

Acknowledgements

Writing ones first research paper is like a long journey where you start without ever before having used a map and a compass. Our gratefulness goes out to those who have helped us through the perils on this journey. We want to express a

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mature PE industry, while Denmark and Norway have smaller and younger industries¹. In mid 2006 over 39 billion euro was managed in the Scandinavian countries. This is a growth of 44 % since 2003². Sweden accounted for 80 % of the managed capital in 2006, while Denmark and Norway only accounted for 6.5% and 12.5 % respectively. Norway is the Scandinavian country experiencing highest growth. Managed capital increased with as much as 160 % from 2003 to 2006. Even the financial crisis does not seem to stop this growth. In fact, the Norwegian PE industry experienced in 2008 the highest level of fundraising in its history³.

The PE industry is organized in the following way. The equity comes from outside investors as well as PE firms. PE firms are professionally managed partnerships, specializing in business and governance. The equity from the two types of investors is pooled into funds, which in turn invest the equity into a portfolio of private companies. The PE firm manages the funds as well as functioning as the owner of the portfolio companies. The outside investors are passive investors. Figure 1 shows the PE industry structure.

Figure 1 *PE Industry Structure*

gone through the first stages of development, like start-up and expansion stage⁵. LBOs are characterized by their financing of both equity and debt, and usually the PE firm buys out the current shareholders to become the majority owner⁶.

Our research question is “Are PE firms better owners?” With this research question we want to investigate whether PE firms actively select their portfolio companies, and whether the change to PE ownership has a positive effect on the value creation in the portfolio companies, compared to previous owners. In the analysis we further examine two main hypotheses; Jensen’s (1986) free cash flow (FCF) hypothesis and the underperformance hypothesis, among others based on research by Jensen and Meckling (1976) and Fox and Marcus (1992).

Our sample consists of portfolio companies in the three Scandinavian countries;

Finally, the results support the underperformance hypothesis for explaining both pre buyout selection and post buyout value creation in portfolio companies. The paper also indicates some differences between the PE industries in Norway and Sweden, possibly due to the differences in the maturity of the two industries.

1.1. Outline

The outline of this paper is as follows; first, we present relevant theory and research together with corresponding hypotheses. Thereafter, we describe how the sample was collected. Third, we present the methodology and the specific hypotheses tested in the analysis. Subsequently, we present the results of the analysis. Fifth, we provide a thorough discussion of the results. We also outline some of the limitations and propose suggestions for future research. Finally, we offer some concluding remarks for the paper.

2. Theory and Hypotheses

The objective with this chapter is to discuss with root in Jensen's (1986) free cash flow (FCF) hypothesis and the underperformance hypothesis⁸ the effect of PE ownership on value creation in their portfolio companies. In the discussion we provide empirical evidence from several previous PE studies, followed by

take the form of excess spending by the management, empire building or simply less effort spent on achieving good results¹⁰. Owning only a small part of a company may not make it worthwhile to reduce the risk of opportunism. If one owner uses time and resources on monitoring the company, the extra return from this activity is shared with other owners that have remained passive. This is called the free-rider problem¹¹. A result of the free-rider problem is that companies with fragmented ownership do not have active involvement by the owners, increasing

We use liquidity as a proxy for the risk of financial distress. Being that leverage is suggested as an important factor in post buyout gains, we further hypothesize that *H₄: Low leverage increases the probability of being bought up by PE firms*

2.1.2. Underperformance Hypothesis

Other PTP hypotheses include that undervaluation or asymmetric information held by the management increases the odds of being targeted for LBOs¹⁴. We consider the use of private information of most interest in MBOs, where the management taking over the ownership. Further, for private companies it is difficult to assess whether there existed any undervaluation of the company at the time of the buyout. Since the shares in a private company are illiquid, it is more likely that a company's performance is reflected in the price paid by the PE firm. This rather makes the hypothesis of underperformance interesting. This hypothesis states that fragmented ownership might lead to operating inefficiencies in public companies¹⁵. Even though this hypothesis is originally connected to public companies with fragmented ownership, we consider underperformance just as relevant for private companies with more concentrated ownership. Private or not, we expect the lack of sufficient corporate governance to increase the risk of agency problems, and that this may lead to underperformance.

According to Nikoskelainen (2006) an underperforming company is a company that has lower operating and cost efficiency than industry peers. In such cases, he argues, LBOs open up to considerable improvements in performance. Indeed, he finds evidence of lower efficiency (measured by EBITDA margin) for target companies. Further evidence of underperformance is give by Harris, Siegel and Wright (2005), which report that plants with less than average productivity were targeted for MBOs. What is more, these plants also experienced a sharp increase in total factor productivity after the MBO. In line with these arguments, we propose the following hypotheses:

H₅: Low operating efficiency increases the probability of being bought up by PE firms

¹⁴ Both these hypotheses are supported by Weir, Laing and Wright (2005)

¹⁵ Jensen and Meckling (1976), Fox and Marcus (1992). Other studies on underperformance include Nikoskelainen (2006) and Reiersen (2008)

H_6

H₉: The change to PE ownership increases the leverage of the portfolio company

H₁₀: The change to PE ownership does not have a strong effect on the tax shield of the portfolio company

2.2.2. Management Ownership

Linking the managements' compensation scheme to the company value is often used by PE firms to reduce the risk of opportunism. The rationale is that this ownership stake incentivizes the management to exert effort, and that this improves the company performance¹⁷. Further combining stocks and options may give the management upside potential as well as some downside risk. Kaplan and Strömberg (2008) argue that management ownership in the PE industry is non-negligible and therefore provides goal alignment between the management and the owner. Moreover, since the ownership stake in private companies are often illiquid, this reduces the incentive to boost short-term performance, thus ensuring a long-term perspective for both management and owner.

The positive effect of interest alignment through management ownership on performance is supported by numerous theoretical and empirical studies¹⁸. Kaplan (1989) studies a sample of management buyouts (MBO). He finds that operating income to total assets and to sales, increases by approximately 20 % the first three years post buyout, while net cash flow increases by more than 20 % every year. Operating income is virtually unchanged the first two years, while being 24% higher in the third year post buyout. The results are adjusted for the industry median, showing that the MBO firms outperform their industry peers. Moreover, Kaplan (1989) finds indications that the operational improvements were due to better managerial incentives rather than layoffs.

Harris et al (2005) support Kaplan's (1989) results, by reporting substantial increase in short and long run total factor productivity for UK manufacturing plants going through MBOs. They attribute a substantial part of the post buyout gains to management efforts in redeploying the companies' resources more efficiently. However, they point to reduced labor intensity throughribSk c b! Sö /

intermediary goods and material, as opposed to Kaplan(1989) who report no layoffs. Further, they find that the MBO plants were less productive than peers before buyout. This may imply underperformance due to low management incentives, which further supports the notion that opportunism or other agency

Cressy, Munari and Malipiero (2007) find that PE-owned companies have 4.5% higher operating profitability than their peers in the first three years post buyout. Industry specialization adds 8.5% to this premium. Finding higher returns when PE firms specialize on certain industries may be seen as supporting evidence that PE firms do indeed transfer their knowledge to their portfolio companies and that this enhances company value. Other studies show that improvements in operating efficiency are largely found not to be at the expense of investments in R&D, capital expenditures or wages²⁰. This supports the earlier hypotheses on profitability and productivity, and leads us to further hypothesize that:

H₁₃: The change to PE ownership increases the efficiency of the portfolio company

H₁₄: The change to PE ownership spurs growth in the size of the portfolio company

H₁₅: The change to PE ownership does not have a negative effect on the wage level for the employees

As a final remark we note that Nikoskelainen and Wright (2005) find that a balance between leverage, owner monitoring and incentive alignment have a positive effect on performance, while a too strong focus on only one element reduces value creation. This suggests that a key success factor of PE ownership is not using either leverage, incentive alignment or monitoring, but rather that the right combination of these factors will spur value creation.

3. Sample Data

3.1. Creation of Sample

To identify the PE deals conducted in the Scandinavian countries, we start with a broad search in the Merger Market database. We then check this with the database Zephyr to control for underreporting in the two databases. We search for completed deals in the period 1998-2008, where the target company is situated in one of the Scandinavian countries. The deal types specified are MBOs, MBIs and

²⁰ Kaplan (1989a), Smith (1990), Lichtenberg and Siegel (1990), Harris et al. (2005), Acharya and Kehoe (2008), Guo, Hotchkiss and Song (2008) and Lerner, Sørensen and Strömberg (2008)

All companies are sorted by industry. This was done by using the industry codes provided in the databases, US SIC core code and NACE 2-digit primary codes for Amadeus, and NAICS 2-digit codes for CCGR (see appendix Table II for further details on industry affiliation in the samples). All companies are converted to NAICS 2-digit codes. Financial companies (NAICS 65, 66, 67 and some companies in 74 and 93) are filtered out of the sample, because their accounting statements by nature differ greatly from the rest of the sample. We end up with a total sample of 126 portfolio companies; 31 for Norway, 74 for Sweden and 21 for Denmark. For detailed information about the adding and subtraction of deals during the creation of the samples we refer to Table I in the appendix.

3.2. Sample bias

A possible bias in our sample is that we have limited access to consolidated accounts. Amadeus provides consolidated accounts only for some companies, while we do not have access to any consolidated accounts in CCGR. This may give a bias in cases where much of the activity is conducted in subsidiaries, since this activity is not included in unconsolidated accounts. We estimate this to give a possible bias for about half of the portfolio companies (please see Table III in the appendix for this calculation). Further, since we are only following the companies identified in the deals, there is no opportunity to control for divestments and demergers or in the cases where the company is merged into another company. On the other hand, we can control for bankruptcies that happen more than one year after deal completion. We believe the direction of the bias can go both ways.

3.3. Variables

From the

The variables proxy for size and growth in the portfolio companies, productivity, profitability, efficiency, leverage and liquidity. Note that proxies for profitability measure profitability both in level and in percentages. Further, profitability to different stakeholders is included to be able to test for value gain to different stakeholders from change to PE ownership. The efficiency proxies include both operating and cost efficiency. Many of the variables are adjusted for size, and provided in percentages, which make it easier to compare results across countries.

While most of the variables are standard proxies, we want to make further comments on some. One such variable is Total Assets; we consider the book value of total assets to be the weakest proxy for size. The reason is that book value of assets may differ according to leasing and depreciation/age of property, plant and equipment, which makes it a poor proxy for assets in place. Even so, in lack of a better proxy for assets in place, we still use the proxy as a variable and as a component in other variables. As a proxy for the value creation to all stakeholders we use both Return on Assets (ROA) and Added Value. Added Value is a variable defined and used by Grünfeld and Jakobsen (2006) in their study of ownership in Norway. It captures the value created to all stakeholders; shareholders, capital providers, employees and the state. The definition of cash flow (CF) is taken from Lehn and Poulsen (1989). It is however modified to not include paid out dividend, because this information is not provided in our sample. Finally, we want to comment on the proxy for liquidity. Here we use the Current Ratio, defined by Amadeus as current assets over current liabilities.

4. Analysis

In this section we present detailed hypotheses and the methodology used in the analysis of selection and corporate governance & active involvement by PE firms. However, we start out by briefly explaining the methodology used when calculating descriptive statistics for the three Scandinavian samples.

4.1. Methodology Descriptive Statistics

We provide descriptive statistics separately for the three countries because of the difficulties in correcting for price levels and exchange rates between the countries.

It is possible to use a purchasing power standard (PPS) to convert the level numbers into an artificial currency, and thereby make them comparable²². However, we consider the information given by such an artificial currency to be of little interest, since it is hard for the reader to relate this currency to other known measures. Thus we choose to provide descriptive statistics separately for the three country samples in their respective currencies. Even though the ratios are strictly speaking possible to provide for all three samples together, we choose to provide them for each country so that they can be compared with the level variables for that country.

Since the years pre and post buyout differ across portfolio companies, the price level due to inflation will also differ within a given country sample. To be able to compare level data within each year, we adjust the level variables in the three countries with their respective national yearly consumer price index (CPI)²³. The base year is set to 2007, such that all level descriptive statistics are reported in 2007-currencies; that is 2007-NOK, 2007-SEK and 2007-DKK. Variables in percentages and ratios are not adjusted for CPI. The descriptive statistics are shown in Table VI in the appendix.

4.2.Selection

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efficiency, productivity and profitability should be lower. Table 1 below show the proxies used for each of these hypotheses, and the expected sign on the coefficients. The logit hypothesis is also shown:

Table 1

Since dividend payouts are not included this is a relatively weaker measure than

4.2.2.1. Matching Peers

Model (1) excludes *Cf*, *Roe*, *Prof_empl*, *Prof_marg* and *Ebit_marg*

$$Z_i = \beta_0 + \beta_1 G_{oprev} + \beta_2 Oprev_{emp} + \beta_3 Op_p_l + \beta_4 Av + \beta_5 Roe + \beta_6 Roa + \beta_7 Wage_empl + \beta_8 Prof_empl + \beta_9 Costs_empl_oprev + \beta_{10} Other_costs_oprev + \beta_{11} Leverage + \beta_{12} Liquidity + u \quad (2)$$

Model (2) excludes *Cf*, *Cf_equity*, *Tax_empl*, *Prof_marg* and *Ebit_marg*

$$Z_i = \beta_0 + \beta_1 G_{oprev} + \beta_2 Oprev_{emp} + \beta_3 Cf + \beta_4 Cf_equity + \beta_5 Roa + \beta_6 Wage_empl + \beta_7 Ebit_marg + \beta_8 Costs_empl_oprev + \beta_9 Other_costs_oprev + \beta_{10} Leverage + \beta_{11} Liquidity + u \quad (3)$$

Model (3) excludes *Op_p_l*, *Av*, *Roe*, *Prof_empl*, *Tax_empl* and *Prof_marg*

$$Z_i = \beta_0 + \beta_1 G_{oprev} + \beta_2 Oprev_{emp} + \beta_3 Cf + \beta_4 Roe + \beta_5 Roa + \beta_6 Wage_empl + \beta_7 Prof_marg + \beta_8 Costs_empl_oprev + \beta_9 Other_costs_oprev + \beta_{10} Leverage + \beta_{11} Liquidity + u \quad (4)$$

Model (4) excludes *Op_p_l*, *Av*, *Cf_equity*, *Prof_empl*, *Tax_empl* and *Ebit_marg*

Z_i is here the dependent binary variable, which is one if the company is bought up by a PE firm and zero otherwise. β_0 is the constant, β_1 to β_{12} measures the coefficients and u is the disturbance term, which measures unexplained variation in the dependent variable. The effect of changes in the explanatory variables on the dependent variable cannot be read directly from β_1 to β_{12} . Rather they must be calculated from the output. The method used to find these effects, called marginal effects is shown in Text-Box I in the appendix.

4.2.2.3. Robustness Checks

The four models estimated include many explanatory variables. Including many explanatory variables in a model may induce higher overall explanatory power of the model, even when the explanatory variables individually do not affect the dependent variable significantly. Thus we look at several goodness-of-fit statistics; Hosmer-Lemeshow (H-L) and Andrews statistics, as well as looking at the McFadden R-square. The H-L and Andrews test compare the fitted values to the actual values, thus estimating the fit of the model to the actual data. Model one has an Andrews probability below 0.05, which indicates that this model has a

lower fit than the other models. All the other P-values are above 0.05 which indicate good model fits²⁹. The McFadden R-square shows the explanatory power of the model, much like the ordinary R-square for OLS regressions³⁰. The models have varying McFadden R-squares. However, excluding model one, we find them

2.1 (continued)				
1. Variable	2. Metric	3. Hypothesis	4. Mechanism	5. Expected Significance
Operating Revenue	Growth	Underperformance (H14)	Involvement	Positive
Number of Employees	Growth	Underperformance (H14)	Involvement	Positive
Total Assets	Growth	Underperformance (H14)	Involvement	Positive
Operating Revenue per Employee	Productivity	Underperformance (H12)	Ownership & Involvement	Positive
Operating Profit or Loss	Profitability	Underperformance (H11)	Ownership & Involvement	Positive
Cash Flow	Profitability	Underperformance (H11)	Ownership & Involvement	Positive
Added Value	Profitability	Underperformance (H11)	Ownership & Involvement	Positive
Return on Equity	Profitability	Underperformance (H11)	Ownership & Involvement	Positive
Return on Assets	Profitability	Underperformance (H11)	Ownership & Involvement	Positive
Wage per Employee	Profitability	Underperformance (H15)	Ownership & Involvement	Non-significant or positive
Corporate Tax per Employee	Profitability	Free Cash Flow (H10)	Leverage	Non-significant or small negative
Profit per Employee	Efficiency	Underperformance (H13)	Involvement	Positive
Profit Margin	Efficiency	Underperformance (H13)	Involvement	Positive
Ebit Margin	Efficiency	Underperformance (H13)	Involvement	Positive
Costs of Employees/ Operating Revenue	Efficiency	Underperformance (H13)	Involvement	Negative
(Other Costs/Operating Revenue)x100)	Efficiency	Underperformance (H13)	Involvement	Negative
Total Liabilities/ Total Assets	Leverage	Free Cash Flow (H9)	Leverage	Positive

1) Other Costs=Operating Revenue- Operating Profit or Loss- Costs of Employees
2)Corporate governance tools to reduce agency problems and enhance value creation:
Leverage to leverage up the financial structure of the portfolio company
Ownership: to incentivize the management through management ownership
Involvement: to use monitoring & active involvement

Table 2 Hypotheses for Panel Regressions

The proxies used in the above hypotheses are by large the variables presented previously, however, some are worth further comments; as proxies for growth, we investigate the change in the three size proxies; Operating Revenue, Number of Employees and Total Assets. We do not use the growth proxies here, due to the fact that by calculating growth in size the samples sizes are reduced by one observation per company. As a proxy for the tax shield we use Corporate Tax per Employee, which gives the size adjusted tax level pre and post buyout. In the analysis we also include the variable Other Costs/Operating Revenue (other costs than the cost of employees as a percentage of operating revenue) from the selection study, due to its statistical significance in two of the logit regressions.

4.3.2. Methodology Panel Regressions

To investigate whether there are significant changes in the portfolio companies from the change to PE ownership, we look at the mean value of the seventeen variables connected to the above hypotheses. The method used in this part is quite similar to the method used by Kaplan (1989). He compares the pre and post buyout sample by using a test for difference in mean for non-normal data³¹. To account for macroeconomic changes in the period he adjusts the results for industry average. We will use panel regressions to test for differences in mean pre to post buyout. We adjust for non-normality by using logarithm, and include macroeconomic variables to control for changes in macroeconomic conditions in the period. With the panel data technique it is also possible to adjust the results for company specific factors that do not change over time, using fixed effects models. This helps ensure that the differences in geometric mean is caused by the ownership change, which is not possible to ensure with Kaplan's (1989) technique. Among the studies using panel regressions are Lerner et al. (2008) in

regression are violated. Others believe that theory should suggest which model to use. While testing for fixed and random effects is perfectly possible, we believe that a theoretically based choice of model is more appropriate. If the choice is based solely on testing it is possible to end up with different models for different dependent variables, which theoretically makes little sense when the companies in each model are equal.

In our models we choose cross-sectional fixed effects, believing that there are some company-specific factors which are different for each company and do not change over time³³. These factors may for instance be company culture. Company culture is known for being hard to change, thus we expect this to be relatively stable even with a change to PE ownership. Cross-sectional fixed effects allow for company-specific heterogeneity in the way that the model estimates a dummy for each firm, which measures the difference from the sample mean due to the company-specific factors. This also ensures that the constant in the models is the mean for the total sample, i.e. that it is not affected by company-specific factors³⁴.

4.3.2.2. Controlling for Macroeconomic Conditions

The companies included in the samples have largely experienced positive macroeconomic conditions throughout the sample period. To be able to compare the companies pre to post buyout we need to control for change in the macroeconomic environment. The most important effects to control for are inflation and business cycles. As in the descriptive statistics we use yearly CPI with base year 2007 to control for inflation in the level accounting variables.

To control for business cycles in the panel regressions we include two proxies; the unemployment rate and the consumer confidence index (CCI)³⁵. Unemployment is measured as a percentage of total employment. While higher levels of employment indicate a growth in the amount of goods and services produced and thereby the growth rate of GDP, higher unemployment indicates a decrease in GDP growth³⁶. Thus unemployment is low in boom times and high in bust times. The CCI gives an indication to the optimism the consumers have to their own

³³ Brooks (2008:506)

³⁴ For more on fixed-effects models we refer to Brooks (2008:490-494)

³⁵ The World Bank Group (2009), Roubini and Backus (1998)

³⁶ Roubini and Backus (1998)

economy and this will again be reflected on consumer spending. It is based on a

4.3.2.5. Robustness Checks

We take several steps to ensure robust models. As mentioned above, we use logarithmic transformation for non-normal variables to ensure approximately normal distribution of the variables. Before running the models, we further ensure that the correlation between the two macroeconomic variables, unemployment and consumer confidence, do not have too high correlations. The correlations are -0.14, 0.37 and -0.615 for Norway, Sweden and Denmark respectively. Since the correlations are below +/- 0.70 we assume a low risk of multicollinearity. We notice that the correlations are negative for Norway and Denmark, while positive for Sweden. For Sweden this suggests that when unemployment increases, consumer confidence also increases. We would expect the correlations to be negative as for the other countries. Because of this difference in correlations the coefficient sign on these variables may differ across countries.

When it comes to heteroscedasticity, this might be due to differences in the size of companies in our sample or to omitted variables in explaining the dependent variable⁴⁰. The differences in size will naturally be reduced for the dependent variables going through a logarithmic transformation. Also running fixed effects models reduce the risk of heteroscedasticity from omitted variables. Even so, we check the residuals of the models to find no signs of heteroscedasticity.

After running the models, we look at the Durbin-Watson statistic for signs of serial correlation. We find that several of the models show evidence of positive and negative serial correlation (DW below 1.5 and above 2.5 respectively)⁴¹

to try to correct for serial correlation. This method makes the disturbances robust to arbitrary serial correlation and time-varying variances⁴³.

Finally, we want to test for unit root in the variables, knowing that this may cause spurious regressions⁴⁴. However, due to the short time series it is difficult to test this formally for our sample. We therefore only inspect the t-statistics and find that they are appropriate. According to Baltagi (2005:237, 250) unit root may be a problem in panels with long time series. Since we have a time period of maximum six years, we do not suspect unit root to be an issue in the panel regressions.

The panel regression outputs are shown in Table IX in the appendix.

5. Results

In this section we present descriptive statistics for the Scandinavian samples and results from the logit and panel regressions. For the regressions we present the results for the hypotheses and leave it to the reader to look at the full result tables; the marginal effects for logit are shown in Table VIII and the differences in mean for panel is shown in Tables X, XI and XII in the appendix.

5.1.1. Results Descriptive Statistics

The descriptive statistics calculated for the three country samples are shown in Table VI in the appendix. We focus on the median, 25 % and 75 % percentiles considering these most adequate in describing the total sample. Also we exclude some findings in year +2 for Norway and Denmark, believing that small sample sizes has affected these results.

Looking at the size proxies there is evidence of growth throughout the six year period, especially for Swedish companies which show increasing growth for all three proxies. While the Number of Employees increases in Norway and Sweden, the results are mixed for Denmark; with a decreasing median, while at the same time increasing percentiles post buyout. The productivity is slightly increasing for all countries. In general the profitability proxies also show an increasing trend; in

⁴³ Eviews5 software, the help-function, search term "Pooled Estimation"

⁴⁴ Brooks (2008:318-335)

particular CF and Added Value show a high increase. ROE shows no significant trend for Sweden, while being quite volatile throughout the period for Norway. Denmark, however, has a positive trend in ROE after buyout. ROA on the other hand is quite stable for all three countries. The efficiency proxies are fairly stable, except for Profit per Employee which show a positive trend for both Norway and Denmark. Both leverage and liquidity are quite steady throughout the period.

5.1.2. Results Logit Regressions

The marginal effects from the explanatory variables on the dependent variable and their P-values may be seen in Table VIII1

Cash Flow/Equity

For every unit change in Cash Flow over book value of equity the probability of being bought up increases with 3.579 percentage points. Recall that results in model one are weaker, due to poor fit of the model. 5 % statistical significance

Leverage

For every percentage point increase in Total Liabilities/Total Assets the probability of being bought up by a PE-firm is reduced by 0.108 percentage points. 5 % statistical significance

Current Ratio

For every unit of Current Ratio increased the probability of being bought up by a PE-firm is reduced by 1.932 percentage points. 10 % statistical significance

Looking at the hypotheses for underperformance, there is overall positive results that low profitability (all variables except Operating Profit or Loss) and low operating efficiency increases the probability of being bought up by PE firms. The hypothesis on productivity is not supported due to non-significant result, and the results on cost efficiency do not support the hypothesis that low cost efficiency increases the odds of a being bought by PE firms. The marginal effects for statistical significant results are as follows:

Operating Profit or Loss

For every 100 000 NOK more in Operating Profit the probability of being bought up increases with 0.016 percentage points. 1 % statistical significance

Added Value

For every 100 000 NOK more in Added Value the probability of being bought up is reduced by 0.003 percentage points. 10 % statistical significance

ROA

For every percentage point increase in Return on Assets the probability of being bought up is reduced by 0.200 percentage points. 10 % statistical significance

Corporate Tax per Employee

For every 100 000 NOK more in Corporate Tax per Employee the probability of being bought up is reduced by 1.528 percentage points. Recall that results in model one are weaker, due to poor fit of the model. 5 % statistical significance

Profit Margin

For every percentage point increase in Profit Margin the probability of being bought up is reduced by 0.179 percentage points. 5 % statistical significance

Ebit Margin

For every percentage point increase in Ebit Margin the probability of being bought up is reduced by 0.158 percentage points. 10 % statistical significance

Other Costs/Operating Revenue

For every percentage point increase in Other Costs/Operating Revenue the probability of being bought is reduced by 0.255 percentage points. 10 % statistical significance

5.1.3. Results Panel Regressions

Tables X, XI and XII in the appendix show the variable means pre and post buyout, the difference between them and the corresponding P-values for the three countries. The tables also indicate whether the variable mean is arithmetic or geometric. We do not report the type of mean for the results below, since we are most interested in the difference in mean. In the following we will report the results that are statistically significant for the three countries.

Looking at Norway, we do not find support for the FCF hypothesis. There is a significant positive increase in Corporate Tax per Employee, which is the opposite of the expected sign (H_{10}). This result actually is in favor of the underperformance hypothesis of higher profitability. The leverage hypothesis (H_9) gives insignificant results, although the difference is positive. The results show more support for the underperformance hypothesis; the results indicate that profitability increases (H_{11}), while the wage level (H_{15}) will not change significantly from change to PE ownership. The results for the other underperformance hypotheses (predicting higher productivity, efficiency and growth) show the expected signs but are

insignificant. We note here that the result of the panel regression is overall consistent with the descriptive statistics for the Norwegian sample. The variables with significant results are as follows:

Operating Profit or Loss

The mean increases by 38 954 000 NOK from a change to PE ownership. 10 % statistical significance

Added Value

The mean increases by 32 261 000 NOK from a change to PE ownership. 5 % statistical significance

ROA

The mean increases by 15.56 percentage point from a change to PE ownership. 5% statistical significance

Corporate Tax per Employee

The mean increases by 130 545 NOK from a change to PE ownership. 5 % statistical significance

Wage per Employee

The result on Wage per Employee is non-significant, with a positive sign on the difference in the mean. This is seen as significant results supporting no significant difference in wage level from change to PE ownership.

We also note that CF show an increase in mean of 22 439 000 NOK with a P-value of 0.145.

The results for Sweden show some support for the underperformance hypothesis, with positive increase in size (proxy for growth), productivity and efficiency (H₁₄, H₁₂ and H₁₃). There are also weak results of higher profitability (H₁₁) by positive difference for Operating Profit, with statistical significance level of 10.5%.

Hypothesis fifteen is supported also for Sweden, showing no significant difference in wage per employee. The FCF hypothesis is not supported, giving results similar to Norway; significant increase in tax per employee and non-

significant results in leverage (H_{10} and H_9). Further, the difference in geometric means for Norway and Sweden go in the same direction for twelve of the seventeen variables tested.

worsen the gain to employees. Looking at the differences in mean for all variables, the results show signs of poorer performance post buyout for the Danish companies. These results are not consistent with the two other countries; with only five differences with equal sign as Norway, and eight differences with equal sign as Sweden. The descriptive statistics are not very consistent with the panel results. The statistical significant results are shown below:

ROA

The mean is reduced by 14.84 percentage point from a change to PE ownership. 10 % statistical significance

Corporate Tax per Employee

The mean is reduced by 47 869 DKK from a change to PE ownership. 10 % statistical significance

Wage per Employee

The result on Wage per Employee is non-significant, with a positive sign on the difference in the mean, which supporting hypothesis fifteen.

We also note that ROE show a decrease of 68.73 percentage points in mean, with a P-value of 0.111.

6. Discussion

We first assess the results for the FCF hypothesis. The results of the selection study supports the statement that higher CFs do indeed increase the probability of being bought up by a PE firm. Lower leverage is also found to increase this probability. Moving on to the post buyout period, the findings show that leverage does not increase significantly post buyout. Further, Reiersen (2008) finds evidence against the FCF hypothesis in his study of Scandinavian PTPs. Instead he finds evidence of the underperformance hypothesis. This may imply that the FCF hypothesis is not adequate for understanding the selection of target companies, private and public, for the late 1990s and 2000s. This explanation is supported by Nikoskelainen (2006). Moreover, this does not mean that leverage is

not an effective corporate governance tool, simply that PE firms are not the first owners to introduce this tool in the portfolio companies.

In light of the post buyout results, how do we then explain the results for the Norwegian companies, that PE firms select target companies with lower leverage? One possible explanation is that PE firms prefer target companies with higher cash flows and lower leverage. This gives an opportunity for making extra profits by changing the capital structure. Indeed the results for Norway show that the mean leverage increases with 0.21 (not significant results) post buyout. By leveraging up the company the ROE should increase, which is also true for the Norwegian companies (again not significant results). For Sweden and Denmark neither leverage nor ROE increase, which may be a result of previous owners having already leveraged the company to its limits. Sweden shows high consistency in results to Norway, while not showing the same features in leverage and ROE. We ask ourselves whether this may be explained by the fact that Sweden's PE industry is more mature, making such low leveraged companies hard to come by. Further, while the results show profitability improvements in Norwegian portfolio companies, PE firms in Swedish companies seem to focus on growth, productivity and efficiency. We also suggest that this may be due to a more mature (less mature) PE industry in Sweden (Norway).

At this point we want to comment on the inconsistency in results of the Danish sample compared to Norway and Sweden. The results for the Danish sample include decreasing profitability, productivity and efficiency (except profit per employee) post buyout. Looking at the descriptive statistics we see that many variables experience a decrease in value for year -1 and poor levels in year 0 and +1. We wonder whether this may be a result of a different focus by PE firms in Danish companies. For instance a focus on expansion may lead to massive investments, explain k a k incurencâÀ òòkâ ò kò òk ´ o n

Operating Profit and CF do not support the evidence of lower profitability. Moving to post buyout results for Norway, we note some interesting results; lower Added Value, ROA and Corporate Tax per Employee increase the probability of a company being targeted by PE firms. At the same time these same variables also show significant increase after buyout. We consider this to be strong evidence in favor of the underperformance hypothesis. This makes us inclined to consider the underperformance hypothesis more adequate in explaining the selection of target portfolio companies in later years than the FCF hypothesis. Also the evidence post buyout supports the notion that corporate governance tools like management ownership and monitoring, and active involvement do indeed have a positive effect on the performance in the portfolio companies.

The results also show evidence of gain to the different stakeholders of the portfolio companies. This is especially true for the Norwegian sample; Added Value, ROA and Tax per Employee all show significant increases post buyout. Further, Wage per Employee does not show any sign of decrease. The Swedish sample show similar results for Wage per Employee and Tax per Employee, while Denmark is only equal to Norway for Wage per Employee. However, the Danish companies show a decrease also in ROE, which supports the notion that PE firms do not increase their gains at the cost of the employees and other stakeholders. Overall we consider this strong evidence that PE firms do not transfer value from other stakeholders of the company to themselves, but rather that they contribute to the value creation to society. We believe that these results help justify today's state investments in the Norwegian PE industry, and that it may encourage an increased focus on and support of the growing PE industry in Norway.

A question still remains; what does it mean that both higher Operating Profits and CFs increase the probability of being bought up by PE firms? To try to answer this question, we turn to the Swedish Venture Capital Association (SVCA). According to SVCA (2009) the main focus of PE firms when identifying buyout candidates is finding target companies with a strong market position, competent management team and strong cash flows, but at the same time there should be a potential for profit improvements. This statement seems to be quite fitting in explaining the results for the Norwegian sample. In this manner PE firms might indeed look for target companies with higher cash flows and lower leverage, to be

able to get higher returns by changing the capital structure of the company. At the same time they might also look for companies with lower profitability and operating efficiency, to realize potential gains from operating improvements.

7. Limitations

In a study there will always be limitations and room for improvements. In the following we have tried to list what we believe are some of the most important limitations of this study.

The first limitation concerns our sample. As mentioned in the section on sample data, about half of the sample consists of unconsolidated accounts for companies with subsidiaries. This may bias the results. We do not know how large this bias is nor which direction it goes. It may also be different for the three Scandinavian samples. This may affect the study results, and is thus a weakness of our sample.

The second limitation is that the samples are not large enough to be divided into different industries. We consider this a limitation for the investigation of changes in performance pre to post buyout. Being able to divide the sample into industries gives much more detailed results, and makes it possible to compare these results with industry averages. Having to use the total country samples we cannot compare this to any benchmarks, thus the analysis is reduced to looking at the changes pre to post buyout inside the portfolio companies. The analysis does correct for business cycles and fixed effects, like corporate culture. However, being able to also correct the results for industry averages would add to the validity of the results.

The third, and final limitation, does also concern the post buyout study. The results of this study give evidence in support of using the corporate governance tools of ownership and monitoring, and also of using active involvement to contribute and share knowledge. However, these two effects; corporate governance and active involvement cannot be separated. Thus, a clear improvement would be to separate these effects by doing further analysis. This can for instance be done by further quantitative analysis on the extent of

management ownership or through qualitative research such as surveying PE firms.

8. Future Research

Having worked from start to end on this study there are two paths for future research we find particularly interesting. The first path concerns the differences between Norway and Sweden. The results of this study indicate that there are differences in the focus of PE firms in Norwegian and Swedish portfolio companies. We attribute these differences to the Norwegian industry being younger and the Swedish industry being more mature. It would be interesting to take a closer look at these differences; to investigate which differences are due to industry life cycle, and which are due to other factors like which industries are most prominent in the two countries.

The second path concerns the difference in selection in PTP and private-to-private transactions. It is not evident which factors concerns the PE firms when they choose listed companies versus unlisted companies. To our knowledge, there have not been done any studies on this specific topic. Do the PE firms look for the same characteristics, or is the focus different for the two types of companies. Further, after the buyout, do they use the different corporate governance tools and do they have the different objective

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Table III Sample Bias

This table shows how many companies we do not have consolidated accounts for and how many companies that are registered as parents. When we are using unconsolidated account we must be aware that may not see the whole picture, since parts of the value creation might be conducted in subsidiaries.

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Without subsidiaries	21	18	6	45
With subsidiaries	10	46	8	64
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Number of companies	-	10	7	17
Total sample	31	74	21	126
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Unconsolidated with subsidiaries/total sample	0,32	0,62	0,38	0,51

Table IV *Descriptives of the variables used in the analyses*

The table provides a description of the used variables names, measurement unit and origin from the two databases, Amadeus and CCGR, or if constructed, how this where done.

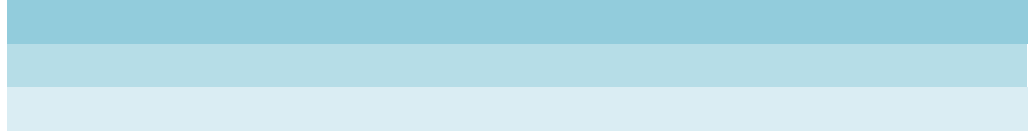


Table VI Descriptives Statistics for the Three Scandinavian Samples

This table shows the descriptive statistics of the PE companies divided in to the three respective countries. All variables given in currency are adjusted for CPI, with base year 2007. Units are stated in parenthesis after the variable.

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1. ZŁ / "€"	28	31	31	31	30	13	60	68	65	65	71	53	6	16	15	16	17	6
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ZŁ %	132 803	166 118	201 074	270 078	315 069	305 584	173 068	182 178	182 655	194 737	222 118	308 072	238 960	301 407	286 316	354 339	379 315	363 379
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fi, - ZŁ. "%#!"	51 829	64 869	79 197	48 166	87 017	112 151	57 135	70 078	77 468	88 331	88 421	143 933	193 183	194 118	234 275	245 680	250 342	290 979
/, - ZŁ. "%#!"	278 155	291 731	309 320	378 775	488 348	434 501	556 420	585 125	508 794	545 653	735 732	784 818	766 048	760 612	605 960	755 055	726 010	1 011 920

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fi, - Ž' %	2	-2	0	12	9 -	9	4	28	1	65 -	7	0	5	4	7 -	
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	1/''')'ifi	ifi''')'ifi	ifi''')'L	L''')'fi	fi''')'fi	fi 1/''')'ifi	ifi''')'ifi	ifi''')'L	L''')'fi	fi''')'fi	fi 1/''')'ifi	ifi''')'ifi	ifi''')'L	L''')'fi	fi''')'fi	fi
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Ž' % %	52	15	23	44	-4 -	-9	4	18	34	50 -	-7	1	-10	10	78 -	
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fi, - ž "" "%#!"	537	7 079	2 401	2 550	15 175	6 345	-1 911	151	-702	-6 725	2 143	-867	-28 698	-6 639	-6 862	-18 117	-2 286	-1 247
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f' %& " & & "(# #) %	204	214	238	809	795	323	250	298	227	419	257					
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/, - 'ž "" %#! "	524	595	640	693	771	641	362	475	456	456						

	1/	ifi	iff	Ł		fi	fi 1/	ifi	iff	Ł		fi	fi 1/	ifi	iff	Ł
f, Z ž! ""#\$ %	28	31	31	31	30	13	59	69								
Z %	-32	30	-66	69	42	-121	117	-18								
Z %&# %	9	18	8	21	14	29	17	12								
f' %& " & & "(# #) %	293	78	385	130	279	829	531	1 219								
Z#%# Z * Z	-1 500	-248	-1 820	-78	-1 128	-2 823	-2 481	-6 129								
Z, +# Z * Z	205	171	229	588	749	593	2 139									
fi, - 'ž "" %#! "	0	0	0	0	0	-1	0									
/, - 'ž "" %#! "	25	68	51	83	68	109	78									

	1/	ifi	iff	Ł		fi	fi 1/	ifi	iff	Ł		fi	fi 1/	ifi	iff	Ł
f, Z ž! ""#\$ %	28	31	31	31	30											

	<i>l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>ifl</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi</i>
<i>f, Ž ž!</i>	27	29	29	31	30	13	60	68	65	65	71	54	6	16	15	16	17	6	6
<i>Ž ~ %</i>	-945	-125	-1	-1572	31	6	-166	2	-200	-55	-308	-2	11	8	12	7	5	8	
<i>Ž " &# %</i>	3	5	7	8	6	5	7	7	5	3	6	6	5	5	6	7	11	9	
<i>f' % & " & & "(# #) %</i>	4881	680	49	9132	204	27	1268	34	1599	270	2548	40	16	11	29	10	21	9	
<i>Ž # # Ž * Ž</i>	-25365	-3650	-177	-50755	-536	-44	-9807	-200	-12890	-1875	-21460	-156	-6	-5	-12	-8	-68	-5	
<i>Ž, + Ž * Ž</i>	97	96	97	1397	950	46	63	81	87	64	133	69	37	39	112	26	28	17	
<i>fi, - ž ~. "%#!"</i>	-2	-1	1	1	2	-2	-1	1	-2	-8	-3	-3	3	3	3	1	4	4	
<i>/, - ž ~. "%#!"</i>	7	10	11	16	29	14	14	12	13	12	14	17	18	8	10	12	14	15	

	<i>l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>ifl</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi</i>
<i>f, Ž ž!</i>	27	29	29	30	30	13	55	63	63	64	69	52	6	16	15	16	17	6	
<i>Ž ~ %</i>	577	93	31	568	32	25	20	21	137	38	161	20	20	23	24	23	27	15	
<i>Ž " &# %</i>	25	25	23	23	24	25	17	16	17	17	17	16	14	22	24	21	20	15	
<i>f' % & " & & "(# #) %</i>	2841	347	36	2929	40	14	15	14	926	111	1151	17	13	9	9	9	25	5	
<i>Ž # # Ž * Ž</i>	2	2	1	4	0	0	0	0	0	2	0	2	13	13	13	13	12	7	
<i>Ž, + Ž * Ž</i>	14794	1892	204	16077	224	49	78	60	7366	883	9580	73	46	40	41	39	120	21	
<i>fi, - ž ~. "%#!"</i>	21	17	19	17	14	14	10	12	12	11	11	12	13	14	15	15	14	14	
<i>/, - ž ~. "%#!"</i>	33	29	28	41	32	33	24	27	27	26	25	23	20	29	31	31	27	18	

	<i>l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>ifl</i>	<i>Ł</i>		<i>fi</i>	<i>fi l/</i>	<i>ifi</i>	<i>iff</i>	<i>Ł</i>		<i>fi</i>	<i>fi</i>
<i>f, Ž ž!</i>	28	31	31	31	30	13	60												

Table IX Panel Regression Models

The following table shows the raw results of the panel data regressions. These are the raw regression outputs and in the cases where there has been used log-transformations this is not transformed back to see the real effects here. We refer the reader to Tables X – XII to see the effects after transformation.

The dependent variable is put as the name of the different models. All currency variables are adjusted for CPI, with base year 2007. The two macroeconomic variables to adjust for business cycle are unemployment and the national consumer confidence index. The models are estimated as Least Squares (LS) with cross-sectional fixed effects model. Logarithmic transformation is used on non-normal dependent variables. White Period coefficient covariance method is used on models showing signs of serial correlation, since this makes the disturbances robust to arbitrary serial correlation and time-varying variances.

2. 1 (N % (Z \$. 1 J4						
6. Ž' . 1' . % 1' + , (ž	: " + ' fi		< + % .		= + . - ' +>	
	6' 1 ** \$ 1 . 1'	1 9 0 1 3 2 9 0 1 4	6' 1 ** \$ 1 . 1'	1 9 0 1 3 2 9 0 1 4	6' 1 ** \$ 1 . 1'	1 9 0 1 3 2 9 0 1 4
" " 1' (0 Ž Ž 1 Ž P 2 + # fi * + , + ; i ž Q						
Constant	11.993	35.751 (0.000)	12.748	55.692 (0.000)	12.386	21.465 (0.000)
PE-Dummy	0.192	1.209 (0.229)	0.257	2.550 (0.011)	-0.000	-0.000 (1.000)
Unemployment	-0.136	-1.595 (0.113)	-0.059	-1.660 (0.098)	-0.033	-0.268 (0.789)
Consumer Confidence	0.021	2.925 (0.004)	0.007	1.032 (0.303)	0.004	0.301 (0.764)
Sample size	158		381		98	
Log on dependent variable	yes		yes		yes	
White Period	yes		yes		yes	
Of fi + i . , ' M & .) + fi + + 5- fi (" fi + P 2 + # fi * + 2 + * 1' % \$ ' & i fi Q						
Constant	7.128	8.478 (0.000)	7.485	41.813 (0.000)	2995.611	3.296 (0.002)
PE-Dummy	0.309	0.990 (0.324)	0.086	1.694 (0.091)	-54.599	-0.355 (0.724)
Unemployment	-0.114	-0.738 (0.462)	0.044	1.420 (0.157)	-236.034	-1.315 (0.194)
Consumer Confidence	0.019	1.063 (0.290)	-0.003	-0.863 (0.389)	3.176	0.302 (0.764)
Sample size	158		363		74	
Log on dependent variable	yes		yes		no	
White Period	yes		no		yes	
Of fi + i . , ' 2 + * 1' " + " Ž Ž P 2 + # fi * + 2 + * 1' , "(i fi Q						
Constant	-36976.46	-0.781 (0.436)	15480.42	0.614 (0.540)	13.174	16.359 (0.000)
PE-Dummy	38954.08	1.895 (0.060)	11615.24	1.624 (0.105)	-0.295	-1.434 (0.156)
Unemployment	15651.08	1.279 (0.203)	409.293	0.094 (0.925)	-0.358	-2.377 (0.020)
Consumer Confidence	-166.995	-0.249 (0.804)	1314.753	2.492 (0.013)	-0.009	-0.549 (0.585)
Sample size	158		393		98	
Log on dependent variable	no		no		yes	
White Period	yes		no		no	

2.1 (N % (Z \$. 1)4						
6. Ž . 1 . % 1' + , (ž	: " + ' fi		< + % .		= + . - ' +>	
	6' + **\$1.1'	1% 01 3% 014	6' + **\$1.1'	1% 01 3% 014	6' + **\$1.1'	1% 01 3% 014
6 ž ? (" P2+ #fi** + 2+ *1' , (ifQ						
Constant	46280.05	1.053 (0.294)	-45302.52	-0.852 (0.395)	757832.4	1.399 (0.172)
PE-Dummy	22438.51	1.466 (0.145)	-3080.311	-0.203 (0.839)	-277779.4	-1.022 (0.315)
Unemployment	-5777.162	-0.587 (0.558)	8293.472	0.912 (0.363)	-144999.3	-0.270 (0.214)
Consumer Confidence	72.904	0.085 (0.932)	2460.89	2.225 (0.027)	8807.782	0.416 (0.680)
Sample size	158		331		51	
Log on dependent variable	no		no		no	
White Period	no		no		yes	
0% %1' 0 P2+ #fi** + 2+ *1' , (ifQ						
Constant	12.065	43.651 (0.000)	13.579	91.296 (0.000)	12.234	29.320 (0.000)
PE-Dummy	0.223	2.316 (0.022)	0.052	1.251 (0.212)	-0.306	-0.824 (0.416)
Unemployment	-0.061	-0.981 (0.329)	-0.036	-1.369 (0.172)	-0.114	-1.336 (0.191)
Consumer Confidence	-0.001	-0.220 (0.827)	0.005	1.872 (0.062)	0.059	1.403 (0.171)
Sample size	158		325		51	
Log on dependent						

U

2. 1 (N % (Z\$. 14						
6. Ž' . 1' . % 1' + , (ž	: " + ' fi		< t % .		= t . - ' +>	
	6' **\$1. 1'	198 01 3298 014	6' **\$1. 1'	198 01 3298 014	6' **\$1. 1'	198 01 3298 014
M1) + " . 0Ži iŽ' P2+ #fi* + 2+ *1' , '(1fQ						
Constant	12.380	0.456 (0.649)	0.747	0.148 (0.882)	48.651	1.499 (0.138)
PE-Dummy	15.562	1.661 (0.099)	-0.683	-0.478 (0.633)	-14.845	-1.784 (0.079)
Unemployment	-2.459	-0.405 (0.686)	0.803	0.930 (0.353)	-7.946	-1.310 (0.194)
Consumer Confidence	-0.356	-0.679 (0.499)	0.365	3.482 (0.000)	0.886	1.292 (0.201)
Sample size	155		386		96	
Log on dependent variable	no		no		no	
White Period	no		no		no	
R' , t fl +5- fl (" fl t ' P2+ #fi* + 2+ *1' , '(1fQ						
Constant	6.281	14.868 (0.000)	408.113	7.370 (0.000)	398.997	4.150 (0.000)
PE-Dummy	0.053	0.283 (0.778)	23.278	1.521 (0.129)	31.395	1.279 (0.205)
Unemployment	-0.085	-0.630 (0.530)	3.120	0.324 (0.746)	-5.974	-0.332 (0.741)
Consumer Confidence	0.001	0.112 (0.911)	-0.974	-0.886 (0.376)	0.165	0.080 (0.936)
Sample size	157		362		91	
Log on dependent variable	yes		no		no	
White Period	yes		no		no	
6' -fl' + t " " #fl +5- fl (" fl t ' P2+ #fi* + 2+ *1' , '(1fQ						
Constant	-168.739	-0.991 (0.324)	605.205	1.717 (0.087)	6.120	5.325 (0.000)
PE-Dummy	130.545	2.217 (0.029)	185.871	1.862 (0.064)	-0.500	-1.690 (0.095)
Unemployment	38.666	1.020 (0.310)	-126.155	-2.084 (0.038)	-0.321	-1.490 (0.141)
Consumer Confidence	-1.001	-0.305 (0.761)	19.266	2.629 (0.009)	0.029	1.204 (0.233)
Sample size	153		375		95	
Log on dependent variable	no		no		yes	
White Period	no		no		no	

Table XI Results from the panel regressions Sweden

This table shows the mean value of the different variables before and after change to PE ownership for the Swedish sample, adjusted for the median unemployment

Text-Box I *Logit regression*

Logit

Logit regression is used when the dependent variable is a categorical variable taking the form of a dummy¹. In our case the dependent dummy variable is binary - one if the company is bought up by a PE firm and zero if not.

The logistic function F follows the cumulative logistic distribution, and the function depends on any random variable z ,

$$F(z) = \frac{e^z}{1 + e^z} = \frac{1}{1 + e^{-z}} \quad (1)$$

Where e is the exponential. The estimated logit model is

$$\hat{y} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)}} \quad (2)$$

Where \hat{y} is the probability that the dependent variable $y^* = 1$.

The fitted regression function appears as an S-shaped line, approaching zero and one asymptotically. Since the model is not linear, a maximum likelihood approach is used to estimate the parameters. Further, since the t-statistics is only valid asymptotically the critical values from the normal distribution, z-statistics, are used².

It is not possible to determine the effect of the explanatory variables on y directly from the fitted regression. Rather the marginal effects need to be found. These can be found by putting in the regression line in expression (2), together with the mean values of the explanatory variables, to find \hat{y} . The marginal effect is then the parameter value times the probability \hat{y} ³.

¹ We chose logit over probit since the differences between the models, when the dependent variable is evenly spread, is according to Brooks (2008:518) minimal.

² Brooks (2008:514-515)

³ Brooks (2008:519)

Text-Box II *Semilognormal transformation*

Comparison of mean using semi-log transformation¹

Doing a logarithmic transformation only on the dependent variable when using linear regression, is equivalent with taking the geometric mean of the variable. This is parallel to the regular regression on the dependent variable, which gives the arithmetic mean.

$$\sqrt[n]{\prod_{i=1}^n a_i} = \exp \left(\frac{1}{n} \sum_{i=1}^n \ln a_i \right)$$

When comparing the geometric mean and the arithmetic mean it is important to remember that the geometric mean is usually smaller than the arithmetic. This is in our case important to remember if comparing the differences in mean across countries.

While dealing with negative numbers, doing log transformation requires us to add a constant to the dependent variable. The constant will not interfere with the slope of the coefficients, but it will bias the mean slightly upwards.

In our panel data model we have three different forms of equations

1)

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

2)

$$\log(y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

$$y = e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2}$$

3)

$$\log(y - c) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

$$y = e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2} + c$$

To get the y's to give sensible comparable results we use median values of X1 and X2 when presenting the dependent variable means, since the dependent variable most likely never are at the intercept².

¹Wolfram Research, Inc. (1999-2009)

² Kreiberg (2009)