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Abstract

Private equity companies have become a major force in the economic landscape. Financial- and operational-engineering are innovative characteristics of this emerging method of finance. The existing empirical data provide strong evidence that private equity activity contribute positively to the rapid growth of companies. In this paper probability of private equity funded buyouts in the Nordic market is investigated. Operationally this is done by applying a logit model on a number of firm specific accounting measures. The main finding is that it is the dynamics of these variables in the target firms that are important for potential buyouts. That is, the growth measured as change in employees, change in the debt equity level, and the change in EBITDA margin, all have a significant effect on the probability of being bought by a private equity firm.

Keywords: Private equity, buyouts, performance, logit model

JEL codes: G34 G32

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1. Introduction

Private equity companies have become a major force in the economic landscape. Financial- and operational-engineering are innovative characteristics of this emerging method of finance. The existing empirical data provide strong evidence that private equity activity contribute positively to the rapid growth of companies. In particular when studying factors such as sales, employment, investment, R&D expenditure and exports (see i.e. Kaplan and Strömberg 2008, Berg and Gottschalg 2003). The private equity industry, although established about 30 years ago has grown in importance for the economy in Sweden as well as in Europe. The Swedish Private Equity & Venture Capital Association (SVCA 2008) estimates that private equity owned companies account for 11% of GDP and employs more than 170 000 people, which equals 4% of the total employment rate. By the end of 2008, over 465 billion SEK was managed by private equity companies. Of the total investments 80 % were buyout investments and the remainder was venture capital investment. Sweden and UK are accordingly the two major private equity investors in Europe. Worldwide it is only USA that invests more than Sweden and UK. According to Kaplan and Strömberg (2008) private equity is highly sensitive to business cycles and market volatility.

This paper investigates the determinants of private equity funded buyouts in the Nordic market and estimate the probability of being bought by a private equity firm. The seven largest private equity companies in the Nordic market are investigated, Altor, Capman, EQT, IK Investment partners, Nordic Capital, Ratos and Segulah. A logit model is used to predict the binary outcome of a buyout with employees, leverage, return on total capital (Rota) and EBITBA margin as explanatory variables.

The paper is organized as follows: Section two gives a brief review of the literature about private equity companies and theories concerning capital structure along with the hypotheses used in the empirical analysis. A description of data and the method are provided in the section three. The result of the econometric analysis is presented in section four. The final section five provide conclusions and some suggestions for further investigation.

2. Background

According to the Swedish Private Equity & Venture Capital Association (SVCA) risk capital is a collective expression of investments in firms. The investments are done in both public and non public firms. Private equity is a time restricted risk capital investment and usually implies a very active ownership. According to SVCA private equity companies can be further divided into buyout- and venture capital companies depending on which phase in the business cycle the companies in which they invest are facing. Venture capital stands for investments in small and medium sized growth companies with often negative or poor cash flows. Buyout capital is an investment with a substantial amount of associated indebtedness in more mature companies with strong cash flows (SVCA). According to the European Private Equity & Venture Capital Association (EVCA) private equity firms and buyout firms are synonymously used and will be so continuously in this text.

Private equity firms' focus is on investing in high-growth potential companies. The investments are thus not solely about capital but mainly about ownership, competence and networking. The private equity firm attempts to professionalize the company and offer on-going support to the management on strategic and policy matters. According to EVCA the private equity firms seek investment opportunities in firms where:

- The growth potential and market size can be accurately calculated.

- A competent and balanced management team has ability to strengthen the company with prior industry and entrepreneurial experience

- The internal processes of the company demonstrate good or strong potential around strategic and financial planning, corporate governance and reporting.

According to EVCA private equity firms invests in mature companies with strong cash flows and high growth potential. This implies that their aim is to strengthen the financials of the target company. Hereby, the theory points in the direction of positive and important outlook of the private equity firms. Section 2.1 continues with an overview of the empirical literature concerning private equity.

2.1 Previous research

Kaplan and Strömberg (2008) defines three sets of changes that private equity firms can induce in the firms in which they invest. They categorize them as financial -, governance-, and operational-engineering. Financial engineering is one of the most widely acknowledged levers applied by buyouts to create value. It refers to the optimization of capital structure and minimization of after tax cost of capital of the portfolio company. Governance engineering refers to the way that private equity investors control the boards and managements of their portfolio companies. Both governance and financial engineering were common in the beginning of the private equity industry's development. The most recent and innovative feature is called operational engineering which refers to specific industry expertise. This might imply that the private equity firm hires consultants who are experts in the particular industrial field. Organizational restructuring commonly takes place after a buyout, which provides a mechanism to enable more efficient use of the firm's resources (Muscarella and Vetsuypens, 1990).

Private equity investors are more actively involved in governance than boards of public companies. According to recent research by Archarya et al (2009) boards of private equity portfolio companies are smaller and have more formal meetings than comparable public companies. Cornelli and Karakas (2008) find that the role of the board is crucial in private equity companies and that studying the boards is a good way to see how private equity firms, that is the buyout firm, can be effective in restructuring a company.

Financial- and governance engineering changes within private equity was described by Jensen (1989) and Kaplan (1989). Kaplan found that the management ownership increased while going from public to private ownership. That is, in order to reduce the management's incentive to manipulate short-term performance, the management team is typically given a

large equity upside through stock and options so that management not only have a significant upside gain, but a significant downside as well.

With U.S. data from 1996 to 2004 Kaplan and Strömberg, 2008 show that the management team as a whole got 16% upside and the CEO got 5,4 % upside in stocks and options. The same pattern holds for United Kingdom where Archarya et al (2009) found that the management team gets 15 % and the CEO gets 3% upside. Since 1980's stock- and option based compensations has become more widely used in public firms, but management's ownership percentages are still greater in leveraged buyouts than in public companies (Kaplan and Strömberg 2008).

Leverage is another tool used to create pressure on the managers. Because of the interest and principal payments of the debt the managers cannot afford to waste money in projects with returns lower than the cost of capital. Jensen (1986) described this as the "free cash flow" problem. This means that rather than returning funds to the shareholder, the management team in mature industries with weak corporate governance has many ways in which they can disperse those funds. On the other hand, financial distress may arise due to a high leverage because of the inflexibility of the required payments (Kaplan and Strömberg 2008).

If leverage is an important factor, it is in contrast to what Modigliani-Miller argued (1958):

" The market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate r_E appropriate to its class."
(Modigliani. Miller 1958)

That is, a firm's debt-equity ratio does not affect its market value. A more detailed discussion of the Modigliani-Miller theorem is given in section 2.2.

Wright et al. (2001) show that most of the value creation in LBOs can be attributed to operational improvements. Enhanced operational effectiveness can be achieved in several areas. It is common that cost reduction programs are initiated after a buyout (Muscarella and Vetsuypens 1990). These measures lead to, for example, considerable enhancement in plant productivity (Lichtenberg and Siegel 1990; Harris et al. 2005; Amess 2002). Further, decreasing overhead costs is important for improving overall efficiency. This is achieved by, for example, reducing the size of corporate staff, creating better mechanisms of communication, and enabling quicker decision making, leading to less bureaucracy in the target firm (Easterwood et al. 1989).

Leverage buyouts, takeovers, corporate breakups, divisional spin-offs and going private transactions are organizational innovations which should be encouraged according to Jensen (1989). The rationale behind this argument is that these events reduce agency problems: the conflict between managers and owners, which according to Jensen is the central weakness of large public corporations. By resolving these weaknesses and through a combination of high financial leverage and powerful incentive schemes the companies can make substantial gains in operating efficiency, employee productivity and shareholder value. The increased

management ownership thus provides strong incentives for managers to improve operating performance and generate cash flows.

Kaplan (1989) presents evidence on improved operating performance of 48 large management buyouts of public companies completed between 1980 and 1986. Consistent with Jensen's hypothesis, he finds evidence of operating changes were the buyout firms experienced increases in operating income, decreases in capital expenditures, and increases in net cash flow. Different explanations for the operating changes and value increases are considered. First, the median change in employment for the buyout firms is positive, which do not support the view that investors benefit from large employment cuts. Second, the evidence favors reduced agency costs rather than superior managerial information as an explanation for the operational changes. The evidence thus suggests that the operational changes are due to improved incentives rather than layoffs and managerial exploitation of shareholders through inside information. With a sample of 58 management buyouts between 1977 and 1986 Smith (1990) also finds that operating cash flows both per employee and per dollar of book value of assets increased on average after an management buyout due to better working capital management. Smith finds little evidence that the post-buyout cash-flow improvements are driven by cutbacks in discretionary expenses. The increases in operating cash flows were correlated with the buyout-induced changes in debt ratios and management ownership, suggesting that these organizational changes play an important role in value creation in LBOs.

Lichtenberg and Siegel (1990) examine post-buyout changes using plant-level data for 1200 leveraged buyouts between. They find that, for leveraged buyouts during 1983-1986, productivity is significantly higher in the first three years after the buyout than in any of the eight years before the buyout. Plant productivity increased from 2% above industry mean in the three pre-buyout years to 8% above industry mean in the three post-buyout years. Moreover, the authors examined the impact of leveraged buyouts on R&D and confirm the finding of previous studies that leveraged buyouts targets are much less R&D-intensive than other firms. They provide two reasons. First that leveraged buyouts targets tend to be in non-R&D-intensive industries and secondly that their R&D-intensity tends to be below the industry average.

Given private equity companies' incentives to exit deals, it might be possible that they promote policies that boost short-term performance at the expense of more sustained long-term growth (Schleifer and Summers, 1988). Challenging this statement Lerner et al (2008) investigate investments in innovation as measured by patenting activity. They analyze the changes in patenting behavior of 495 firms with at least one successful patent application filed in the period from three before to five years after being part of a private equity transaction. Their main finding is that firms pursue more influential innovations, as measured by patent citations, in the years following private equity investments

By examine a large number of Swedish listed firms Bjuggren et al (2008) confirms, that both domestic and foreign institutional owners positively influence firm performance. The only research looking particularly on Swedish private equity companies is Bergström et al (2007),

which investigates the operating impact and value creation of buyouts in Sweden. In line with theory they find that the true operating impact in buyout companies is significantly positive when using Ebitda margin and return on invested capital (ROIC) as operating measurers. No evidence is found suggesting that the firm value is created by the breach of implicit contracts, facilitated by the buyout. Instead, contrary to theoretical literature and popular allegations, their findings suggest that employment and wage levels in buyout companies have developed in line with the peer groups. The results also indicate that changes in wage and employment levels, leverage, management shareholdings, and the type of buyout has a limited explanatory power on operating impact.

But how do the private equity firms single out the target companies? As there are no empirical studies done in this area this paper contributes by analyze data from the seven largest private equity companies in the Nordic countries. A overview of the existing literature is presented in table 1.

Table 1. Summary overview of the empirical investigations on the effects of buyouts.

Author	Land	Years	Main findings
Kaplan and Strömberg (2008)	US	1970-2007	Strong evidence that private equity activity creates economic value on average.
Bjuggren, Eklund and Wiberg (2008)	Sweden	1999-2005	Institutional ownership positively influences firm performance.
Bergström et al (2007)	Sweden	1998-2006	Operating impact on buyout companies is significantly positive.
Archarya and Kehoe (2009)	UK	1996-2004	Significant value creation for portfolio companies
Cornelli and Karakas (2008)	UK	1998-2003	The role of the board is crucial in private equity.
Lerner, Sorensen and Strömberg (2008)	US	1980-2005	No evidence that LBOs are associated with a decrease in innovation investments.
Harris, Siegel and Wright (2005)	UK	1994-1998	MBOs reduce agency costs and enhance economic efficiency
Amess (2002)	UK	1986-1997	MBOs leads to improved firm-level activity via reduced agency cost, debt bonding and monitoring by buyout specialists.
Wright (2001)	US/UK	1989-1995	Most of the value creation in LBOs can be attributed to operational improvements
Lichtenberg and Siegel (1990)	US	1981-1986	Productivity is significantly higher in the first three years after the buyout than in any of the eight years before the buyout

2.2 Capital structure and the Modigliani – Miller theory.

The Modigliani-Miller Theorem (henceforth M-M) is a cornerstone of modern corporate finance and the underlying base for research about the capital structure of firms. The Theorem consists of four separate statements from a series of papers (1958, 1961, and 1963).

Their first paper “The Cost of Capital, Corporation Finance and the Theory of Investment” (1958) states the first proposition that under certain conditions, a firm’s debt-equity ratio does not affect its market value.

Derived from this first proposition (or theorem 1) the second proposition establishes that a firm’s leverage has no effect on its weighted average cost of capital i.e., the cost of equity capital is a linear function of the debt-equity ratio. Prior to M-M’s path breaking work, it was generally believed that the shareholders would demand a substantial premium in order to hold a company’s shares once its debt equity level had passed some critical value. This would imply that the return on a firm’s shares would rise exponential after some debt equity level. By the M-M assumptions, however, the return on a firm’s shares rises linear with the debt equity ratio. The underlying assumption is that individuals can both buy and sell riskless debt (Mueller 2003).

The third proposition establishes that firm market value is independent of its dividend policy. That is the shareholders are indifferent to the decisions whether to reinvest an additional sum of funds or pay it out as dividends.

The fourth proposition shows why equity-holders are indifferent about the firm’s financial policy. Again, assuming that there are no transaction costs.

The M-M theorems are as mentioned based crucially however on a series of strong assumptions. In their original work, Modigliani and Miller (1958) makes the following assumptions:

1. Capital markets are perfectly competitive.
2. Individuals and firms can borrow and lend at the risk-free rate r .
3. All firms are assumed to be in the same class risk.

Assumption 1 implies no transaction costs and no restriction on asset trade, i.e., long and short positions are possible at zero cost and further that market investors have full (and symmetric) information concerning the return of the firm. Assumption 2 means that when firms or households borrow, they are not subject to default risk so that they can borrow and lend at the risk free rate. Assumption 3 means that the stream of EBIT is the same for all firms in the same class risk; if two firms, one leveraged and one unleveraged belong to the same class risk, then, they differ only with leverage.

With these assumptions in mind it is not surprising that Modigliani-Millers’ propositions have been exceedingly debated ever since their publication. First of all a risk-free interest rate does not exist in the sense that investors can borrow or lend at the same rate. More remarkable is that in order to fulfil these criteria it follows a hidden statement, which implies that the ownership and leadership structure must be identical among all firms. This is of course an unrealistic assumption, which in fact invalidates the purpose of the whole private equity industry, which has one of its main objectives and business ideas to professionalize the buyout firm’s management. That is, the incentives for the private equity firms lies more or less in the assumptions. So as theory suggests (Cumming et al 2007 and Kaplan and

Strömberg 2008), corporate takeovers, especially LBOs, results in a more efficient use of the firm's resources. Even though these findings were not meant to be counter-evidence of Modigliani-Miller, it does support the fact that the capital structure does matter when the M-M assumptions do not hold*.

2.3 Hypotheses for the empirical investigation

Based on the theory and the literature review, four hypotheses are formulated for the empirical analysis.

Because private equity companies want to maximize their profit, they will constrain overall costs of the buyout firm, which can be decreased by a reduction of the corporate staff and the labor force in the post-buyout firm. As discussed previously recent theories (Bergström et al 2007, Kaplan and Strömberg 2008) implies that buyouts are positively related with firm performance. That is, private equity firms seek investment opportunities in companies where the marginal profits could be improved. The M-M theorem provides little guidance on what can be expected about this; therefore hypothesis 1 is based on recent research on private equity companies. Hypothesis 1 implies a negative relationship between the probability of being bought and EBITDA margin.

Hypothesis 1: The probability of being bought out by a private equity firm increases as the target company's EBITDA margin decreases.

Because the private equity companies according to EVCA, and suggested by Bergström et al 2007, invests in mature companies with growth potential it is expected that the level of employment is positively related to probability of a buyout. Number of employees are in this context used as a proxy for firm size and change in employment is a proxy for firm growth. Hypothesis 2 states that private equity companies will invest in relatively large companies. Hypothesis 3 states that growth in terms of employment will be positively related to the probability of buyout.

Hypothesis 2: The probability of being bought out by a private equity firm increases with the firm size

Hypothesis 3: The probability of being bought out by a private equity firm increases as the change in the number of employees is positive

Although the M-M theorem shows how debt/equity level is irrelevant for the value of the firm, previous empirical studies suggest that Private equity firms are likely to invest in companies with a low debt/equity ratio. As argued in the theory section (i.e. Bergström et al 2007, Kaplan and Strömberg 2008), it is likely that the debt/equity ratio matter when many of the buyouts are leverage buyouts, which implies that the transaction is financed by debt usually secured by the buyout firms' assets or future cash flows.

Hypothesis 4: The probability of being bought out by a private equity firm is negatively related to the debt level.

Section four now continues with a presentation of the method used to test the hypotheses, description of the data and definitions of the variables.

* Because of the importance of the M-M theorem 1 for the empirical investigation of this study, a mathematical derivation of the M-M theorem and the proposition that leverage does not influence value is provided in appendix 4.

3 Variables, Data and Method

A logit model is used in order to predict the probability of being bought by a private equity company. This type of regression is used for binary-outcome variables, and superior to OLS-regression, where the linear relationship between the explanatory variables and one dependent variable is estimated. In the logit model, the interpretation is that the slope (β_2) measures the change in L, the logit, for a unit change in X. That is, it tells how the log-odds in favour of being bought by a private equity firm changes as for example debt/equity changes by one unit. Before presenting the model in more detail the following section defines the data and the variables.

3.1 Data

The sample consists of 51 firms, which have been bought out by one of the seven largest private equity companies[†] in the Nordic market from 1999 to 2007. The sample is restricted to firms that had data available for at least three years. The data set consists of a panel of 571 observations. All financial data is from the Bureau van Dijks database Amadeus. In order to compare, a peer group consisting 57 firms that have not been bought by private equity firm has been constructed. The companies in the peer group have been sort out by the NACE rev 2 code[‡], the geographic area, that is the Nordic market, and then by corresponding operating revenue.

3.2 Variables

A buyout is followed by a set of changes in the post buyout firm. Unfortunately, many of the changes, such as strategic refocusing are difficult to measure and hence not included. In order to count for industry specific factors, dummy variables bases on the 2-digit NACE rev codes are however included.

Following Bergström et al (2007) the chosen variables are *EBITDA* margin (earnings before interest, taxes, depreciation of tangible assets, and amortization of intangible assets divided by sales), return on total asset (*ROTA*), profit/loss and growth in operating revenue. Prices in the buyout universe are often quoted in terms of multiples of *EBITDA* and it is therefore a highly relevant variable when measuring the probability of a buyout. According to Barber and Lyon (1996) it is preferable to use a measure of operating income rather than earnings. Operating income measures, more correctly than earnings, the productivity of operating assets. Since the assumption that the capital structure is changed after a buyout, that will have an effect on interest expenses and therefore earnings, but not operating income. Number of employees is used as a proxy for firm size. Employment in terms of size is of particular interest compared to other size variables such as total assets and sales, this because many studies deals with the question whether buyouts are followed by positive or negative changes in employees. The variables are described in detail in Table 2.

[†] The seven largest private equity companies in the Nordic market are without relative order: Altor, Segulah, Capman, EQT, IK Investment Partner and Ratos

[‡] The industrial codes are based on NACE rev.2 which is a statistical classification system of economic activities the European Community.

Table 2. Description of Variables

<i>Variable</i>	<i>Definition</i>
Probability of Buyout dummy_t (P)	Dummy variable for being owned by a private equity firm at time t, 1 if owned and 0 if not owned. Represents the Dependent variable.
Employees (Empl)	Number of full time employees of the company. Used as a proxy for firm size.
Rota	Return on total assets EBIT/TA [§]
Debt/equity (D/E)	The leverage ratio = Total debt / total equity funds
EBITDA margin (Ebitda m)	Earnings before interest, taxes, depreciation of tangible assets, and amortization of intangible assets/sales
Ind 1-22	Dummy variable representing industrial codes based on NACE rev 2.

A correlation matrix with the variables used in the empirical investigation is provided in Appendix 2. The variables used in the empirical models are employees, debt/equity, EBITDA margin, and industry dummies. ROTA replaces EBITDA as a test of robustness when analysing the importance of operating variables. Summary statistics of the variables used are provided in Table 3.

Table 3. Summary statistics, complete dataset. Buyouts firms and peer group firms.

<i>Variable</i>	<i>Observ</i>	<i>Mean</i>	<i>Median</i>	<i>Std. Dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>
Empl	708	823.9	285.5	2341	3	21391	6.292
Rota	708	0.103	0.904	0.123	-0.414	0.660	0.466
D/E	708	0.650	0.653	0.183	0.118	1.227	-0.257
Ebitda m	708	0.095	0.828	0.094	-0.503	0.563	0.8123
ΔEmpl_{t-1}	487	0.084	0.028	0.254	-0.607	2.194	3.215
ΔRota_{t-1}	487	0.689	-0.062	17.30	-79.61	307.1	12.196
ΔD/E_{t-1}	487	0.032	-0.007	0.380	-0.803	4.830	7.849
ΔEbitda m_{t-1}	487	0.293	-0.027	5.221	-42.612	80.67	8.652

The number of employees, which proxy for firm size, is apparently dispersed and skewed. The skewness is 6.292 see Table 3. The wide range in the number of employees reflects both the buyout companies before and after the buyout and the respective peer group's number of employees. The minimum and maximum number of employees indicate that the target company's size in terms of employees range from small- to very large firms (min 8 and max

[§] ROTA (return on total asset) is a measurement of company performance and assesses the operating efficiency of the total business. The method of calculating is EBIT/TA. EBIT is the amount remaining when total operating cost is deducted from total revenue, but before interest or tax have been paid.

21391, Table 3). The low number of employees reflects in some cases a parent holding company, that is the company with a low number of employees but on the other hand the more capital intense part of the company. According to the mean value of employees in Table 4 (1335), it seems to be relatively large companies that are targets for buyout. On the other hand the average change in employees is about 8 percent, which implies that both groups have a positive development in number of employees. Table 4 presents summary statistic for the buyout firms and Table 5 for the peer group firms.

Table 4. Summary statistics Buyout companies

<i>Variable</i>	<i>Observ</i>	<i>Mean</i>	<i>Median</i>	<i>Std. Dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>
Empl	269	1335	499	3340.376	8	21391	4.722
Rota	269	0.096	0.867	0.105	-0.174	0.608	1.061
D/E	269	0.657	0.657	0.183	0.128	1.227	-0.096
Ebitda m	269	0.098	0.090	0.082	-0.141	0.562	1.285
ΔEmpl_{t-1}	168	0.110	0.033	0.285	-0.607	2.194	3.578
ΔRota_{t-1}	168	-0.864	-0.065	6.271	-69.109	10.777	-8.661
ΔD/E_{t-1}	168	0.062	-0.009	0.484	-0.803	4.830	6.326
ΔEbitda m_{t-1}	168	-0.151	-0.042	4.480	-42.612	35.097	-2.271

The mean change in employees is positive, on average 11 percent (Table 3) and supports the hypothesis that private equity companies invest in growing companies. This implies that the mean change in employees was 11 percent one year before the buyout. The negative mean value of the change in the operating statistics ROTA -0.864 and EBITDA margin -0.151 (Table 4) are somewhat surprising. This implies that the companies on average have had a negative performance one year before the buyout. This is a further indication that there must be something beyond these variables that are interesting for the private equity firms when evaluating the target companies. Most likely it is connected to the governance engineering which is unfortunately not measurable in this study and empirical setting.

Table 5. Summary statistics Peer group

<i>Variable</i>	<i>Obser</i>	<i>Mean</i>	<i>Median</i>	<i>Std. Dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>
Empl	434	503	218	1333.79	3	11213	5.984
Rota	434	0.106	0.094	0.132	-0.414	0.660	0.223
D/E	434	0.647	0.652	0.183	0.118	1.087	-0.352
Ebitda m	434	0.093	0.068	0.101	-0.503	0.537	0.667
ΔEmpl_{t-1}	318	0.070	0.022	0.235	-0.5	1.608	2.755
ΔRota_{t-1}	318	1.512	-0.069	20.890	-79.613	307.074	10.632
ΔD/E_{t-1}	318	0.015	-0.007	0.311	-0.496	4.380	9.160
ΔEbitda m_{t-1}	318	0.530	-0.023	5.572	-8.037	80.667	11.473

The average number of employees in the peer group is lower than for the buyout group see Table 5. The mean number of employees is 503 for the peer group firms (Table 5) compared

to 1135 employees for the buyout firms (Table 4). One reason for this difference might be that the peer group were selected by the comparing operating revenue and hence not by the number of employees. This group has in contrast to the buyout group positive signs in the change in the operating performance measurers. The leverage ratio is approximately the same, but the change in the leverage ratio differs across the groups.

3.3 The Logit Model

To test the probability of being bought by a private equity company empirically a logit model is used. A logistic regression model allows for an empirical assessment of the relationship between the binary outcome variable (regressand) and a group of predictor variables (Train, 2009). Equation 5 represents the logistic distribution function;

$$P_i = \frac{1}{1 + e^{-z_i}} = \frac{e^{z_i}}{1 + e^{z_i}} \quad (5)$$

Where P_i is the probability and ranges between 0 and 1. e is the base of the natural logarithm and $z_i = \beta_1 + \beta_2 X_i$. Hence it can also be written;

$$P_i = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_i)}} \quad (6)$$

P_i is nonlinear in both X and the β 's which implies that OLS cannot be used. Eq. 6 states the probability of a certain occurrence. Consequently the probability of the opposite occurrence is;

$$1 - P_i = \frac{1}{1 + e^{z_i}} \quad (7)$$

or stated as the odds ratio;

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad (8)$$

Where $P_i / (1 - P_i)$ represents the odds ratio in favour of a certain occurrence. In this study it represents the ratio of the probability that a firm is owned by a private equity company to the probability that the firm is not owned by a private equity firm.

Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). In this way, logistic regression estimates the odds of a certain event occurring.

By taking the natural log. L. of eq. 8;

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i \quad (9)$$

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2 X_i + \varepsilon_i \quad (10)$$

The log of odds ratio becomes linear in X and the parameters. L is called the logit and hence the name of Eq. 10 is the logit model (Gujarati, 2003).

Using the logit model the observation points on the y-axis are either 0 or 1. That is, the model predicts the shape of the curve based on where on the x-axis and the y-axis most of the observations are. Marginal effects are popular in disciplines like economics because they often provide a good approximation to the amount of change in Y that will be produced by a 1-unit change in X_i . In binary regression models, the marginal effect is the slope of the probability curve relating X_i to $P(Y=1|X)$, holding all other variables constant. Given the nonlinearity of the model, the slope is the average rate of change.

3.4 Empirical models

Four models are stated in order to test the hypothesis. First, in model 1, equation 11, the probability of being bought is estimated by lagging the independent variables so that the probability of being bought out at time t depends on the number of employees, the debt/equity ratio and EBITDA margin, at time t-1, one year before the buyout;

$$\ln\left(\frac{P}{1-P}\right)_t = \beta_1 + \beta_2 Emp_{t-1} + \beta_3 D/E_{t-1} + \beta_4 Ebitda_{t-1} + \varepsilon_t \quad (11)$$

If hypothesis 2 is true, model 1 will generate a positive relationship between the parameter β_2 and the dependent variable, that is the probability of being bought by a private equity company.

Second, if the private equity firm invests in growing companies it is relevant to check for the change in the variables. Thus in model 2 the employee variable, that in the first model is a proxy for firm size, is now defined as the change in employees. The change in employees is therefore no longer a stationary variable but rather a dynamic variable that measures the employment growth. The percentage change in t-1 and t-2 is tested in model number 2, equation 12;

$$\ln\left(\frac{P}{1-P}\right)_t = \beta_1 + \beta_2 \Delta Emp_{(t-1)} + \beta_3 \Delta D/E_{(t-1)} + \beta_4 \Delta Ebitda_{(t-1)} + \varepsilon_t \quad (12)$$

Model 3, equation 13, shows the average number of employees, debt/equity, and EBITDA margin over two years before the buyout. This specification is based on the assumption that the private equity company most likely analyses the target firm's financials over more than one year;

$$\ln\left(\frac{P}{1-P}\right)_t = \beta_1 + \beta_2 \text{AvgEmp}_{(t-1)} + \text{Avg}\beta_3 D/E_{(t-1)} + \text{Avg}\beta_4 E_{(t-1)} + \varepsilon_t \quad (13)$$

In the last model, model 4 equation 14, the operating variable EBITDA margin is replaced by ROTA.

$$\ln\left(\frac{P}{1-P}\right)_t = \beta_1 + \beta_2 \Delta \text{Emp}_{(t-1)} + \beta_3 \Delta D/E_{(t-1)} + \beta_4 \Delta \text{Rota}_{(t-1)} + \varepsilon_t \quad (14)$$

4 Regression result and analysis

Table 5 presents the results of the logit estimation with the different model specifications. Neither model 1 nor model 3 produce significant estimates. This implies that the real lagged numbers in model 1, and the average numbers over two years in model 3 are of little interest when specifying the determinants of a private equity buyout. The model with significant estimates is model 2, in which change in the variables between t-1 and t-2 were analysed. According to the results it is the change or rather the dynamics of the variables that is important and that an effect of the probability of buyout.

In model 2 employees has an odds ratio of 3.451 and is significant at the 1 percent level. For each percentage increase in the number of employees, there is a 245 percent increase in the odds effect^{**}. This means that for one percent increase in growth there is a 245 percent increase in the odds of being bought by a private equity firm. In order to simplify the interpretation the marginal effect can be calculated. Even though the marginal effect should not be interpreted literally because it represents the average rate of change, it is still a good way of explaining the results. Looking at the marginal effect in model 2, the probability of being bought by a private equity firm increases by 9.6 percent by one percent increase in

Table 5. Logit model Probability of buyout by Private equity companies between 1999-2008.

Variable	Model 1		Model 2		Model 3		Model 4	
	Odds Ratio	Marginal effect	Odds Ratio	Marginal effect	Odds Ratio	Marginal effect	Odds Ratio	Marginal effect
Empl _(t-1)	1.000 (0.404)	3.55e-06 (0.409)						
ΔEmpl _(t-1)			3.451*** (0.004)	0.096*** (0.004)			3.259*** (0.008)	0.092*** (0.007)
Avg. Empl _(t-1)					1.000 (0.429)	4.15e-06 (0.433)		
D/E _(t-1)	1.385 (0.705)	0.238 (0.706)						
ΔD/E _(t-1)			0.491* (0.063)	-0.055* (0.060)			0.492* (0.077)	-0.055* (0.071)
Avg. D/E _(t-1)					1.794 (0.601)	0.494 (0.601)		
Ebitda m _(t-1)	4.161 (0.484)	0.104 (0.481)					-	-
ΔEbitda m _(t-1)			0.867** (0.034)	-0.011** (0.027)				
Avg. Ebitda m _(t-1)					4.785 (0.562)	0.132 (0.560)		
ΔRota _(t-1)	-	-	-	-	-	-	0.966** (0.027)	-0.003** (0.019)
Industry dummy	Yes		Yes		Yes		Yes	
Pseudo R ²	0.029		0.074		0.039		0.067	
N	571		468		468		468	

Robust p-values in parentheses. *** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.

employees. This implies that the growth of size of a company (in terms of number of employees) is important for the probability of buyout. The result supports EVCA's proposition that private equity companies invest in growing firms. According to this result hypothesis 2 cannot be rejected. That is, a positive change in employment increases the probability of being bought out by a private equity firm. In the context of Model 2, it is the change in employees rather than the level of employees that is important.

^{**} When the odds ratio is more than 1, the interpretation can be simplified by subtracting 1 and multiplying by 100: $(3.451 - 1.00) * 100 = 245\%$.

The variable debt/equity in model 2 has an odds ratio of 0.491 at a 10 percent significance level. The odds of being bought by a private equity firm is multiplied by 0.491 for each additional unit of debt/equity. That is, for each percentage increase in the debt/equity the odds of being bought decreases by 50 percent. Interpreted as the marginal effect this means that for each one-unit increase in debt/equity there is a 5.5 percent decrease in the probability of being bought by a private equity firm. This result is in line with theory since many of the buyouts are leverage buyouts. Meaning that the transaction is financed by debt usually secured by the buyout firms' assets or future cash flows. The result is in line with the expectation of hypothesis 3 and can therefore not be rejected. Bergström et al (2007) did not, however, find any evidence that the buyout firms' increased debt equity level is related to the increased operating performance.

EBITDA margin has an odds ratio that is lower than one, 0.867^{††} at 5 percent significance level(see Table 5 model 2). This implies that the change in EBITDA margin has a negative impact on the probability of being bought. For each percentage increase in the change of EBITDA margin the odds of being bought by a private equity firm decreases by 13 percent. The marginal effect shows that for each unit increase in EBITDA margin the probability of being bought decrease by approximately one percent. The result cannot reject hypothesis 1 that the probability of being bought out by a private equity firm increases as the target company's EBITDA margin decreases. But this relationship does not explain that the operating values of the target firms are negative themselves but rather relatively lower than the firms that have not been targets for buyouts. The summary statistics (Table 4), however, showed that the mean change in both EBITDA margin and ROTA is negative while the mean change in employees is positive. It is thus likely that the target company has growth potential with unused resources.

In Model 4 EBITDA margin is replaced by ROTA to test the robustness of model 2. From hypothesis 2 it was expected that operating performance measures are valid in order to assess the probability of being bought out. ROTA has an odds ratio 0.966 at a 5 percent significance level. In order to calculate the decrease in the odds ratio we need to subtract the odds ratio from 1.00: $(1.00 - 0.966) * 100 = 3.4\%$. This means that for each of one unit ROTA, here percentage change in thousands of euro, the odds of being owned by a private equity firm decrease by 3.4 percent. Defined by marginal effect; the probability of being bought by a private equity firm decreases by 0.2 percent for each percentage increase in ROTA.

ROTA was included to verify the reliability of model 2 and to test an alternative operating performance measure. The change in employees and the change in the debt/equity level generates almost the same estimates in model 2 and model 4. This supports the validity of the explanatory variables.

4.1 Methodological issues and suggestion for further studies

A classification test was used to evaluate the predictive accuracy of the logistic regression model. The classification table is provided in appendix 3. Despite the significant variables,

^{††} When the odds ratio is lower than 1, the interpretation is made by subtracting the odds ratio from 1 and multiply by 100: $(1-0.867) * 100 = 13.3\%$

the model only predicts slightly better than without a model at all (The model predicts 90.38 percent accurately which improves the predictive accuracy with 0.6 percent compared to without a model). A likely explanation for this can be the fact that the dependent binary outcome variable includes substantially more zeros than ones. That is, the dataset is a panel which includes firm data for at least three years and up to nine years. The year in which the buyout was carried out is denoted with 1. Thereby there are more observations where the probability of buyout dummy is zero than one. In an attempt to circumvent this problem an aggregated model was tested. In this model formulation the years were aggregated in order to even up the zeros and the ones. This increased the accuracy of the model by 5 percent. The results are otherwise “qualitatively” unchanged but since the number of observations decreased to one fourth of the data set, the results are not presented but available upon request. It is, however, interesting for further studies when it apparently points in the direction that it is the change in the variables that is important.

Another factor that might influence the results is the fact that some of the buyout companies are parent companies, that is they may have one or more subsidiary companies. This might, due to accounting standards, cause problems such as the distribution of asset and debt and the number of employees in the parent company, which reflects the corporate staff in the parent company, rather than the number of employees for the whole group. This is a concern that should be controlled for in subsequent studies, for instance by only including data from the consolidated group. A second concern is about the peer group. It is possible that companies in the peer group are target companies and hence buyout objectives this year or in the nearby future. That is, it is possible that a firm in the peer group has been observed during a couple of years and is thereby a target company.

The fact that some of the buyouts were secondary buyouts might also affect the results. A secondary buyout is when the company is bought from another private equity firm. This implies that some of the companies were bought out already at time t-1. Meaning that financial restructuring already has been made. On the other hand, the large private equity companies, which are included in this study, must observe some potential in those companies and are hence still looked upon as target companies. Future research should control for primary and secondary buyouts.

One should also pay attention to the fact that this empirical study does not include the important implications of the operational- and governance engineering. Which according to Kaplan and Strömberg (2008) are two of three sets of changes that the private equity firm will induce in the portfolio firm. Even though it is not clear how large impact each type of change has. This study only includes parts of the financial implications. That might also be added as an explanation for the low explanatory power of the model.

5 Conclusion

The existing empirical data provide strong evidence that private equity activity contributes positively to the rapid growth of the portfolio companies. On the account of this, the aim of this paper is to assess the probability of being bought by a private equity firm. A panel of buyouts by the seven largest private equity firms in the Nordic countries and a corresponding peer group of non-buyout firms is used in the empirical investigation.

The main finding is that it is the change in the operating variables; employees, debt/equity and EBITDA margin that is important for the probability of buyout. More specific, the lower the change in the debt/equity ratio and EBITDA margin in period t-1 the more likely it is that a firm will be target for a buyout. For each percentage increase in the change of EBITDA margin the odds of being bought by a private equity firm decreases by 13 percent. Analysing the result for the debt/equity variable shows that for each percentage increase in the debt/equity the odds of being bought decreases by 50 percent. Interpreted as the marginal effect this means that for each one-unit increase in debt/equity there is a 5.5 percent decrease in the probability of being bought by a private equity firm. The change in employees is used as a proxy for firm growth and has a positive relation with the probability of being bought by a private equity firm. That is, the odds of being bought by a private equity firm increases by over 200 percent by each additional percentage increase in growth.

To sum up, target companies seems to be expansive firms in terms of a positive development in employees. At the same time the change in operating performance measures have a negative relation to the probability of being bought out. Thus the empirical result supports the existing theory that the private equity firms are looking for companies with great growth potential. It is also very likely that the operating- and governing- engineering have a great explanatory value in the probability of a buyout. Especially the governing engineering aspect is of great interest for future studies since it implies that ownership structure positively influences firm performance and that the role of the board is crucial in private equity.

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Appendix 1

Some of the buyouts were secondary buyouts, meaning that the companies were bought from another private equity firm. This might affect the results because the companies already were bought out at time t-1. On the other hand, the large private equity companies which are included in this study must still observe some potential in those companies and are hence regarded upon as target companies.

Almondy was bought from Smedvig Capita.

Minimax was bought from Investcorp.

Jötul was bought from Accent Equity partners.

Saferoad AS was bought from Reiten.

Komas was bought from Midinvest Management.

Contex was bought from EQT.

Q-Matic AB was bought from 3i and Iitorina.

Isaberg rapid AB was bought from Industrivärden.

MCC was bought from Candover.

Kabel Baden-Württemberg GMBH & co. kg was bought from Blackstone and CDPQ.

Thule AB was bought from Candover Investments.

Åkers AB was bought from STC Interfinance.

Anticimex AB was bought from Nordic Capita.

Appendix 2

Correlation Matrix absolute levels of variables.

	Prb Buyout	Empl.	D/e	Rota	Ebitda m	Cost of empl	Op.rev	P/L
Prb Buyout _t	1							
Empl.	0.063	1						
D/e	0.063	-0.122	1					
Rota	-0.022	-0.071	-0.380	1				
Ebitda m	0.0203	0.143	-0.354	0.625	1			
Cost of empl.	0.049	0.967	-0.128	-0.060	0.161	1		
Op.rev	0.066	0.777	-0.069	-0.058	0.119	0.813	1	
P/L	0.023	0.467	-0.197	0.150	0.317	0.569	0.514	1

Cost of employees, Operating revenue (op.rev) and Profit/Loss (P/L) were excluded due to correlation.

Correlation Matrix for change in variables.

	Empl	D/e	Rota	Ebitda m	Cost of empl	Op.rev	P/L
Empl	1						
D/e	0.071	1					
Rota	-0.073	-0.054	1				
Ebitda m	-0.055	-0.061	0.690	1			
Cost of empl	-0.035	0.017	-0.014	-0.010	1		
Op.rev	-0.005	0.004	-0.016	-0.006	0.799	1	
P/L	-0.005	-0.025	0.005	-0.000	-0.019	-0.018	1

Appendix 3
Classification table

		True		
Classified	D	-D	TOTAL	
+	3	0	3	
-	45	420	465	
Total	48	420	468	

Correctly classified : 90.38%

420 is the total number of zeros and the total numbers of ones is 48. Hence, the distribution is substantially skewed towards the number of zeros.

Appendix 4.

Derivation of M-M theorem 1

Let us first mathematically clarify an important assumption that firms can be divided into “equivalent return” classes. Meaning that, the return on the shares issued by a firm in any given class is proportional to the return of the shares issued by any other firm in same class. By this definition follows that in equilibrium (in a perfect capital market) in any given class the price of every share must be proportional to its expected return. Or consistently, the price per dollar’s worth of expected return must be the same for all shares of any given class. This factor of proportionality for any class, k is denoted as $1/\rho_k$, let p_j denotes the price and x_j the expected return per share of the j^{th} firm in class k :

$$p_j = 1/\rho_k \times x_j \quad (1)$$

Or equivalently:

$$x_j/p_j = \rho_k \quad (2)$$

The significance of this assumption is that it permits the classification of firms into groups within which the shares of different firms are homogeneous or perfect substitutes for one another.

Consider any firm j and let V_j denote the market value of the firm by the market value of its common shares, S_j and the market value of the firm’s debts, D_j :

$$V_j = S_j + D_j \quad (3)$$

The proposition states that there is equilibrium in:

$$V_j = (S_j + D_j) = x_j/\rho_k \quad (4)$$

That is, the market value of any firm is independent of its capital structure.

Imagine two firms that generate the same stream of operating income and differ only in the capital structure. Again left hand side S denotes the equity, V denotes the value of the firm and D the value of the firms’ debt. Firm 1 is levered and its stock value is equal to the value of the firm less the value of the debt: $S_1 = V_1 - D_1$. Firm 2 is unlevered, hence the value of its equity S is the same as the total value of the firm: $S_2 = V_2$. Proposition 1 says that V is a constant, regardless of the proportions of D and S , provided that the assets and growth opportunities on the left-hand side of the balance sheet are held constant. "Financial leverages" - that is, the proportion of debt financing - is irrelevant.