Louvain School of Management

and

NOVA School of Business & Economics

Long-term Value Creation of Private Equity firms with Evidence from the Nordic countries

Research Master's Thesis submitted by

Alexander Branding

with a view of getting the degrees

Master 90 credits in Finance

Master 120 credits in Management, professional focus

Supervisor at NOVA School of Business & Economics

Prof. Paulo Soares de Pinho

Supervisor at LSM

Prof. Leonardo Iania & Prof. Philippe Gregoire

Academic Year 2017-2018

Abstract

This paper aims to study the long-term value creation of Private Equity firms by comparing their after performance utilizing the post IPO performance of PE-backed vis-à-vis non-backed IPOs in the Nordic countries (Sweden, Norway, Denmark, Finland and Iceland), from 2001 to 2016. Moreover, this paper aims to analyse whether certain PE-related firm characteristics drive stock performance and if there is any sizable difference relative to non-backed firms.

Keywords: Private Equity, Nordic Countries, Post IPO performance, Firm characteristics

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1 Introduction

Leveraged Buyout is a transaction where the buyer which is referred to as a financial sponsor or Private Equity firm uses significant amount of borrowed money to finance the acquisition of the target company as an organizational form, the effects and the utility of PE firms have been widely debated throughout the years (Jensen, 1986).

After Jensen, a number of authors followed to analyse the effects of firms undergoing LBO procedures (Kaplan, 1989), (Barry *et al.*, 1990). Most authors came to similar conclusions: the operating performance of firms undergoing LBOs significantly improves during the Private Equity company's ownership.

The most recent debates have focused on the trade-off between short-term and long-term effects of PE firms on target companies (Robert Harris, 2016), (Paul Gompers, 2015) and analysing if PE firms focus on short-term results are enacted at the expense of long-term value creation (Harford and Kolasinski, 2012). Thus, the focal point of the debate surrounds whether PE firms only engage in restructuring processes which have visible short-term profit generating effects or if they engage in such activities because they believe that this would have long-term benefits for the target companies.

Most studies of PE firms' effect on their portfolio companies focus on performance development between entry and exit dates. Thus, not considering the trade off-between short-term and long-term value creation. Nonetheless, a few studies, mainly focusing on the US, UK and Europe and using older data from Initial Public Offerings (IPOs) from the 1980s and/or 1990s have focused on the long-term aftermarket performance of PE-backed firms (Barry *et al.*, 1990). A potential aftermarket outperformance could constitute a proxy for long-term value creation of PE firms, vis-á-vis non-backed IPOs.

Keeping this in mind, given the lack of PE studies performed in the Nordic countries (Sweden, Norway, Denmark, Finland and Iceland). The methodology, research questions posed, and introduction have been inspired by (Nejad & Strand, 2013), who wrote a similar paper based on Private Equity in Europe. The following research questions have been formulated below, in an attempt to bridge this gap of PE-studies in the Nordic countries.

1.) *Do Private Equity-backed IPOs in the Nordics exhibit superior long-term stock performance compared to non-PE-backed IPOs?*

Another question which is raised frequently when discussing the effects of PE firms regards the focus of the restructuring process and what the PE firm de facto improves in the target companies. (Nikoskelainen and Wright, 2007) find that the two main drivers of performance development during the buyout period are the level of gearing and the size of the buyout. Thus, as there is an interest in which key factors drive PE firms' value creation and if it may have changed over the years, the second research question is:

2.) *Which firm characteristics affect long-term performance of IPOs and are there any differences in terms of firm characteristics between PE-backed and non-backed firms?*

The differentiating factor of this study compared to previous studies within the field of PE is that this study aims to analyse the questions *1.)* and *2.)* in a Nordic market context, whereas, until now, it has only been done in a US, UK or Europe as such. The Nordic context is what makes this paper unique.

This paper is structured in the following way: in section 2, the literature review is presented giving the background and context; this is followed by the theoretical framework in section 3; methodology in section 4; followed by a description of the dataset in section 5. The results and analysis of this paper are presented in section 6 and conclusions are presented in section 7; followed by limitations in section 8; and lastly further research is found in section 9.

2 Literature Review

2.1 Leverage buyouts & Operating Efficiency

Several authors have studied firms undergoing an LBO process: (Kaplan, 1989) analyses the operating results for a sample of 76 large management buyouts completed between 1980 and 1986, three years after the buyout experience increased operating income, decreased capital expenditure and increased net cash flow. (Barry *et al.*, 1990) did a similar study with 72 companies taking part in a reverse LBO (RLBO), the going-public process of a firm that has previously been subject to an LBO. Both papers reach similar conclusions that operating performance of firms undergoing LBOs, when analysing gross margin, operating income, several other measures and significantly improves during the studied holding period. Since then more studies have been conducted to observe the operational performance of companies under PE ownership. (Smith, 1990) reaches a similar conclusion as (Kaplan, 1989) that operating measures such as operating income to sales and cash flow to sales of the studied US firms had increased after they were bought out from the public through PE firms. Moreover, the studies show that PE-backed firms have on average higher leverage levels and tighter monitoring, which combined with improved operating performance creates value.

More recent studies on non-US data reach similar results: (Bergstrom, Grubb and Jonsson, 2007) use a sample of Swedish buyouts between 1998 and 2006 and (Boucly, Sraer and Thesmar, 2011) analyse operating efficiency on French target companies from 1994 to 2004. Moreover, (Weir, Wright and Scholes, 2008) using a sample of 122 public to private transactions in the UK find that the studied firms experience improved financial health as per improved efficiency (higher profits per employee and lower expenses) as well as increased liquidity. (Weir, Wright and Scholes, 2008) also find that the studied firms have leverage exceeding the industry average.

2.2 Performance of Sponsor backed IPOs (PE-backed IPOs)

Observing the stock returns following a going-public process of the PE held company is another way of studying the effects of LBOs have on target companies. During the 1990s, two major US studies were conducted within the subject: (Zeckhauser, 1993) who studied 62 RLBOs from 1983 to 1987 and (Holthausen and Larcker, 1998) who analysed 90 RLBOs between 1983 and 1988. Both studies conclude that RLBO stocks outperform peer firms in the years following flotation. In a more recent study (Cao and Lerner, 2009) using a sample of 496 global RLBOs from 1980 to 2002, reach similar conclusions as (Holthausen and Larcker, 1998), (Zeckhauser, 1993) observing superior stock returns over a five-year period compared with other IPOs. However, (Cao and Lerner, 2009) do not find any significant explanatory variable of level of gearing to market performance. (Ritter, 2009) calculate that the BHR of PE-backed IPOs are 7.1 % using figures from 1980 to 2006 in the US, compared to -5.0 % for non-PE-backed IPOs. Moreover, (Katz, 2009) shows that the long-term performance is superior when the majority of the ownership stake is held by the PE firms prior to an IPO. The author also shows that the PE-backed firms tend to be more conservative in terms of reporting (prior to and after the IPO), whilst they also have higher earnings quality in general.

The major focal point of PE-backed IPOs' aftermarket performance has been on the US market. However, the few studies which have been conducted on non-US data corroborate the previous findings. Using data from 1994 to 2004 and a sample of 1522 IPOs, (Bergstrom, Grubb and Jonsson, 2007) find that PE-backed IPOs in London and Paris outperform non-backed IPOs during the corresponding time period. Lastly, using data between 1992 and 2005 on 1595 transactions conducted in the UK, (Levis, 2011) concluded that PE-backed IPOs have higher stock returns in the following three years vis-à-vis non-backed IPOs, and the market as a whole from 1992 through 2005.

2.3 Post IPO Performance & IPO under-pricing

The aftermarket performance of IPOs is a topic that has been widely discussed among scholars throughout the years. Many studies have indicated an apparent underperformance compared to the market. (Ritter, 1991) using a sample of 1526 IPOs between 1975 and 1984 in the US finds that they significantly underperform the market indices and comparable companies three years after floatation. Subsequently, (Loughran and Ritter, 1995), using a sample three times larger than (Ritter, 1991) and collected between 1970 and 1990, reach the conclusion that this underperformance is sustained over a five-year period following the IPO.

(Miller, 1977), suggest one explanation linked to post IPO performance which is that most investors in an equity issue are optimistic buyers, resulting in that the offering price is more likely to be higher than the "fair" price. (Miller, 1977), argues that the stock will fall as time goes by towards the "fair" price as more information is made available.

The IPO under-pricing phenomenon, which implies that the stock is undervalued with relations to its intrinsic value (Rock, 1986). He suggests that IPO returns are required by uninformed investors as compensation for the risk of trading against informed investors, as there is asymmetric information. (Carter & Manaster, 1990), find that IPOs with more informed investor capital require higher returns and that prestigious underwriters are associated with lower risk offerings. Consequently, prestigious underwriters are associated with lower returns.

2.4 IPO Timing

IPO timing is a well-documented phenomenon and several studies have shown that initial public offerings (IPOs) tend to cluster both with relations to industry and in time (Ibbotson & Jaffe, 1975). What exactly causes the hots and colds in the market cycles is less clear (Loughran and Ritter, 1995). Empirical findings suggest that there is a weak link between IPO clustering and urgent funding needs (Pagano, et al., 1998). Instead, (Baker & Wurgler, 2002)

find that market timing based on market sentiments is a factor behind IPO decisions. Also, recent academic literature has focused on information spill-over as the main driver behind hot market phenomenon. This phenomenon implies that information generated through valuing a set of pioneers make the valuation of followers easier and hence trigger more IPOs, most likely due to asymmetric information and herd behaviour (Lowry & Schwert, 2002). The empirical evidence for the hot market phenomenon is strong according to (Lowry & Schwert, 2002) and (Benveniste, et al., 2003).

3 Theory

The following section will present the theoretical framework to underpin the main arguments for and against a potential value creation which can be derived from PE-ownership.

3.1 Theoretical Framework

3.1.1 Efficient market hypothesis (EMH)

The efficient market hypothesis was first developed by Eugene Fama, who argue that stocks always reflect their fair value, based on their future cash flows, given all information is available to investors (Fama, 1970). Consequently, it would be impossible for investors to "beat the market" by purchasing undervalued stocks or through selling overvalued stocks. The only way to obtain higher returns is by chance or by purchasing riskier investments (Fama, 1970). (Fama & French, 2012) support this view by showing that the distribution of abnormal returns of US mutual funds is very similar to what would be expected if fund managers had no skills when deciding allocation strategy.

3.1.1.1 Three variants of the EMH

There are three variants of the EMH, "weak", "semi-strong" and "strong" form. The weak form efficiency, claims that future stocks' prices are random and not influenced by past events, implying that all current information is reflected in the stock price (Malkiel, 1973). Semi-strong form efficiency claims that prices reflect both all public information and that the

prices changes instantly to reflect new information being public (Malkiel, 1973). The strong form further adds on to the semi-strong efficiency and claims that prices reflect even hidden "insider" information (Malkiel, 1973).

3.1.2 Noisy market hypothesis

In contrast to EMH, the nosy market hypothesis claims that the prices of securities might not always be the best estimate of the true intrinsic value of the firm (Siegel, 1994). Alternative explanations could be behavioural economics (Shiller, 2000). Some of these irrational behaviours are: herd behaviour among investor, loss-aversion and underreaction to new information (Kahneman & Tversky, 1992), (Malkiel, 2003).

3.1.3 Agency theory

(Jensen, 1989) suggests that the high level of gearing, the concentration of ownership and the supervision from a financial sponsor incentivises the firm not to invest in negative NPV (Net Present Value) project. Moreover, (Jensen, 1989) argues that this also gives a more efficient decision-making process due to the firm having fewer owners. In a previous paper (Jensen, 1986) discussed the main disadvantages of a firm which holds too much cash.

He argues that an unnecessary surplus of cash enables managers to spend money on non-value adding activities, also known as "empire building". In summary, these increase the size of the company but not necessarily its profits, at the expense of efficiency and firm value. Thus, debt can provide a firm with more financial rigor as the company has amortize the debt which limits the unnecessary surplus of cash, reducing these types of non-value-added activities and mitigating the risk of "empire building".

4 Methodology

This part of the paper will explain how the study is conducted which include presenting the measures used to evaluate the long-term performance of the stocks as well as the regression

model used to explain the alpha between the two observed subsample groups and analytical test performed before the regressions.

4.1 The defined and obtained performance measures

4.1.1 Jensen's Alpha

The proxy used for long-term value creation is the post-IPO risk adjusted returns. Thus, as a measure for this Jensen's alpha is studied on a Buy and Hold basis for the dataset of IPOs. Michael C. Jensen developed the Alpha measure in 1967 and measures a security's or portfolio's excess return over its theoretical (or required) return. Jensen's Alpha is defined below:

$$JA_t^S = BHR_t^S - E(BHR_t^S) \quad (1)$$

Where:

(i) JA_t^S = Jensen's Alpha for stock *S* at time *t*,

(ii) BHR_t^S = Buy and Hold Return for stock *S* at time *t* and

(iii) $E(BHR_t^S)$ = Expected Buy and Hold Return for stock *S* at times *t* according to the CAPM (Capital Asset Pricing Model)

Capital Asset Pricing Model, CAPM, determines the theoretical expected return of a security, taking into consideration the systematic risk (caught in the model by the beta), the corresponding market return and the risk-free rate of return. The CAPM-model was developed simultaneously and independent by (Sharpe, 1964), (Litner, 1965) and (Mossin, 1966) based on previous findings made by (Markowitz, 1952), a pioneer within modern portfolio theory. The CAPM-model is defined in the following way:

$$E(BHR_t^S) = r_f + \beta_M^S * (BHR_t^M - r_f) \quad (2)$$

Where:

(i) The expected Buy and Hold Return of security *S* at time *t*, $E(BHR_t^S)$, is determined as above,

(ii) r_f = The risk-free rate,

(iii) β_M^S = Beta of stock *S* in relation to its local market index, *M*, over three years and

(iv) BHR_t^M = The Buy and Hold Return of the market index, *M*, if bought at the IPO date of the corresponding firm

In order to estimate the risk-free rate, the yearly average of the 10-year German government bond is used. Mainly because over time the German government bond has been one of the lowest in Europe and widely accepted by scholars (apart from the US-government bond) to be a proxy for the risk-free rate. Since, the Nordic countries' economies are interconnected with the EU (and most of them are members of the EU), this is more appropriate than using the US-government bond in this paper. Moreover, if the IPO is issued in year t_0, the t_1 yearly average is used for the one-year returns. In other words, if the IPO is issued in 2000, the 2001 yearly average is used and so forth.

The notion of Buy and Hold Return implies that the investor buys the stock at the opening of the offering date, thus buying at the offering price and holding it until a pre-determined date. In this paper the pre-determinate dates are one year, two years and three years after flotation (after IPO date). N.B. that the stock prices are adjusted for dividends, spin-offs, splits and new-equity issues. The Buy and Hold Return is calculated in the following way:

$$BHR_t^i = (P_t^i - P_0^i)/P_0^i \quad (3)$$

Where:

(i) P_t^i = The price of the stock (or index), *i*, at time *t* and

(ii) P_0^i = The offering price of the stock (or the opening price of the index) at the time of the IPO of the corresponding stock, *i*.

In order to make market returns comparable to each corresponding stock's return, the index needs to be rebased based on the corresponding IPO date. Thus, the initial value of the index is the opening value of the IPO date of each corresponding stock.

In this paper the Alpha's are analysed on both an equally weighted and value weighted basis. Thus, when analysing the Alpha on equally weighted terms no adjustments are made and all firms are given the same weights in their respective portfolios (PE-backed, non-backed IPOs and together). However, when analysing using on a value-weighted basis, the stocks are given different weights depending on the market capitalisation of the company at the end of the first trading day. The value weighted approach helps to get a purer reflection of the overall performance of the IPO stocks since less weight is given to smaller companies (given the issue relating to greater information asymmetries among smaller issues) and thus, a relatively large weight is given to larger IPOs.

4.1.2 Sharpe Ratio and M²

Introduced by William F. Sharpe in 1966, and later revised in 1994. The Sharpe ratio is sometimes referred to as "reward-to-variability", the ratio, which measures the compensation the investor receives in relation to the total risk taken. The investor's compensation is measured as the excess return (or the risk premium) per unit of risk, whilst the total risk is measured by the standard deviation of the excess returns. The Sharpe ratio is defined below:

$$SR_t^S = \frac{BHR_t^S - r_f}{\sigma_{BHR_t^S}} \quad (4)$$

Where:

(i) SR_t^S = The Sharpe ratio for stock, *S*, at time *t*,

(ii) BHR_t^S = The Buy and Hold Return for the stock, *S*,

(iii) r_f = The risk-free rate and

(iv) $\sigma_{BHR_t^S}$ = The standard deviation of the excess return of the Buy and Hold Return for stock, *S*.

To make it easier to interpret the Sharpe ratio (given that it is a dimensionless measure), it can be transformed into the Modigliani risk-adjusted performance (MRAP), also known as the M^2 measure. Developed in 1997 by Franco and Leah Modigliani, the M^2 measure indicates how well a security or portfolio performs given its risk relative to a benchmark portfolio and risk-free rate. The M^2 measure is denoted in percentage units, making it more easily interpreted than the Sharpe ratio. The M^2 measure is defined below:

$$M_t^{2^S} = SR_t^S * \sigma_t^M + r_f \quad (5)$$

Where:

(i) $M_t^{2^S}$ = The Modigliani risk-adjusted performance measure for stock, *S*, at time *t*,

(ii) SR_t^S = The Sharpe ratio for stock, *S*, at time *t*,

(iii) σ_t^M = The standard deviation of the market returns during the corresponding time, *t*, and

(iv) r_f = The risk-free rate

Student's t-test for differences in means between Alphas, Sharpe ratios and M^2s are run on the two subsamples of groups (PE-backed IPOs and non-backed IPOs). One of the main assumptions of Student's t-test is that the variables follow a standard normal distribution under the null hypothesis. However, the t-test can also be performed assuming unequal variance among the subsamples.

4.1.3 Regression Model Specification

In order to study the relationship between firm characteristics and Post IPO performance, various proxies have been obtained to build the regression model. The EBITDA-margin (used as a proxy for profitability), Asset Turnover (as a proxy for asset usage efficiency), Debt-to-Assets (used as a proxy for leverage), OCF-ratio (used as proxy for liquidity) and Sales (used as a proxy for size of the firm).

The model consists of the 1Y, 2Y and 3Y Alpha as dependent variable and the 3Y M^2 – variable is used as an alternative model for robustness. The companies are grouped based on if they are PE-backed or non-backed to separate and analyse the respective groups impact on the dependent variables (Alpha, M^2). Thus, the regression model will be separated into two models when performing the analysis. Company *i*'s Alpha is a panel data of the corresponding yearly values of the independent variables.

The OLS (Ordinary Least Squares) regression model is specified below:

$$JA_i^S = \propto_0 + \gamma_{i,1} + \beta_{i,2} * EM_i + \beta_{i,3} * AT_i + \beta_{i,4} * DA_i + \beta_{i,5} * S_i + \beta_{i,6} * OCF_i + \varepsilon_i \quad (6)$$

Where:

(i) JA_t^S = The Alphas of the different stocks, *i*,

(ii) $\propto_0$ = The regression intercept

(iii) EM_i = The EBITDA- margin of the company, i

(iv) AT_i = Asset Turnover

(v) DA_i = The Debt-to-Asset ratio, (Total Debt to Total Assets)

(vi) S_i = Sales of the company

(vii) OCF_i = The OCF-ratio, defined as Operating Cash Flow divided by Current Liabilities

(viii) $\gamma_{i,1}$ = Country fixed effects (defined and explained in section 4.1.4.3)

(ix) ε_i = The error-term of the regression model

4.1.4 Statistical test in conjuncture with the regressions

Before running the regression, several analytical tests relating to the dataset have been performed to ensure quality, and that the appropriate conclusions are reached.

4.1.4.1 Missing value analysis

Dataset often contain missing values and it's important to understand why there are missing observations, whether it's a measurement error or something else. The presence of missing data can influence the results, and therefore needs to be dealt with adequately. According to (Acock, 2005) its important to either substitute the missing values or delete the observations for a statistical procedure to produce meaningful results.

4.1.4.2 Outlier test through Grubbs' test & Dixon's test

An outlier is an observation which deviates significantly from the normal observations. A Grubbs' test is a statistical test used to detect outliers in a univariate dataset which is assumed to be normally distributed (Grubbs, 1969). Whereas, the Dixon test does not assume normality of the dataset.

4.1.4.3 Natural Logarithm (ln) & First Difference

The dependent variables are denoted in ln-form to account for fixed effects in the regression model (Mummolo & Peterson, 2017), which implies controlling for unobserved heterogeneity between the independent variables which may exists because of discrepancies between

different countries in the subsamples. The first difference is also used (lagging of the independent variables by one time period) to ensure that the regressions results are robust.

4.1.4.4 Heteroskedasticity

Heteroskedasticity is a situation where the variance of the residual term increases or decreases with each observation, not accounting for heteroskedasticity might cause biased estimates (Gujarati & Dawn, 2009), hampering to draw conclusions. The regression model is tested using the Breusch-Pagan test. To account for heteroskedasticity the regression model is run using robust standard errors (Breusch & Pagan, 1979).

5 Data

The data used to produce this study was manually collected and is adjusted to answer the research questions adequately. The following section will be split in two parts. The first part describes the initial dataset, while the second describes in a detailed manner the adjustment made to the dataset.

5.1 Initial dataset

The initial dataset used in this study consists of panel data from all the Nordic countries (Denmark, Sweden, Norway, Finland and Iceland) on all firms within the aforementioned countries that went public between 2001 and 2016, and raised net proceeds of at least EUR 5 million or more. The IPO data was collected from the Zephyr database and the corresponding stock prices, indices and regression data were collected from the Bloomberg terminal.

The main reason why this study focuses on data from 2001 to 2016 is because it is increasingly difficult to find reliable data from 2000 as a result, this was the temporal delimitation chosen, to study data that is relevant today. The Zephyr database was not as plentiful and reliable in the year of 2000, the technological difference vis-à-vis today and the development of the database yielded relatively incomplete available information in the year of 2000.

5.2 Alterations to the dataset

After adjustments of missing values and IPOs listed outside of the Nordic countries, the total dataset consists of 212 IPO transactions over the years of 2001-2016. Among these, 55 are PE-backed transactions and 157 are non-backed IPOs. As the relatively scare number of IPOs in the Nordic countries between 2001 to 2016 led to a subsequently limited sample size, the sample mean has been used in three observations when calculating the alphas for this subsample because of extreme values (such as greater than -100 % returns), as one can assume that most investors don't use leverage when investing in stocks. This aims to make the dataset more harmonized and enables for a better analysis process.

6 Results & analysis

The following section will present the descriptive statistics collected to assess the potential outperformance of PE-backed IPOs vis-à-vis non-backed IPOs. Moreover, the results from student's t-test will be presented in the second part and in the third, the regression results and the main differences between the subsamples will be presented, all of the aforementioned results will be analysed as well throughout this section.

6.1 Aftermarket performance comparison between PE-backed & non-backed IPOs

In order to assess the potential post IPO outperformance of PE-backed firm, the Alpha, Sharpe ratio and M^2 are primarily used. These descriptive statistics are presented in Table 1-3 in Appendix 1. In general, the two subsamples (PE-backed & non-backed IPOs) have a positive performance post-IPO performance, these findings are inconsistent with (Ritter, 1991) and (Loughran and Ritter, 1995) who predict a negative post-IPO performance. Only the value weighted portfolio of non-backed exhibit negative post IPO returns while the PE-backed has a modest positive alpha over the years, albeit very close to zero, indicating no difference in performance. However, the performance of PE-backed IPOs is considerably

higher than non-backed IPOs over the three years, especially when analysing the equally weighted portfolio and the median alpha of the subsamples.

The average Sharpe ratio in Table 1-3 indicate an outperformance of PE-backed vis-à-vis non-backed at least in the second and third year. Regarding risk, there is a considerable difference between PE-backed and non-backed IPOs standard deviation this could be explained by a higher gearing ratio of PE-backed companies vis-à-vis non-backed companies which would be consistent with pervious findings of (Kaplan, 1989).

There is an increase in standard deviation for both subsamples over time which is to be expected, since the volatility over a larger time horizon is a function of annualized volatility and time. However, there is a vast increase in volatility for PE-backed firms which could indicate that they operate with higher levels of leverage compared with non-backed firms. The quantified version of the Sharpe ratio M^2 is similar between the two subsamples in the first and third year while the second year the PE-backed firms is considerably higher than non-backed firms.

The results from the student's t-test for differences in mean between PE-backed and non-backed post- IPO performance between the Alpha, Sharpe ratio and M^2 are presented in Table 4-6 in Appendix 2. Across all of the years, the Alpha is significantly higher compared to non-backed IPOs since the p-value is less than 5 % and, thus, the null hypothesis can be rejected that there is no difference between the subsamples. These findings could be explained by the fact that PE-firms have a vast expertise in streamlining a company's operations and enhance corporate governance in various ways as well as potentially mitigating agency costs.

There is a significant difference between PE-backed and non-backed performance in the second and third year, while during the first year this difference is insignificant. Moreover,

the M^2 measure is significant at around the 10 % level for the first year and significant at the 5 % level for the second year.

6.1.1 Variance test of the subsamples & results of t-test assuming unequal variance

Given that the descriptive statistics indicate a considerable difference in standard deviation of the PE-backed firms' returns vis-à-vis non-backed firms, variance tests have been performed to analyse if there is such a difference among the performance measures (Alpha, Sharpe ratio and M^2). The results conclude that across all of the year there is a statistically significant difference in variance between the PE-backed and non-backed firms (Alpha, Sharpe ratio and M^2), apart from the M^2 measure in Y1.

Thus, in order to correct for this and yield more robust results the mean differences between the two subsamples have been performed allowing for the data to be unpaired and have unequal variances. The results are presented in Table 10-12 in Appendix 3. The Alpha measure is significant at the 5 % level in Y2, with a mean difference between PE-backed and non-backed of 17,05 %, and at the 10 % level in Y3, a mean difference of 11,95 %. The Sharpe ratio and M^2 measure is only significant the 10 % level in Y2 while being insignificant the remaining years.

Despite not all of the performance measures being significant when analysing the mean difference between the subsamples, these findings are still consistent with those by (Katz, 2009) and (Ritter, 2009) who find superior Post IPO performance of PE-backed firms. This conclusion is reached because the Alpha is considerably larger for PE-backed firms vis-à-vis non-backed firms, which indicates a long-term outperformance for at least one of the measurements, indicating inconsistency with the EMH.

6.2 Regression results & analysis

6.2.1 Results from statistical test in conjuncture with the regressions

Given the size of the dataset it is assumed to be normally distributed as it is well above the threshold defined by the Central Limit Theorem (CLM) (Voit, 2003). However, for increased robustness the Dixon test have also been included which, assumed non-normality of the dataset. The test results were negative, and no outliers have been found in the dataset. As mentioned earlier, in section 4.1.4 the independent variables have been transformed into ln-form and first difference to account for fixed effects. Moreover, Breusch-Pagan test has been performed on the regression model, and no heteroskedasticity is found in the model. However, its de rigour that the regression model is still run with robust standard errors this has been done to ensure the validity of the regression results (King & Roberts, 2015).

6.2.2 Results from the regression models

The regression model has been separated into two models, one with the PE-backed firms, and another with the non-backed firms. The results comparison will follow in this section of the paper.

6.2.2.1 PE-backed regression results

From the PE-backed regression results presented in Appendix 4, it is possible to conclude that the Asset turnover ratio and OFC-ratio are significant at the 10 % (p-value) level when analysing the 1Y Alpha, the Asset turnover ratio coefficient predict a 0,4160 increase in Alpha. While the OCF-ratio coefficient estimates a -0,2730 decrease in Alpha, which is inconsistent with previous findings of (Barry *et al.*, 1990) and (Smith, 1990).

When analysing the 2Y Alpha regression, the Asset turnover ratio and OCF-ratio they are significant at the 5 % level and the EBITDA-margin variable becomes significant at the 10 % level. The OCF-ratio coefficient predicts a decrease of -0,2400 in Alpha and the Asset turnover ratio coefficient is estimated to increase Alpha by 0,6132. The EBITDA-margin coefficient is marginally negative and predicted to decrease the Alpha by -0,0002, which is

inconsistent with previous findings, (Barry *et al.*, 1990) and (Smith, 1990), as the coefficient is expected to be positive.

When analysing the 3Y Alpha regression the EBITDA-margin is still significant at the 10 % level but becomes significant at the 5 % level when the first difference regression is analysed. The Debt-to-Asset ratio variable is significant at the 10 % level for the first time and remains so when the first difference regression is analysed. The EBITDA-margin coefficient is estimated to decrease the Alpha by -0,2912 and the Debt-to-Asset ratio coefficient is estimated to decrease the Alpha by -0,1114, also inconsistent with previous findings, (Barry *et al.*, 1990) and (Smith, 1990).

The OFC-ratio becomes insignificant in the 3Y Alpha regression for the first time but becomes significant again when analysing the alternative model 3Y M^2- regression, at the 10 % level. The OCF-ratio coefficient is predicted to have a negative impact on the Alpha by -0,1216.

6.2.2.2 Non-backed regression results

From the non-backed regressions results presented in Appendix 5, the OFC-ratio is significant at the 10 % level when analysing the 1Y Alpha model and increase in the 2Y Alpha model to a significance level of 5 %. The OCF-ratio coefficient is estimated to decrease the Alpha by -0,0365 in the 1Y Alpha model and decrease the Alpha by -0,0405 in the 2Y model. The rest of the independent variables are insignificant.

The 3Y Alpha model conclude that the EBITDA-margin is significant at the 5 % level, for the first time. While, the OCF-ratio now becomes insignificant (this does not change when the first difference model is analysed). The EBITDA-margin coefficient is estimated to increase the Alpha by 0,0270 in the 3Y model.

6.2.3 The main differences & similarities among the PE-backed and the non-backed regression over the years analysis

Based on the regression results between the PE-backed and non-backed regressions, in Appendix 4 and 5. The Asset turnover ratio is significant for the PE-backed firms and insignificant for the non-backed firms. The Asset turnover coefficient is estimated to increase the Alpha for PE-backed firms with 0,4160 in the 1Y model and by 0,6132 in the 2Y model.

The OCF-ratio has similar significance between the PE-backed firms and non-backed firms but the coefficients for the PE-backed firms are considerably more negative. As the PE-backed OCF-ratio coefficient is estimated to decrease the Alpha by -0,270 in 1Y model and by -0,2400 in the 2Y model. While, the non-backed OCF-ratio is calculated to decrease the Alpha by -0,0365 in 1Y model and -0,04276 in the 2Y model.

The EBITDA-margin coefficient has similar significance between PE-backed and non-backed firms in the 3Y model and the main difference is that the PE-backed regression has a negative coefficient, estimated at -0,2912, having a negative impact on the Alpha. While, the non-backed 3Y regression has a positive EBITDA-margin coefficient calculated to 0,0270 implying a positive impact on the Alpha.

The Debt-to-Asset ratio variable is significant at the 10 % level in the 3Y model, while the equivalent variable is insignificant in the non-backed 3Y model. The Debt-to-Asset ratio coefficient is estimated to -0,1114, implying a negative impact on the Alpha. The Asset turnover (proxy for asset usage efficiency) is significant for the PE-backed firms is consistent with previous findings of (Smith, 1990), as the private equity firm would have increased the operating performance measures of the IPO firm. The OCF-ratio for PE-backed firms vis-a-vis to non-backed firm are similar, which is inconsistent with previous findings of (Barry *et al.*, 1990) and (Smith, 1990), who find a higher OCF-ratio for PE-backed firms. However, the

coefficients are expected to be positive and thus, partly inconsistent on that basis with (Barry *et al.*, 1990) and (Smith, 1990).

Similar results would be expected of the EBITDA-margin (proxy for profitability) but there seems to be only small difference between the PE-backed and non-backed firms, which is inconsistent with previous findings of (Barry *et al.*, 1990) and (Smith, 1990) and the coefficient are expected to be positive for the PE-backed regressions. Nonetheless, the Debt-to-Asset ratio (proxy for leverage) is significant at the 10 % level for PE-backed firms which is consistent with previous findings of (Barry *et al.*, 1990) and (Smith, 1990).

7 Conclusions

This paper aims to analyse the long-term value creation of Private Equity firms by comparing the three-year aftermarket performance utilizing the post IPO performance of PE-backed vis-à-vis non-backed IPOs in the Nordic countries between 2001 and 2016. Moreover, this paper aims to analyse whether certain PE related firm characteristics drive stock performance and if there is any sizable difference relative to non-backed firms.

The Student's t-test conclude that the PE-backed post IPO performance is different from non-backed stock performance when allowing for unequal variance among the subsamples. The Alpha measure is significant at the 5 % level in Y2, with a mean difference between PE-backed and non-backed of 17,05 %, and at the 10 % level in Y3, with a mean difference of 11,95 %. These findings are consistent with previous findings of (Ritter, 2009), (Bergstrom, Grubb and Jonsson, 2007). The rest of the performance measures only give indicative results. Thus, the conclusions in this paper is partly consistent with previous findings within the Private Equity field of studies, (Ritter, 2009), and inconsistent with the Efficient Market Hypothesis.

The regression results conclude that the main difference in terms of firm characteristics between PE-backed and non-backed firms is the Asset turnover (proxy for asset usage efficiency) as well as the Debt-to-Asset ratio (proxy for leverage). The Asset turnover coefficient is estimated to increase the Alpha for PE-backed firms with 0,4160 in the 1Y model and by 0,6132 in the 2Y model. While, the Debt-to-Asset ratio coefficient is estimated to -0,1114, in the 3Y model, implying a negative impact on the Alpha. Based on previous literature the coefficients are expected to be positive and thus partly in line with findings of (Barry *et al.*, 1990) and (Kaplan, 1989). However, the EBITDA-margin (proxy for profitability) and OCF-ratio (proxy for liquidity) is similar among the PE-backed and non-backed firms, which is inconsistent with previous results of (Barry *et al.*, 1990) and (Kaplan, 1989).

To conclude, the results of this paper are partly in line with previous studied conducted within the field of Private Equity. Despite, some performance measures in the regression models having negative coefficients and not all the t-tests performed being significant.

8 Limitations

Limitations to this study include the difficulty in separating the Private Equity backed IPOs and the Venture Capital (VC)-backed IPOs, as most platforms don't disclose vendor names or several vendors. This implies that there is a difficulty in separating a PE-backed IPO from a VC-backed IPO, especially if there are several vendors. To mitigate this, manual searches were made to determine if the vendor was a PE or VC company but many times no search results were found forcing me to trust the database. Moreover, if there is an overlap between VC and PE firms this distinction becomes more difficult and could impact the conclusions of this study. The dataset collected from Zephyr is most likely affected by the documented "underreporting bias" by Private Equity transactions, as discussed by (Strömberg, 2008)

resulting in the PE-backed IPO sample dataset being incomplete. When calculating the stock performance the end of the day price is used in an attempt to mitigate the IPO under-pricing phenomenon (Barry, Muscarella and Vetsuypens, 1991).

9 Further studies

Further studies relating to Private Equity could include a focus on the difference between PE-backed firms in the Nordic countries and if there are any differences vis-à-vis i.e. US or UK firms given the corporate culture differences. Furthermore, other studies could include sector specific analysis relating to PE-firms and their performance with relations to non-backed firms.

10 Appendices

10.1 Appendix 1

10.1.1 Descriptive Statistics – Aftermarket performance (Table 1-3)

The table presents the post IPO performance of the two subsamples as well as combined. Table 1 presents the on-year aftermarket performance, table 2 and table 3 describe the two-year aftermarket performance and three-year aftermarket performance, respectively. PE denotes private equity backed firms while NB denotes the non-backed firms.

One-year performance (Table 1)			
	All	**PE**	**non-Backed**
Average Alpha (Equally-weighted)	10,88%	15,63%	9,21%
Average Alpha (Value-weighted)	0,02%	0,32%	-0,08%
Median Alpha	8,28%	18,03%	6,12%
Std. Deviation (Equally-weighted)	7,73%	42,99%	20,96%
Average Sharpe Ratio	3,23	2,99	3,30
Average M^2	8,94%	9,97%	8,63%
Two-year performance (Table 2)			
	All	**PE**	**non-Backed**
Average Alpha (Equally-weighted)	19,34%	31,97%	14,92%
Average Alpha (Value-weighted)	0,15%	0,78%	-0,05%
Median Alpha	18,67%	34,44%	12,42%
Std. Deviation (Equally-weighted)	36,78%	58,65%	26,39%
Average Sharpe Ratio	5,02	7,00	4,33
Average M^2	14,13%	18,61%	12,59%
Three-year performance (Table 3)			
	All	**PE**	**non-Backed**
Average Alpha (Equally-weighted)	26,93%	35,78%	23,83%
Average Alpha (Value-weighted)	0,19%	0,73%	0,003%
Median Alpha	29,95%	40,26%	24,99%
Std. Deviation (Equally-weighted)	32,99%	62,59%	26,27%
Average Sharpe Ratio	7,06	8,55	6,56
Average M^2	20,92%	21,30%	20,79%

10.2 Appendix 2

10.2.1 T-test between the subsamples aftermarket performance (Table 4-6)

The tables present the initial results from Student's t-test for difference in mean post IPO performance between the two subsamples. Table 4 describe the t-test for the mean Alpha performance, table 5 and table 6 describe the mean difference in Sharpe ratio and M^2, respectively. The p-value shows the significance level of the mean difference between the two subsamples. The null hypothesis is a two-tailed test if the mean performance is significantly different between the subsamples.

Student's t-test Alpha (Table 4)				
		1-Year Alpha	**2-Year Alpha**	**3-Year Alpha**
PE-backed IPOs	Mean	18,55%	34,11%	38,93%
	Mean Std. Error	0,0535461	0,074150	0,076425
non-backed IPOs	Mean	4,59%	12,79%	20,80%
	Mean Std. Error	0,03133	0,03698	0,04559

Observations		44	44	44
P-value		0,0296	0,0094	0,0456
Student's t-test Sharpe ratio (Table 5)				
		1-Year Sharpe Ratio	**2-Year Sharpe Ratio**	**3-Year Sharpe Ratio**
PE-backed IPOs	Mean	3,0405	8,0959	9,3523
	Mean Std. Error	1,16962	1,68754	1,732688
non-backed IPOs	Mean	2,1866	4,0776	4,6726
	Mean Std. Error	0,88955	0,97902	1,083538
Observations		51	45	44
P-value		0,5727	0,0443	0,0362
Student's t-test M^2 (Table 6)				
		1-Year M^2	**2-Year M^2**	**3-Year M^2**
PE-backed IPOs	Mean	12,53%	23,92%	23,95%
	Mean Std. Error	0,02676	0,03855	0,04708
non-backed IPOs	Mean	6,54%	13,41%	16,39%
	Mean Std. Error	0,02434	0,02737	0,03090
Observations		51	45	44
P-value		0,1171	0,0330	0,2207

10.3 Appendix 3

10.3.1 T-test between the subsamples aftermarket performance assuming unequal variance and unpaired data (Table 10-12)

Similar t-test as above with the difference being that the two subsamples are assumed to have unequal variance and allow for unpaired data as the observations between the groups are different.

Student's t-test Alpha (unpaired & unequal variance) (Table 10)				
		1-Year Alpha	**2-Year Alpha**	**3-Year Alpha**
PE-backed IPOs	Mean	15,63%	31,97%	35,78%
	Mean Std. Error	0,0511492	0,063882	0,067020
non-backed IPOs	Mean	9,21%	14,92%	23,83%
	Mean Std. Error	0,01679	0,02055	0,02193
Observations (combined)		212	212	212
P-value		0,2377	0,0134	0,0948
Student's t-test Sharpe ratio (unpaired & unequal variance) (Table 11)				
		1-Year Sharpe Ratio	**2-Year Sharpe Ratio**	**3-Year Sharpe Ratio**

PE-backed IPOs	Mean	2,9920	6,9978	8,5463
	Mean Std. Error	1,09813	1,55860	1,530468
non-backed IPOs	Mean	3,3022	4,3323	6,5567
	Mean Std. Error	0,48872	0,55765	1,69159
Observations (combined)		234	214	213
P-value		0,7970	0,1120	0,3843

Student's t-test M^2 (unpaired & unequal variance) (Table 12)				
		1-Year M^2	**2-Year M^2**	**3-Year M^2**
PE-backed IPOs	Mean	12,29%	22,61%	22,51%
	Mean Std. Error	0,02512	0,03374	0,04079
non-backed IPOs	Mean	8,63%	12,59%	20,79%
	Mean Std. Error	0,01223	0,01475	0,05063
Observations (combined)		234	214	213
P-value		0,1933	0,0081	0,7916

10.4 Appendix 4

10.4.1 The regression model with the independent variables in natural logarithm format

The table shows the regression results from the PE-backed firm characteristics. The first column is the independent variables, the second third and fourth display the correlation coefficient for the regressions performed. The standard errors are the robust standard errors of the regression. The * indicates 10 % significance, ** indicates 5 % significance and *** is significance at 1 % level.

Variables		**1-Year Alpha**	**2-Year Alpha**	**3-Year Alpha**
EBITDA-margin	Mean	-0,0001	-0,0002*	-0,2912**
	Std.error	0,01075	0,01384	0,21732
Asset Turnover	Mean	0,4160*	0,6132**	0,4122
	Std.error	0,27348	0,31979	0,33585
Debt-to-asset ratio	Mean	-0,0051	-0,0038	-0,1114*
	Std.error	0,00410	0,00478	0,05903
Sales	Mean	0,0000	0,0001	0,0273
	Std.error	0,00001	0,00001	0,05680
OCF-ratio	Mean	-0,2730*	-0,2400**	-0,1216
	Std.error	0,15518	0,12942	0,12526
Constant	Mean	-0,1304	-0,5001	-0,2409
	Std.error	0,30937	0,59572	0,79011
Observations (combined)		234	212	212
R2		0,1324	0,1348	0,2560

10.5 Appendix 5

10.5.1 The non-backed regression model with independent variables in natural logarithm format

The table shows the regression results from the non-backed firm characteristics. The first column is the independent variables, the second third and fourth display the correlation coefficient for the regressions performed. The standard errors are the robust standard errors of the regression. The * indicates 10 % significance, ** indicates 5 % significance and *** is significance at 1 % level.

Regression results				
Variables		**1-Year Alpha**	**2-Year Alpha**	**3-Year Alpha**
EBITDA-margin	Mean	0,0441	0,0191	0,0270**
	Std.error	0,02724	0,02074	0,03797
Asset Turnover	Mean	0,0396	-0,1920	0,0499
	Std.error	0,13695	0,12437	0,13399
Debt-to-asset ratio	Mean	0,0257	-0,4126	-0,0665
	Std.error	0,11598	0,12482	0,12715
Sales	Mean	0,1141	0,1774	-0,0052
	Std.error	0,10669	0,10008	0,10572
OCF-ratio	Mean	-0,0365*	-0,0405**	0,0128
	Std.error	0,04587	0,04276	0,01278
Constant	Mean	-0,3453	-1,2131	0,1251
	Std.error	1,09215	1,10170	1,09675
Observations		179	157	157
R2		0,0646	0,1932	0,6814

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Place des Doyens, 1 bte L2.01.01, 1348 Louvain-la-Neuve, Belgique **www.uclouvain.be/lsm**

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