe and abroad.

It is important to consider the applicability of non-EU research – particularly from the US – to European data. It is uncontroversial to suggest that regional characteristics influence the success of PE-backed IPOs; Nahata et al. (2014) and Schertler & Tykvová (2012) show that high levels of economic growth and stock market development positively impact private equity and venture capital (VC) investments, while Baker et. al (2021) find that Initial Public Offering (IPO) underpricing is lower in countries with higher ESG Government Ratings, and that this effect is stronger in countries with "more transparent financial disclosures, higher liability standards, and stronger shareholder protection". Kräussl & Krause (2014) find that intrinsic differences between US and European VC partly explain success and performance rate differences, which they attribute to higher levels of entrepreneurial activity in the US. Consequently, studies on US firms will be used only when necessary and will be treated with the needed scepticism.

2.2 Conceptual Overview

2.2.1 - *Private Equity and Venture Capital*

This section will cover a few key concepts important for the understanding of this analysis, in addition to providing relevant background on the subject. Caselli & Negri (2021) define private equity as "investments made in private companies that may find themselves at every stage of their life cycle." If the company is in its first years of activity and in a development stage, the investment is referred to as venture capital, a subcategory of private equity. Firms invested in by both PE and VC are referred to as venture-backed companies (VBC) – this title is due to venture capital's birth before private equity. PEs raise capital from private investors to create a fund, which is then used to invest and reinvest in VBCs to provide returns for their investors. Due to illiquidity, lack of monitoring, and non-compulsory disclosures, VBCs often exhibit higher cost of capital than public companies – private investors thus require higher expected return from private than public securities (Caseli & Negri, 2021). Although by the definition

used here, VC is a subclass of PE, a proportion of the literature distinguishes between buyout funds and venture capital funds (Harris et. al, 2014; Michala, 2019).

The first private equity firm was established in 1976 (Caseli & Negri, 2021), leading to the rise of an industry that has since played a significant role in our modern financial ecosystem. By the turn of the century, the industry had undergone two major booms, the first in the late 1980s and the dot-com bubble in the late 1990s, both followed by retreats in investment and fundraising (Wadecki et. Al, 2012). Similarly, the period from 2005-2007, which was coined the "golden era of private equity", was followed by the largest drop in fundraising levels in the history of the industry. My study will focus on IPOs from the period of 2010 to 2019 (with corresponding 5-year ahead data up to 2023), with the chosen starting point being the beginning of the post-financial crisis era.

Private equity gained popularity in the UK in the 1980s, staying true to the trend of a significant boom, followed by the early 1990s recession – Europe experienced a similar boom in the late 1980s and recession in the early 1990s. With the high technology boom of the late 1990s and 2000 (Seretakis, 2012; ECB Monthly Bulletin, 2005), Europe surpassed the US in buyout activity from 2000 to 2004. In the wake of the financial crisis, the European Parliament adopted the AIFM Directive in November 2010, which encompassed managers of private equity and aimed to create "a harmonized regulatory and supervisory framework for alternative investment fund managers (AIFMs) and promote an internal market for their activities." The directive imposed minimum capital requirements on managers, obliged them to maintain appropriate liquidity and risk management policies, and applied policies that discouraged bearing excessive risk, among other policies aimed at fund regulation (Seretakis, 2015). Unfortunately, due to the lack of reliable literature on the empirical consequences of the AIFM Directive, it is difficult to judge its impact on the European PE industry. However, the European Parliament adopted an amended AIFM directive in February 2024, alongside a review of the original directive completed in 2021, concluding that "the objectives of integrating the Union market for alternative investment funds, ensuring a high level of investor protection and protecting financial stability have mostly been met" (European Commission, 2021).

2.2.2 - *Initial Public Offering (IPO)*

Once the private equity firm is looking to exit its investment, it is faced with the choice of exit strategy. The most common strategies are exit through Initial Public Offering (IPO), trade sale (selling the VBC to another company), secondary buyout (sale to another private equity firm), repurchase by the entrepreneur, or liquidation through filing for bankruptcy (Jenkinson & Sousa, 2015; Cumming, 2010). In an IPO, a firm sells a significant portion of its stock on public markets to raise capital (Ibbotson & Ritter, 1995). The increased liquidity of public markets allows firms easier access to capital, at more favourable terms than offered in private capital markets. This comes at the cost of significant one-time costs of IPOs (such

as underwriting, auditing, and management costs), often in addition to indirect costs such as underpricing and subsequent underperformance (Ljungqvist, 2007; Ibbotson & Ritter, 1995).

Despite not being the most common option, IPO exit was chosen as the exit route of my study. This is due to the unavailability of data, especially in the long term, on other forms of exit. A VBC will often cease to exist after a trade sale, getting swallowed by the acquiring firm. It will otherwise not be listed as a public firm but be privately owned by the acquiror, greatly increasing difficulty of obtaining data – this is also a concern for secondary buyouts and repurchases. Due to the general availability of public data on public firms, along with greater variable choice and higher standardization, I believe IPO exit is the best choice of exit route for building a substantial sample to assess the long-term impact of private equity involvement.

2.3 Literature Review

2.3.1 - *Performance of Private Equity Funds*

There is a significant body of literature on the performance of private equity funds, with greatly varying results. Much of the literature on the US shows overperformance of PE funds relative to the S&P 500 index up until the 1990s, followed by equal or even underperformance in the 2000s. Harris et. al (2014) documented consistent overperformance of buyout funds formed from 1984-2008, and initial overperformance of VC funds in the sample followed by underperformance in the 2000s. Similarly, Sensoy et. al (2014) shows PE fund overperformance in the 1990s followed by underperformance in the 2000s. This study used an extensive sample of funds formed from 1991 to 2006, comprising 5200 individual funds (76% of all North American private equity funds ever raised, 63% of European funds, and 46% of funds from Asia and the rest of the world, prior to data cleaning.) Braun et. al (2017) found similar results using both American and European data from 1974 to 2012.

One of the most comprehensive studies was conducted by Harris et. al (2016), who used a sample of both buyout and VC funds comprising of 1800 North American funds and 300 European funds, analysed separately. The analysis was done using the Public Market Equivalent (PME) which "directly compares an investment in a PE fund to an equivalently timed investment in the relevant public market" (Harris et. al, 2016). They found overperformance of PE funds relative to public markets in both North America and Europe from 1984-2010.

More recently, Brown & Kaplan (2019) showed consistently higher returns of US PE funds over the S&P 500 in the post-financial crisis era, using data extending to 2018. An important concern is raised by Phalippou (2013) – although PE and VC typically overperform in relation to the S&P 500, they typically underperform when compared to small-cap stock indices, which Phalippou argues are more relevant for

comparison than the S&P. Despite the extensive literature using US and UK data, there is a lack of reliable research on European PE performance.

2.3.2 - *Medium-and long-term Performance of PE-backed firms*

The main question of this paper has been studied in much of the past literature, most of which has now become outdated. The most recent relevant work on the long-term performance of VBCs is Matanova et. al (2022). Computing buy-and-hold performance using PE, VC, and non-VBC data on 1,975 US IPOs from 1997-2010 (with data extending to 2013), they concluded that PE-backed firms exhibited higher buy-and-hold performance than both VC-backed firms and non-VBCs. Brav & Gompers (1997) closely mirrors my research goals, despite using now outdated data (extending only to 1992) on US firms. They found that VBCs outperformed non-VBCs over the sample. Jelic & Wright (2011) conducted similar research using deal data on 1,225 UK PE-backed IPOs from 1980–2004 and corresponding firm data up to 2009. Contrasting with the results of Matanova et al. (2022) and Brav & Gompers (1997), Jelic & Wright (2011) did not find evidence of overperformance of VBCs over their non-private equity backed counterparts. Using a similar timeframe and sample of UK PE-backed IPOs, Levis (2011) found better buy-and-hold abnormal returns for PE-backed firms over non-PE-backed firms in the sample.

Bessler & Seim (2012) used a sample of venture-backed IPOs on European stock exchanges from 1996 to 2010 to compute average buy-and-hold returns across their sample. Comparing that to MSCI market indices per country, they found higher average buy-and-hold returns of venture-backed firms in the sample, declining over time until they fell below market returns two years on average after firms' respective IPOs. Finally, Meles et. al (2014) used data on Italian PE-backed firms that received investment after 2000 and were exited before 2009 to compare operating performance in the last year before exit to average operating performance in the three subsequent years. These firms were individually matched to comparable firms based on economic activity, sales, and EBITDA/ Sales ratio to create the control group of non-VBCs. A regression analysis on the effect of PE involvement resulted in a positive PE dummy coefficient – however, it was shown that when broken down to buyout and venture capital only VC was shown to have a positive effect while the buyout dummy had an insignificant negative effect.

A less common method of measuring performance is through probability of survival. Using a sample of 2,151 U.S. firms from 1997-2010, Hotchkiss et. al (2021) showed that private equity-backed firms tend to have higher leverage and thus default more often than other firms. Furthermore, "PE-backed firms restructure more quickly, avoid bankruptcy court more often, and liquidate less often compared to other highly leveraged firms experiencing financial distress" – consequently managing financial distress at lower cost and retaining control more often than non VBCs (Hotchkiss et. al, 2021).

Tykvová & Borell (2012) showed that PE firms tend to choose less financially distressed companies, and that the risk of financial distress increases post-buyout; this was based on a sample of European companies from 2000 to 2008. Despite the increased distress risk, they did not find evidence of higher bankruptcy rates for VBCs than comparable non-venture backed companies. Finally, Wilson & Wright (2013) used an extensive database of 153,000 insolvencies in the UK from 1995-2010 to show that PE-backed buyouts are not more prone to insolvency than non-PE-backed buyouts, when controlling for firm size and age, sector, and macro-economic conditions.

2.4 Hypothesis Formation

Two potential opposing hypotheses are possible for this research. Bloom et. al (2015) conducted a survey on management practices of PE-owned firms, scoring firms based on 18 management practices (such as hiring and firing practices, monitoring, pay, and promotions) and using a double-blind methodology to minimize bias from the researchers and the participants. They found generally superior management practices of VBCs, in addition to a strong correlation between these management practices and improved firm performance. If I assume the long-term value-added hypothesis, based on Levis's (2011) expectation that management and financial practices adopted by the PE firm stay in place long after exit, the superior management practices adopted by PE-backed firms should continue to positively impact firm performance in the long term. This should lead to improved 3-year, and possibly even 5-year target firm performance after PE exit.

In contrast, the short-term value hypothesis as outlined by Meles (2014) predicts that "PE investors take actions to maximize their wealth, resulting in unfavourable long-term effects for the firm." This would likely cause a detrimental effect of private equity involvement; the PE firm is incentivized (based on this hypothesis) to take action to inflate short-term value in order to maximize IPO returns, at the cost of medium-term firm performance, and at an even greater cost to long-term performance. Antoni et. al (2019) found significant increases in employee turnover and decrease in employment after private equity buyouts, along with lower employee earnings five years after the buyout. This may be an example of the wealth maximizing actions of private equity discussed by Meles (2014) – although reducing employment and wages may inflate returns in the short term by cutting costs, it may result in a subsequent decrease in profitability (Guthrie & Datta; 2008).

In studying the three-year and five-year post-IPO performance of VBCs, my hypotheses are based on a combination of the short-term and long-term value-added hypotheses. In the medium term I predict a slightly negative effect of private equity involvement; this aligns with Bessler & Seim (2012) who found underperformance of VBCs starting from the third year post-IPO. I expect the theoretical continued benefit of PE involvement described by Levis (2011) to fade away over the 3-year time frame – it is simply unworthwhile (and possibly counterproductive) for private equity firms to make investments that

would continue to benefit their targets for long after exit. I would also like to reiterate the results of Meles et. al (2014), who found a positive 3-year impact of PE involvement, but an insignificant negative one when exclusively considering involvement by buyout funds.

Accordingly, my first hypothesis is as follows:

H1: Private equity-backed IPOs will exhibit slightly lower medium-term performance than their non-private equity-backed counterparts.

Furthermore, I predict that the long-term value-added hypothesis will prevail over the 5-year time frame, in line with the findings of Jelic & Wright (2011) and Bessler & Seim (2012). I hypothesize that the wealth-maximizing actions of private equity firms expected by Meles (2014), such as the cuts in employment and wages demonstrated by Antoni (2019), will make target firms worse off in the long run. This should translate into a negative coefficient for PE involvement on return on assets five years after the IPO. My second hypothesis is thus as follows:

H2: Private equity-backed IPOs will exhibit lower long-term performance than their non-private equity-backed counterparts.

CHAPTER 3 Data and Methodology

3.1 Data collection

This research is conducted using European firm data from 2010 to 2023, combining data from Orbis M&A and Refinitiv Eikon (LSEG Datastream). Orbis M&A has information on 2.2 million M&A, IPO, private equity, and venture capitals deals and rumours from 200 countries spanning 20+ years. LSEG Datastream contains data on 35 million individual instruments and indicators, spanning 175 countries and 120 years. Two searches were conducted on Orbis M&A for IPOs in Europe from 2010-2019: one search for "Deal Type (IPO)", and one for "Deal Type (IPO, Private Equity or Venture Capital)". The searches were limited to target firms based in Western Europe, Nordic states, Scandinavia, Balkan states, Baltic states, and Eastern Europe – no geographical restriction was placed on the acquiring firms. After excluding the PE and VC-backed IPOs from the first sample, a dummy variable for private equity involvement (*PE*) was created, taking value 1 if the firm data was retrieved using the "Deal Type (IPO, Private Equity or Venture Capital)" search and 0 otherwise.

Orbis M&A provided the cross-sectional data on target firm names, their IPO dates (*IPO*), their major sector (*Industry*), the country they are based *(Country)*, and their International Securities Identification Number (ISIN) codes. ISIN codes were used to merge the Orbis data with panel data on the chosen firms, retrieved using Refinitiv Eikon – this provided data on "Net Income Available To Common" (*NI*), total assets (*TA*), total debt (*TD*), and market capitalization (*MC*)**.** After extracting the data, observations denoted in currencies other than Euros were removed to avoid exchange rate inconsistencies, along with firms that went public before 2010 or after 2019. Although this study does not involve a panel regression, panel data was necessary for calculating medium-term and long-term return on assets for each firm after the IPO.

Combining the Orbis M&A and Refinitiv Eikon data and reshaping it using python resulted in one dataset, compatible for use on STATA. This dataset contains data on 852 firms, 166 PE-backed IPOs and 686 non-PE-backed IPOs. 128 observations are of firms that went bankrupt throughout the period – a limitation of the data is the unavailability of pre-bankruptcy data on any of these firms. Since no data is available on firms that went bankrupt, these observations were dropped from the sample, leaving 724 observations. Only three of the 128 firms that went bankrupt were PE-backed. Finally, removing observations with missing data on any of the dependent or independent variables resulted in the final dataset of 523 firms, of which 140 are PE-backed and 383 are non-PE-backed. This dataset is used for the first hypothesis, while the second hypothesis requires further removal of observations missing 5-year ROA. The final dataset for the second hypothesis is 356 observations, of which 109 are PE-backed and 247 are not.

3.2 Variable definitions

Target Name: This variable, retrieved through Orbis M&A, provides the legal name of each firm. This was used to create the variable *FirmID* which takes a unique value for each target firm name.

IPO Date (*IPO*): This variable shows the confirmed IPO date of each observation, retrieved through Orbis M&A. This was used to create the variable *IPOYear* as a control for effects of IPO timing. Additionally, two variables for 3-year and 5-year post-IPO dates were created, rounding down from January to June and up from June to December.

Target Major Sector (*Industry*): This variable, retrieved through Orbis M&A, represents the industry of the target firm's main operations. It was used to create categorical control variable *Industry.*

Country (*Country*): This variable, retrieved through Orbis M&A, represents the country where the target firm is based. It was used to create categorical control variable *Country.*

Year: This variable shows the date of each observation, retrieved through Refinitiv Eikon. Each observation is measured at 00:00:00 on the first of January for each year; the day, month, and time were thus removed from the observations and the year was kept as (Year – 1) to represent end-of-year data.

Company Market Capitalization (*MC*): This variable, retrieved through Refinitiv Eikon, represents the total market value of all relevant share types issued by the firm. The value of the requested share type is multiplied by the number of shares outstanding to calculate the market capitalization. A log transformation of this variable was used to create the control variable *LogMC*.

Net Income Available To Common (*NI*): This variable, retrieved through Refinitiv Eikon, represents net income after preferred dividends and before dividends to common shareholders.

Total Assets (*TA*): This variable, retrieved through Refinitiv Eikon, represents the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.

Total debt (*TD*): This variable, retrieved through Refinitiv Eikon, represents the total debt held by the firm, calculated as a sum of "Notes Payable/Short-Term Debt, Current Portion of Long-Term Debt/Capital Leases and Total Long-Term Debt." The control variable debt to asset ratio (*DTA)* was calculated as total debt divided by total assets.

Return on assets (*ROA*): This variable is defined as net income divided by total assets. This variable was used along with the IPO date to create two variables for return on assets three years and five years after

each firm's IPO date (*ROA_med* & *ROA_long*). These are the two main independent variables in this study.

3.3 Sample Descriptive Statistics

Table 1 and table 2 contain sample descriptive statistics on the data for regression 1 and regression 2:

Table 1: Descriptive Statistics

This table contains descriptive statistics on 3-year and 5-year return on assets (*ROA_med*, *ROA_long*), debt asset ratio (*DTA*), and market capitalization (*MC*).

Variable	Mean	Standard Deviation	Minimum	Maximum	Observations
ROA_med	-0.0826	0.405	-5.661	0.672	523
ROA_long	-0.0881	0.341	-2.871	0.550	356
DTA	0.250	0.203	0	1.384	523
MC	1,214,056	3,343,742	480	36,071,496	523

Table 2: IPOs per year

This table shows the distribution of firm IPO dates over the years in the sample for regression 1 (H_1) and regression 2 (H_2). The table shows the number of observations in the private equity backed sample, the non-private equity backed sample, and the combined sample.

Year	PE-Backed		Non-PE-Backed		Total	
	H_1	H_2	H_1	H_2	H_1	H_2
2010	6	6	19	17	25	23
2011	9	9	35	29	44	38
2012	5	5	22	20	27	25
2013	5	5	24	22	29	27
2014	27	25	40	34	67	59
2015	28	26	51	46	79	72
2016	18	17	52	45	70	62
2017	17	16	45	33	62	49
2018	16	0	61	1	77	1
2019	9	0	34	0	43	0
Total	140	109	383	247	523	356

3.4 Dependent variables

Determining post-IPO operating performance of private equity targets requires a reliable measure of profitability. A large portion of the past literature on PE target performance, including Meles et. al (2014), Jelic & Wright (2011), Wang et. al (2003), and Brav & Gompers (1997), uses return on assets (ROA) to measure profitability. Furthermore, the general availability of data on net income and total assets makes

return on assets a good choice for minimizing missing data. This is thus the chosen measure of operating performance for this study, measured as follows:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

Two variables are then created using the ROA variable, ROA_med and ROA_long, representing return on assets three years and five years after the firm's IPO date respectively, rounded to the nearest year. For the purposes of this research, I define the medium-term as three years and the long-term as five years. ROA_med is the dependent variable of H1, while ROA_long is the dependent variable of H2.

3.5 Independent and control variables

Consistent with Levis (2011), Dushnitsky and Lenox (2006), and Meles et. al (2014), I use data on non-VBCs to measure the effect of PE backing rather than comparison to market indices; this is on the assumption that "any results based only on a sample of PE-backed firms may cause considerable misinterpretation" (Meles, 2016). As shown by Phalippou (2013), results of performance measurement are sensitive to the choice of market index – it is thus more informative to compare PE-backed firms to non-PE backed firms in the same sample. Therefore, the independent variable in both hypotheses is the private equity involvement dummy (*PE).*

The control variables I use for the analysis on 3-year return on assets are firm size, proxied by market capitalization (*MC*), total debt to total assets (*DTA),* and two categorical variables for industry (*Industry)* and country (*Country).* Furthermore, I use year of the IPO (*IPOYear*) as a control for 5-year return on assets, in addition to *MC*, *DTA*, *Industry*, and *Country.* These variables were chosen as controls for my analysis following Levis (2011), Meles et. al (2014), Jelic & Wright (2011), and Robinson & Sensoy (2016).

3.6 Regression Models

To determine whether private equity involvement has the hypothesized effect on medium and long-term return on assets, I build two linear regression models using ordinary least squares (OLS). The tests are two-sided to allow the possibility of both positive and negative effects of PE. The first regression models three-year return on assets on the PE dummy, market capitalization, debt to asset ratio, and industry and country categorical variables. The second regression models 5-year return on assets on the PE dummy, market capitalization, debt to asset ratio, industry, country, and year of the firm's IPO. All regressions and diagnostic tests are tested at a 5% significance level, unless otherwise specified.

Estimating these models via OLS regression on STATA ideally answers H1 and H1. However, it is important to first discuss the OLS assumptions and how their violation might affect our model. Firstly,

the assumption of homoskedasticity, or constant variance of the error term, is tested. The Breusch-Pagan test is used to test for heteroskedasticity, with a null hypothesis of constant variance of the error term. Both regressions resulted in (Probability > chi^2) < 0.0000, which is significant evidence for heteroskedasticity. Robust standard errors are thus used to account for heteroskedasticity in line with Jelic & Wright (2011), providing more reliable standard error estimates.

The next assumption to be tested is that of no perfect multicollinearity. To investigate this, the variance inflation factor (VIF) is used to test for multicollinearity between independent variables for both models. VIF values less than 5 are generally acceptable, while values of 5-10 indicate moderate to high risk of multicollinearity. A VIF of 10 or larger indicates significant risk of multicollinearity. The test showed high VIF values for many country subcategories, with mean VIF of 6.537 for the country variable in regression 1 and mean VIF of 19 for the countries in regression 2. This points towards a high risk of multicollinearity from the country variable, particularly in model 2, which represents a model limitation as multicollinearity can cause biased coefficient estimates.

Furthermore, the assumption of normality should be tested. According to Li et. al (2012), the normality assumption is not necessary for validity of a linear regression in large sample sizes. However, the somewhat small size of the sample used in this study calls into question the applicability of the law of large numbers. A Shapiro-Wilk W test for data normality is conducted on the continuous variables *ROA_med*, *ROA_long*, *MC,* and *DTA*. This test is of the null hypothesis that the data is normally distributed. Since the p-value (Probability > z) < 0.00000 for all four variables, the null hypothesis of normality is rejected.

The Shapiro-Wilk test results represent another limitation of this analysis. Similarly to Robinson & Sensoy (2016), the logarithm of firm size (market capitalization) is taken to deflate extreme values. However, since this would not be possible for return on assets (which takes on negative values) and would not make sense for a ratio such as the debt asset ratio, the normality assumption is violated for these variables. This may have an adverse effect on the reliability of the model coefficients in my study.

After adjusting for robust standard errors and log-transformed market capitalization, the final regressions are as follows:

$$ROA\_med = \alpha + B_1 * PE + B_2 * logMC + B_3 * DTA + B_4 * Industry + B_5 * Country + e_i$$

$$ROA\_long = \alpha + B_1 * PE + B_2 * logMC + B_3 * DTA + B_4 * Industry + B_5 * Country + B_6 * IPOYear + e_i$$

CHAPTER 4 Results & Discussion

The regression results are in table 3 below:

Table 3: Regression Results

This table contains the results of regression 1 and regression 2, with coefficients of each regressor and standard errors in brackets. 3-year return on assets is regressed on the private equity dummy (PE), the logarithm of market capitalization (LogMC), debt to asset ratio (DTA), and industry and country categorical variables in regression one. 5-year return on assets is regressed on the private equity dummy, the logarithm of market capitalization, debt asset ratio, year of the IPO (IPOYear) and industry and country categorical variables in regression 2. All coefficients are rounded to 3 significant figures. * Significant at a 10 percent level ($p < 0.1$), ** Significant at a 5 percent level ($p < 0.05$), *** Significant at a 1 percent level ($p < 0.01$).

Variable	Coefficient (1)	Coefficient (2)
PE	-0.0380	-0.108**
	(0.0347)	(0.0473)
LogMC	0.0450***	0.0383***
	(0.0118)	(0.0131)
DTA	-0.146	-0.126
	(0.117)	(0.184)
IPOYear		-0.00730
		(0.00940)
Country Dummies	Yes	Yes
Industry Dummies	Yes	Yes
Constant	-0.738***	14.122
	(0.231)	(18.812)
Observations	523	356
r^2	0.142	0.174

For regression 1, the private equity dummy has a negative coefficient of -0.038, with p-value of 0.274, insignificant at the 10% significance level. The firm size control variable had a positive coefficient of 0.045, highly significant at the 1% significance level. This implies that a 1% increase in firm size in the year of its IPO, as measured by market capitalization, is correlated with an increase of 0.045 in the 3-year ahead return on assets in my sample. The debt to total assets coefficient of -0.15 is negative and insignificant at the 10% significance level.

Furthermore, coefficients of industry 10 (metals & metal products) and industry 18 (wood, cork, and paper) are positive and significant at the 5% level, with p-values of 0.011 and 0.032 respectively, while the industry 17 (wholesale and retail trade) coefficient is positive and significant at the 10% level. This means that being in industry 10, 18, and 17 is correlated with 0.21, 0.16, and 0.15 higher return on assets in this sample respectively, when compared to the reference industry (banks). The remaining industry coefficients were insignificant at the 10% level, and all positive except for industry 2, 13, and 15. Finally, all countries had positive coefficients when compared to the reference country Austria except for Belgium and Switzerland, which were highly insignificant at the 10% significance level. Target firms in Great Britain and Lithuania showed 0.41 and 0.33 higher 3-year return on assets than those in Austria at a 1% significance level. Coefficients for Latvia, Spain, Greece, Italy, Finland, and Malta are significant at the 5% level, and those for Portugal and Cyprus are significant at the 10% level.

Although the results of regression 1 show that the effect of private equity intervention on 3-year return on assets is in the same direction as hypothesized, the coefficient of the private equity dummy is insignificant. There is thus a lack of statistical evidence that private equity is a valid predictor for 3-year return on assets in this sample. Firm size appears to be the most reliable regressor in this model, with a p-value less than 0.001 – this provides evidence for a relationship between firm size during the year of the firms IPO and its return on assets three years later.

Despite the private equity dummy coefficient in model 2 being of lower magnitude than model 1 (-0.108), it is still negative and significant at the 5% level, with p-value of 0.024. This implies that firms that were backed by private equity before their IPO showed 0.11 less return on assets on average five years later than firms that were not backed by PE in my sample. Additionally, the 95% confidence interval of the PE dummy is [-0.0146 – -0.201] – this further reaffirms the significance of the PE dummy as 0 is not present in the confidence interval.

Similarly to regression 1, the coefficient of firm size is significant at the 1% level, with p-value of 0.004. The coefficient of 0.038 implies that a 1% increase in firm size the year of a firm's IPO is correlated with 0.038 higher return on assets five years later in this sample. Coefficients of debt to asset ratio and IPO year are negative but highly insignificant at the 10% significance level, and all the industry subcategories are also insignificant. Finally, all country coefficients are positive when compared to the reference

category Austria except for Ireland and Switzerland, which are insignificant. Greece and Lithuania are significant at the 1% significance level; Italy, Great Britain, Malta, Croatia, Germany, Finland, and Spain at the 5% level; and Cyprus and Sweden at the 10% level.

The regression 2 results are as predicted by hypothesis 2: firms with pre-IPO private equity backing show lower return on assets on average five years later than firms without PE backing. There is thus evidence of a statistically significant negative relationship between private equity involvement and long-term return on assets in my sample, which is further validated by the absence of 0 in the private equity confidence interval.

Based on these results, hypothesis 1 is rejected. There is no evidence that private equity backing has an effect on medium-term return on assets in my sample. However, hypothesis 2 is accepted – there is evidence of a negative effect of private equity involvement on 5-year return on assets. Despite the insignificant coefficient the regression 1 private equity dummy, the presence of the negative PE coefficient on 3-year ROA and the significant one on 5-year ROA supports the declining returns on private equity targets over time showed by Bessler & Seim (2012). Similarly to how the buy-and-hold returns in their study declined over time when compared to the market, falling below the market indices two years after IPO, the negative effect of PE backing in my sample were present yet insignificant after three years, but significant after five years.

This provides evidence for Meles (2014)'s prediction on the adverse effects of wealth-maximizing actions of private equity investors on their target firms in the long-term. Levis (2011)'s hypothesis that "management and financial practices put in place at that time will be maintained at least for some time after the exit" may provide some explanation for the less significant regression 1 coefficient – the interplay between the short-term and long-term value-added hypotheses may cause higher short-term performance for PE-backed firms (Bessler & Seim, 2012), similar performance in the medium term (Jelic & Wright, 2011; Wilson & Wright, 2013), and worse performance in the long-term.

It is important to consider the results found here in the scope of previous literature. While research using older data – such as Brav & Gompers (1997) and Drathen (2008) – often concluded overperformance of VBCs, research using 2000s data was quite controversial in comparison (Matanova, 2022; Jelic & Wright, 2011; Bessler & Seim, 2012; Meles et. al, 2014; Levis, 2011). The lack of relevant research using data from the 2010s has caused a significant gap in the literature – it is unclear whether private equity target performance experienced a rebound in the post-financial crisis era or continued its possible downward trend. I believe the downward trend has continued – just as the inconclusive 3-year results found in my study are not in line with Drathen's (2007) findings on 3-year VBC overperformance (which used 1990s-2000s data), my results of significant 5-year underperformance contradict Brav & Gompers's (1997) findings along the same time frame.

Despite this, it is difficult to make conclusive statements on a trend from the results found here. The current study has a number of limitations that cast doubt on the reliability of the results, and strongly call upon further research on this time period using more extensive data. The difficulty of obtaining a large number of deals on Europe-based VBCs that went public in the 2010s, with data on all controls used in my model, led to final samples with 140 and 109 VBCs in regression 1 and regression 2 respectively – this, coupled with the use of non-normal return on assets data, presents the possibility of biased coefficient and/or standard error estimates. Based on the central limit theorem, as tested and discussed by Kwak & Kim (2017), the larger the sample size the more closely the sample means algin with the population mean, and the more the standard errors decrease, leading to more accurate coefficient estimates regardless of the population's distribution. Since the sample size used in this study is limited, it is difficult to say whether the coefficients estimated by this model mirror the true coefficients.

It is also relevant to note the relatively low r^2 values for both models, of 14.2 and 17.4 respectively. I believe this may be caused by relevant variables omitted from the model – other variables, such as firm age as used by Meles et. al (2014), may have been relevant for this analysis. Unfortunately, since the age data collected from Orbis M&A contained a large number of incorrect observations, and that from Refinitiv Eikon was unavailable for a large number of firms, adding age as a control would have reduced the sample size of this study by more than reasonable.

Finally, the possibility of multicollinearity in the model, due to the concerningly high VIF values for several country subcategories (particularly in model 2), is a further cause of concern for the results found in this study. Multicollinearity may inflate model standard errors, leading to biased coefficient estimates; the presence of high VIF values thus decreases the reliability of the PE dummy coefficient.

It is also important to discuss possible biases caused by the data. Firstly, the removal of bankrupt firms has significant potential to bias the PE coefficient – if the majority of firms that go bankrupt are PE-backed, then the coefficient will likely appear to be of a lesser (negative) magnitude than it actually is, as the VBCs will appear to be performing better than they actually are. However, since only three of the firms that went bankrupt throughout the sample were backed by private equity, the model likely overestimates the performance of non-PE-backed firms, which may result in a PE coefficient that appears greater in magnitude than it is. This possibility of survivorship bias is concerning for the coefficient estimates of my model.

Another possible bias in the model is the possibility of selection effects of private equity. Since this study is only concerned with the direct effects of PE involvement, greater performance of VBCs that is caused by the selection process of the firms rather than the value added to them would be likely to cause inflated performance of VBCs in the model relative to non-VBCs. As shown by Wilson et. al (2021), private equity firms target large, old firms, likely with higher proportions of tangible assets and operating in

stable industries, with high cash generation and profitability while still having room for productivity growth. Similarly, Block et. al (2019) identified revenue growth, value-added, profitability, and management factors as investment criteria for private equity. All these factors may contribute to chosen firms performing better than the market without taking into account the policies adopted post-acquisition. As shown by Jelic & Wright (2011), VBCs tend to differ from non-VBCs in size, exit route, origin, and industry – which may contribute to selection effects that cause a bias towards better-appearing performance of VBCs, potentially biasing the PE coefficient in my models towards 0.

CHAPTER 5 Conclusion

This paper has conducted an analysis on the effect of private equity involvement on medium and long-term target firm performance, as measured by 3-year and 5-year return on assets. A linear regression model was run via OLS to estimate regression coefficients for private equity involvement on performance. Controlling for size, industry, country, and debt asset ratio in the medium-term in addition to year of the target firm's IPO in the long-term, I found a negative yet insignificant 3-year coefficient on ROA of firms with PE involvement when compared to those without, rejecting H1 of better performance of non-PE targets in the medium term. However, over the 5-year period the PE coefficient was negative and significant, pointing towards worse performance of VBCs relative to non-VBCs in this sample. H2 is subsequently accepted – there is evidence of underperformance of PE target firms over the long-term. The results point towards inconclusive results in the medium-term, which may be caused by the retention of some of the beneficial practices described by Levis (2011), which give way towards Meles's (2014) prediction that profit-maximizing practices of the PE firm are likely to harm their targets in the long run. These results are most in line with Bessler & Seim (2012), who found overperformance of PE targets for the first two years, decreasing over time and transitioning to underperformance from the third year onwards.

The results found here indicate that the benefits of private equity involvement may not be as they seem. Short-term inflation of firm profits followed by decline after PE exit is concerning for firm shareholders, who might look towards private equity as a lifeline for their firm, only to find that the main long-term benefactor of the transaction is the private equity investors. These results highlight the importance of considering all options of raising capital before choosing to transfer ownership to private equity, which may end up inflating value in the short-term to maximize return without taking into account the long-term effects on their target firms.

It is important to consider these results in the context of the limitations of my model, as the sample size is limited and firm age (which may be a relevant predictor of return on assets) is not controlled for. Furthermore, there is a possibility of biases stemming from multicollinearity, non-normality, survivorship, or selection effects which may affect the regression results. This calls into question the reliability of the calculated regression coefficients, warranting the need for further research to attempt to build more conclusive models on the value added by private equity involvement. Further research may also investigate the impact of private equity involvement on innovation, such as measuring by the long-term impact of PE backing on patent citations, to determine whether VBCs exhibit a greater or lesser tendency for innovation after PE exit. Analysis that investigates the causal effects of private equity involvement on VBCs is crucial for truly evaluating the place of private equity in our current financial ecosystem.

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