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Title: **The Impact of Buyouts on Company Performance: Evidence from Norway**

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This thesis was written as a part of the Double Degree programme between NHH MSc in Economics and Business Administration, Major in Financial Economics, and The Business school of the University of Mannheim, Mannheim Master in Management (MSc). Neither the institutions, the supervisor(s), nor the censors are - through the approval of this thesis - responsible for neither the neither the theories and methods used, nor results and conclusion drawn in this work.

The Impact of Buyouts on Company Performance: Evidence from Norway*

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ABSTRACT

There exists a long-standing controversy about private equity and its impact on the funded company. Using a novel data set compiled by the Argentum Centre for Private Equity at the NHH on Norwegian buyout transactions, the economic impact on the respective portfolio company is analyzed for a sample of 113 buyouts occurring within the period of 1996 and 2009. The focus lies on five performance dimensions: the financial performance, profitability and productivity, the development of financial distress risk, the impact on employment as well as innovation. At first, enhancements in operating income and net cash flow are observed for portfolio firms in conjunction with substantial increases in sales. Secondly, a productivity improvement owing to the buyout transaction occurs. Finally, evidence depicts a substantial increase in employment remuneration for private equity-backed companies, thus suggesting that the universal criticism on the impact of buyouts on employment and wages is unfounded and misplaced.

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Contents

Although private equity is not a new phenomenon, the tremendous market growth since the early 2000s has been accompanied by increased media attention as well as criticism from, among others, trade unions. Despite being accused of asset stripping, notwithstanding its strict illegality, and asset flipping, private equity firms have been criticized for instigating restructuring programs negatively impacting employment, in addition to reducing its tax charges and thus enhancing its financial performance by the use of leverage and having offshore holding companies (Wright, Gilligan, and Amess, 2009). However, much of this private equity debate tends to be based on hearsay or, at best, isolated examples, with little reference to the actual real economic impact of the private equity industry Strömberg (2009).

Existing academic research largely dissents the prevailing criticism and provides evidence for a positive impact of private equity, i.e. its active advising and monitoring role, on various aspects of the individual portfolio company's development. In particular, profitability and productivity improvements are observed for private equity-backed companies (see e.g. Kaplan (1989b), Muscarella and Vetsuypens (1990), Lichtenberg and Siegel (1990), Guo, Hotchkiss, and Song (2011) or Wilson, Wright, Siegel, and Scholes (2012)). Such advances are correlated with financial performance and ultimately result in higher investor returns. Correspondingly, academic evidence finds consistently high fund performance. For instance, Harris, Jenkinson, and Kaplan (2014) report a buyout fund out-performance (to the S&P 500) by averages of 20% to 27% (more than 3% p.a.).

On the contrary, the financial distress risk might be at stake, negatively impacting the economy, as buyouts are often characterized by large amounts of debt, financing the transaction. Similarly, enhancements in profitability, e.g. created by implemented restructuring programs, might be at the expense of employment or other stakeholders' wealth. Consequently, controversy exists whether private equity returns stem from true economic value creation or are merely the result of value appropriation from other stakeholders of the portfolio company.

Most academic research focuses on one aspect of private equity performance and thus fails to provide a solid judgment on the real source of private equity value. For instance, by analyzing the financial distress risk, Tykvová and Borell (2012) find increased financial distress risk after the buyout event, but lower distress risk and bankruptcy rates for buyout-backed firms than non-buyout comparables. However, the analysis does not address other performance aspects. In this context, it might be the case that the underlying sample does not provide exemplary profitability improvements or financial performance. Hence, the strict distinction of most academic literature on a certain field of interest facilitates an understanding on certain relationships, but fails to provide a holistic perspective.

One main obstacle has been the lack of available data since private equity investments have been largely exempt from public disclosure requirements (Kaplan and Schoar, 2005).

Thus, research has been challenged and, additionally, focused on large economies, such as the U.S., which provides the longest history of private equity investments due to its early capitalistic system, or Europe as a whole. Few research exists examining the impact of private equity funding on companies within a singular country, especially a small one such as Norway. But, such effort is needed to provide a foundation for political discussions concerning the implementation of regulations or investment incentive schemes. Furthermore, such economies might provide plenty of growth potential and thus have already been targeted by investors. Norway seems to provide extra-ordinary opportunities or at least offered such in the recent past, which is underlined by Preqin, reporting two Norwegian funds among the top European buyout funds, i.e. the Herkules Private Equity Fund I (net IRR of 79.8%) and the HitecVision Private Equity III (net IRR of 72.0%).

This thesis examines the entire Norwegian buyout activity, using a novel data set compiled by the Argentum Centre for Private Equity at the NHH (ACPE) on Norwegian private equity investments, and analyzes the development of the underlying portfolio companies in order to provide evidence on the economic impact of private equity by answering the question whether the abnormal development stems from real economic value creation or only value appropriation from other stakeholders. For a representative sample of 113 different buyout transactions in Norwegian portfolio companies which occurred before 2009, the performance is assessed using a comprehensive Norwegian accounting database, supplemented with additional data where appropriate.

Economic value attributable to private equity is measured as the differential development between the portfolio company and a constructed counterfactual outcome using propensity score matching among all public and private Norwegian corporations. To provide a holistic assessment on the economic impact, the analysis differentiates the performance along five dimensions, i.e. the financial performance, profitability and productivity, financial distress risk, employment and wages as well as innovation.

With respect to these dimensions the analysis reveals three major points. First, an improvement in operating income and net cash flow is observed within the financial performance analysis for private equity-backed portfolio companies after the buyout occurred. In this context, evidence implies decreasing capital expenditures, which underlines the cash-driven focus of private equity firms. In terms of profitability and productivity, substantial increases in inflation-adjusted sales and asset turnover are observed for private equity-backed portfolio companies, providing evidence that private equity firms aim to enhance the firm potential. Furthermore, the current ratio of buyout firms decreases over time, suggesting a valuation of tighter working capital at the expense of increased liquidity risk by private equity firms. Moreover, an efficiency improvement is observed using a Cobb-Douglas model specification. In this regard, evidence indicates that targeted companies provide a lower efficiency compared to their matched peers before the buyout occurs, i.e. an efficiency differential of -10.8%, and experience a significant improvement

to a differential of 29.3% after the buyout transaction.

Second, results for Norwegian companies provide evidence that the private equity investments' enhancements in profitability are not entirely generated at the expense of employees, as significant improvements in wages are observed for portfolio companies. Finally, evidence on innovative performance remains inconclusive, whereas findings on bankruptcy risk depict a bankruptcy probability of 4.42% for portfolio companies. Even though, control firms provide a lower bankruptcy risk, i.e. bankruptcy probability of 2.12%, the bankruptcy probability of buyout firms is still below the general probability of bankruptcy among Norwegian companies, i.e. 12.36%. Furthermore, by analyzing the panel on factors that influence the bankruptcy likelihood, evidence reports a positive, but insignificant effect of receiving private equity funding, which implies that the bankruptcy likelihood is statistically not higher for buyout companies than their comparables. Hence, private equity returns from investments in Norwegian companies seem to be based on real economic value creation, although it cannot be entirely averted that certain stakeholders, which are not regarded within this thesis, are negatively affected by the buyout transaction.

By capturing the development along five dimensions and thus not only analyzing one aspect of corporate performance, this thesis contributes to the existing academic research as it provides a holistic overview on the economic impact of private equity. Furthermore, this thesis is based on a profound attempt to capture all buyout market activity and thus aimed to diminish the sample selection bias existent in previous research. By depicting the entire buyout activity and not only the resulting sample, this thesis provides an unadorned view on the Norwegian buyout market, on which the Argentum Centre for Private Equity at the NHH is able to take appropriate actions to enhance their existing database by eliminating distortions and gathering essential data. Furthermore, data distortions are highlighted in the underlying accounting database. Thereby, this thesis has to acknowledge a certain bias in the results if distortions in the accounting database, based on missing or false values, are systematic due to the gathering process or other aspects in the collection process.

The remainder of the thesis is structured as follows. In Section I, the private equity industry as a whole is investigated in terms of fundraising, investments and divestments, using a top-down approach by starting on a global basis to a detailed analysis of the Norwegian market. Section II reviews the existing academic literature exploring the performance of private equity investments and its determinants in terms of investor returns, operating profitability, financial distress risk as well as its impact on employment and innovation. The construction of the data set is described in Section III, whereas the empirical analysis is presented in Section IV. Section V concludes the thesis and discusses potential future research.

I. Private Equity - Market Analysis

A. The Private Equity Market

Kaplan and Strömberg (2008) report 17,171 private equity-backed buyout transactions that occurred from 1970 until the end of June 2007 analyzing the database Capital IQ. The buyout transaction activity in terms of value reached its first peak in 1988, dropped during the early 1990s, increased and peaked in the later 1990s, declined in the early 2000s and rose substantially between 2004 and 2006. Owing to the recent tremendous growth, the substantial fraction of buyout activities has taken place within the last years. To exemplify, Capital IQ recorded 5,188 buyouts between 2005 and June 2007 at a combined estimated enterprise value of over $1.6 trillion (estimated in 2007 dollars), accounting for 30% of all transactions and 43% of the total real transaction value from 1984 to 2007, respectively (Kaplan and Strömberg, 2008).

Private equity investments in the late 1980s occurred primarily in the U.S., Canada and to a smaller extent in the UK, covering together 89% of the entire worldwide leveraged buyout (LBO) transactions and 93% of the transaction value within the period of 1985 and 1989. Those deals were mainly acquisitions of relatively large mature companies and public-to-private deals (P2P). After the market for junk bonds fell in the late 1980s, P2P transactions declined significantly to less than 10% of the transaction value, while the average target company's enterprise value decreased from $401 million to $132 million (both estimated in 2007 dollars). Instead, 'Middle-market' non-public firm buyouts, i.e. acquisition of an independent company or a division from a large company, gained importance at that time. Previously, the manufacturing and retail industry had been targeted by private equity firms, whereas then others such as technology, financial services and health care became more attractive as target industries. Even though, the aggregate transaction value decreased in the first half of the 1990s, the number of transactions doubled compared to the second half of the 1980s. In the following period of 1995 up to 2004, the private equity market experienced steady growth with the exception of drops during the dot-com crisis (2000-2001). While buyouts of private firms still amounted for 80% of the total transaction value and 90% of the transactions, buyouts of public companies increased. Due to private equity fund exiting their old investments, the deal-flow of buyouts was stimulated. By the period of 2000 up to 2004, those secondary buyouts made up over 20% of the aggregate transaction value. Nevertheless, conglomerates' divestitures of divisions were the largest source of deal at that very time. Even in continental Europe, buyout activity emerged. Between 2000 and 2004, the western European private equity market, including the UK, accounted for 48.9% of the aggregate worldwide transaction value, as compared to the U.S. with 43.7% (Kaplan and Strömberg, 2008).

There is a similar cyclicality between transaction activity and fundraising. Global

fundraising data obtained from Preqin[1] report a significant increase since the early 1980s. In 1980, 12 private equity funds with a final size volume of $692.7 million were raised. Six of these funds were classified as buyout funds with a volume of $522.7 million. In comparison, these figures increased to 479 funds with a total final size volume of $214.89 billion, of whom 255 were classified as being buyout funds with a volume of $191.88 billion in the year 2014. Within the 1980s, buyout fundraising reached its peak in 1987 with $9.64 billion, decreasing in the first half of the 1990s, increasing afterwards with a peak in 2000 with $108.14 billion, dropping as a result of the dot-com crisis, rising again between 2005 and 2008 by raising a total of $890.1 billion, dropping to a low of $63.17 billion in 2010 and recovering in the meanwhile. For Europe, Preqin reports that the first two buyout funds were raised in 1985 with a total final size volume of $348.21 million, whereas in 2014, 75 buyout funds with a volume of $60.19 billion were raised. Similarly to the global comparison, venture capital specialized funds have a diminishing role compared to its buyout counterparts in fundraising.

The European Venture Capital Association (EVCA)[2] provides a more detailed overview in their annual yearbooks on fundraising, investment and divestment activity in Europe from 1989 onwards. In 1989, the European private equity market raised funds in the amount of €5.81 billion, of which €5.29 billion as new funds (difference comes from realized capital gains). By 2014, total funds increased to €44.64 billion, peaking in 2006 with €112.34 billion. Of total funds raised in 2014, €35.15 billion (78.7% of total funds raised) were raised by 89 funds with a stage focus in buyouts and €4.06 billion (9.1%) by 120 venture focused funds. Most of the funds raised by buyout funds were gathered from pension funds (29.7%) in 2014.

Investment and divestment statistics provided by the EVCA are distinguished between industry and market statistics. Industry statistics cover investments and divestments by the affiliation of the private equity firm, whereas market statistics cover the activities by the country of the portfolio company. Obviously, the latter is of more interest in this empirical setting, analyzing the impact on Norwegian companies. Unfortunately, market statistics are only provided from 2007 onwards. To provide a comprehensive overview, the following analysis covers firstly the industry statistics for the entire time horizon and secondly the market statistics where appropriate. The same structure applies for the Norwegian market analysis in Section I.B. From 1989 to 2014, European private equity firms invested an aggregate transaction value of €479.89 billion as buyouts representing 66.62% of the total private equity transaction value. In 1989, buyout investments amounted to €1.91 billion, whereas in 2014 to €31.71 billion, peaking in 2007 with €59.64 billion. However, 78.55% of the aggregate buyout transaction amount were made between 2004 and 2014.

Investment returns are realized by exiting the equity stake in the portfolio company. The GP liquidates his equity holding either through an initial public offering (IPO), a

trade sale (sale to industry investor), a secondary investment (sale to another private equity firm), a buyback (sale to the initial owners), or a write-off, i.e. financing termination and investment discarding due to a failure. Within the 1990s, an annual average of 42.3% of private equity investments were exited as a trade sale. Public offerings were the second most often chosen form with a yearly average of 20.9%. Consistently, write-offs increased significantly in years with economic downturns. For instance, in 1991 divestments through write-offs accounted for 27.9%, while the yearly average was 16.2% in the 1990s. In 2000, write-offs accounted for 7.6%, whereas in 2001 this number increased to 22.8% by an increase in total divestment of 37.0%. Similarly, in 2007 divestments in the amount of €0.78 billion were undertaken as write-offs, whereas in 2009 this number increased to €4.1 billion. Between 2000 and 2012, exiting through a trade sale was the dominant form with an annual average of 28.8% of total fractions. In contrast to the 1990s, secondary divestments, i.e. sale to another private equity house, gained importance (annual average of 18.7%, accounting for 25.14% of total divestments). Divestments through public offerings as well as write-offs still accounted for a large fraction, i.e. annual average of 11.7% and 13.5% between 2000 and 2012, respectively. In 2014, divestments by trade sale and sale to another private equity house were the dominant forms accounting for 25% and 24% of total divestments of €39.07 billion, respectively.

Table I provides detailed statistics on the percentages invested in private equity as of GDP for individual countries. Panel A displays the GDP for the Nordic countries as well as large European economies for benchmarking purposes. The European GDP is the sum of the GDPs of all individual countries covered by the 'EVCA Private Equity Activity Data 2007-2014'. Panel B reports the private equity investment amount as a fraction of GDP under market statistics, whereas Panel C under industry statistics. For Europe, only slight differences exist between Panel B and C. The statistic is higher under industry statistic than market statistic for every year, indicating that European private equity firms invest more in companies abroad than private equity companies from outer-Europe invest in European portfolio companies. Larger differences exist for the individual countries. For instance, the private equity firms of the UK invested 1.57% of its GDP, whereas only 0.93% was invested in companies located in the UK in 2007.

Despite general fundraising statistics, Preqin also provides general data on private equity funds and their most recent performance, measured by the internal rate of return (IRR) and/or the cash multiple (i.e. total distributed divided by total invested), and, if available, detailed cash flow data. To provide an overview on the market performance of private equity, the former has been used. Results are depicted in Appendix A. Panel A provides the vintage returns on a global basis separated between buyout and venture funds, where the performance is as of December 2014. The data covers 567 buyout and 683 venture capital funds, which were raised between 1980 and 2012, with lack of information afterwards. The average equal-weighted IRR for buyout and venture funds

Table I
Private Equity Investments as % of GDP

This table provides statistics on private equity investments of selected countries in contrast to the European benchmark. Panel A reports the respective GDP in € billion. Panel B reports the aggregate amount of private equity investments in portfolio companies of the respective country in relation to its GDP, whereas Panel C considers the investments undertaken by private equity firms of the country in relation to the country's GDP.

Panel A: GDP (€ billion)								
	2007	2008	2009	2010	2011	2012	2013	2014
UK	2,164	1,907	1,664	1,817	1,864	2,041	2,017	2,218
Germany	2,510	2,558	2,457	2,576	2,699	2,750	2,809	2,904
France	1,946	1,996	1,939	1,998	2,059	2,091	2,114	2,142
Sweden	356	352	310	369	405	423	436	429
Norway	293	317	278	324	358	397	393	377
Denmark	233	241	230	242	246	251	253	257
Finland	187	194	181	187	197	200	202	204
Europe	*13,685*	*13,841*	*13,029*	*13,682*	*14,182*	*14,505*	*14,596*	*14,965*

Panel B: Private equity investment (market statistics) as % of GDP								
	2007	2008	2009	2010	2011	2012	2013	2014
UK	0.93%	0.69%	0.30%	0.70%	0.55%	0.49%	0.48%	0.43%
Germany	0.42%	0.37%	0.12%	0.19%	0.25%	0.24%	0.18%	0.25%
France	0.62%	0.45%	0.16%	0.33%	0.47%	0.25%	0.30%	0.39%
Sweden	0.87%	0.65%	0.36%	0.75%	0.83%	0.60%	0.19%	0.33%
Norway	0.40%	0.36%	0.25%	0.58%	0.25%	0.24%	0.43%	0.59%
Denmark	0.79%	0.50%	0.21%	0.16%	0.36%	0.34%	0.74%	0.49%
Finland	0.57%	0.34%	0.37%	0.32%	0.43%	0.30%	0.39%	0.35%
Europe	*0.51%*	*0.39%*	*0.19%*	*0.31%*	*0.32%*	*0.25%*	*0.25%*	*0.28%*

Panel C: Private equity investment (industry statistics) as % of GDP								
	2007	2008	2009	2010	2011	2012	2013	2014
UK	1.57%	1.20%	0.59%	1.08%	1.13%	0.80%	0.80%	0.72%
Germany	0.32%	0.28%	0.11%	0.19%	0.16%	0.19%	0.22%	0.20%
France	0.65%	0.43%	0.18%	0.30%	0.45%	0.25%	0.28%	0.42%
Sweden	0.84%	0.95%	0.43%	0.85%	0.53%	0.48%	0.36%	0.37%
Norway	0.24%	0.24%	0.23%	0.29%	0.20%	0.22%	0.22%	0.34%
Denmark	0.57%	0.21%	0.20%	0.18%	0.17%	0.28%	0.59%	0.26%
Finland	0.20%	0.25%	0.20%	0.24%	0.22%	0.24%	0.28%	0.28%
Europe	*0.53%*	*0.39%*	*0.19%*	*0.32%*	*0.33%*	*0.26%*	*0.26%*	*0.28%*

is 21% and 17%, respectively. The average size-weighted IRR for buyout funds is 19%, whereas for venture funds 18%. However, buyout performance judgment is biased due to the tremendous growth in recent years. Funds raised in 2001 have the highest median IRR with 31%. As pointed out above, roughly half of the overall transaction value has been undertaken recently with their performance not yet determined. The financial crisis seems to have had a significant impact on buyout performance, as e.g. the buyout vintage median return of 2006 (i.e. 9%) is the lowest in the time period covered, but if this remains the case and to what extent will be only known in a couple of years due to its longer investment horizon.

In Europe, the data set covers 189 buyout funds between 1989 and 2012. The average equal-weighted IRR for buyout funds is 21%. The average size-weighted IRR for buyout funds is 21%. Buyout funds with vintage years in the second half of the 1990s provide lower IRRs (average median IRR is 15%) compared to the first half of the 1990s (average median IRR is 23%) as well as of the 2000s (average median IRR is 25%). Similar to the global analysis, recent performance figures should be analyzed cautiously. For 51 venture capital funds, the IRR is recorded between 1997 and 2012 with missing data in between, which makes an evaluation inefficient.

KKR has raised $62.96 billion in 14 funds over the last 10 years and has been among others, such as ABRY Partners ($8.15 billion raised in seven funds) and Apollo Global Management ($54.17 billion raised in six funds), among the world's top performing general partners in the buyout segment. In Europe, Altor from Sweden and Auctus Management from Germany are the top performers with all their funds being among the top quartile. Altor has raised during the last 10 years $7.07 billion in three funds, whereas Auctus Management has raised only $0.61 billion in three funds. The largest European GP among the consistent top performing buyout managers is CVC Capital Partners having raised 50.48 billion in 9 funds (on position four). The European buyout fund with the highest net IRR of 239.8% is the Auctus Fund I (vintage year is 2003), followed by the Imperial Capital Acquisition Fund II with a net IRR of 147.4%. Interestingly, among the top European buyout funds, there is on position six the Herkules Private Equity Fund I (vintage year is 2004) and on position 9 the HitecVision Private Equity III (vintage year is 2002) with a net IRR of 79.8% and 72.0%, respectively, both of them being headquartered in Norway with investments in Norwegian companies.

B. Private Equity in Norway

Compared to other European countries such as the UK and Germany, the Norwegian private equity market is relatively small and adolescent. Despite its young development stage, Norway has experienced a considerable growth in the number of private equity managers and funds as well as assets under management over the last two decades.

It was only in 2001, when the Norwegian Venture Capital Association (NVCA) was established, while the EVCA had already existed since 1983. With its incorporation, the NVCA's members had approximately €900 million under management, while this number increased to €10 billion in total to the end of 2013 (Wiese-Hansen and Nordal, 2014). Near the end of 2013, NVCA reported 51 Norwegian private equity managers, who managed 107 funds (Hammerich and Heistad, 2015). By June 2015, Argentum reports 56 Norwegian private equity houses (compared to Sweden with 72 private equity firms), of whom 17 are focused in the buyout segment. Geographically focused on Norway are 148 buyout funds, whereas 48 buyout funds have their headquarters in Norway. Through its development, Norwegian private equity firms have established an international reputation and thus compete now against far more seasoned international private equity houses on international grounds (Wiese-Hansen and Nordal, 2014). Hence it follows, it has only been recently that private equity has attracted increasing attention and become acknowledged as an alternative financing way for businesses stimulating economic growth and being a catalyst for innovation.

The immediate effect of an active private equity industry is the available access for businesses to risk capital for its R&D activities and thus the encouragement of innovation. Annually, the European Innovation Scoreboard (EIS), i.e. an instrument of the European Commission developed under the Lisbon Strategy, has been published, providing a comparable assessment of the innovation performance capturing different key indicators. As from 2011, the EIS has been replaced by the revised Innovation Union Scoreboard (IUS). The IUS classifies countries with the highest level of innovation as innovation leaders, the second highest as innovation followers, followed by moderate innovators and last modest innovators. According to the IUS report of 2015, Norway is a moderate innovator with a strong innovative performance in tertiary education and its scientific activities, thus getting closer to the performance of innovation followers. Even though, such strong performance exists and good relative performance is observed for venture capital investments, Norway's performance is for most IUS dimensions, in particular for license and patent revenue from abroad and exports in medium and high-tech products, below the European average. Still, Norwegian innovation performance has been increasing since 2006, peaking in 2012 with a slight decline in 2014. To clarify, Norway had a score of 0.434 in 2006 and 0.479 in 2014, whereas the European average was 0.493 and 0.555, respectively. Sweden had the second highest score behind Switzerland not only in 2006 with a score of 0.732, but also in 2014 with 0.740. Denmark and Finland, with position three and five, remained above Norway with place 17 in 2012. Initially in 2006, Norway was positioned 14 in the ranking. In 2014, Finland and Norway improved its ranking position to four and 16, respectively (Hollanders and Es-Sadki (2014), Hollanders, Es-Sadki, and Kanerva (2015)).

Even though, innovative performance is increasing and thus most certainly attracting

private equity investors, market and regulatory conditions have genuinely a substantial influence on investor activity. Due to its extensive natural resources, Norway has one of the largest GDP per capita in the world, leading to a high standard of living associated with high individual earnings. Keeping this in mind, taxation regulation, employment protection and large employee remuneration might suppress growth potential and thus challenge private equity opportunities.

When a private equity manager (the general partner, i.e. GP) establishes a fund, several factors influence his preferences for a certain jurisdiction and legal form for the fund. To exemplify, the size of the fund, the manager's professionalism, whether the fund will address international or Norwegian investors, and the focused market segment, i.e. buyout or venture capital, are important and have to be taken into account by the manager (Wiese-Hansen and Nordal, 2014).

Unfortunately and in contrast to many other European and offshore jurisdictions, Norway does not offer a certain fund legislation that is designed to the needs of the private equity firms and its investors. When establishing a Norwegian private equity fund, the manager has to use one of the ordinary commercial company structures, none of which have been specifically developed for the fund or the private equity industry. Furthermore, the Norwegian infrastructure and back-office service providers have less experience and are less sophisticated than in many other well-known European fund jurisdictions. Consequently, the largest and most professional Norwegian private equity firms establish their funds abroad (Wiese-Hansen and Nordal, 2014) such as HitecVision and Norvestor Equity who have established funds e.g. in Guernsey.

Among the choice of legal structures, Norwegian private equity funds are usually established as limited liability companies (Aksjeselskaper (AS)), internal companies/silent partnership (Indre selskap (IS)) or limited partnerships (Kommandittselskap (KS)) with the latter two being tax-transparent vehicles. Owing to this and the higher inherent capital flexibility, many fund managers and investors prefer to establish and invest in a limited partnership or an internal company, with the latter having the most similarities with a foreign limited partnership (Wiese-Hansen and Nordal, 2014). Especially, the fund manager's decision on the fund's jurisdiction and its legal structure is highly affected by the tax regulation not only for the chosen vehicle itself and the GP's income, but also for the investors' income. If the fund manager fails to recognize certain investor needs with respect to taxation and other forms of regulation, the GP will not be able to raise the required funds.[3]

In spite of local taxation rules, takeover regulations are important, in particular for buyout funds. In Norway, the EU Takeover Directive is implemented through the Norwegian Securities Trading Act, applying for Norwegian and foreign corporations listed on the Oslo Stock Exchange or Oslo Axess (regulated Norwegian market place). If a voluntary offer is accepted by the existing shareholders, a mandatory offer obligation for

the remaining shares is triggered if the buyer becomes owner of more than one-third of the voting rights, with a repeating obligation at 40% and 50%, respectively. If the target company is unlisted, regardless of being public or private, the buyer can determine the transaction process largely himself, being only restricted on potential agreements with the target company or its shareholders (Hammerich and Heistad, 2015).

Through the 'Public Limited Liability Companies Act' (ASA Act) and 'Limited Liability Companies Act' (AS Act) in 2013, the rules on business incorporation, firm capital and organizational matters were eased. To exemplify, the excess amount of paid-in capital above the notional amount belongs now to distributable reserves, instead of the existing treatment as restricted capital. Furthermore, the book value of R&D, net deferred tax assets as well as acquired goodwill will now be included in the calculation basis for dividends. Moreover and most importantly, the new regulations are less draconic, in the sense, that they permit credit granting within groups if such security providing serves the economic interest of the group. This is sufficiently in place if one or more, but not necessarily all companies within the group benefit from the agreement. In addition to this, the strict prohibition of credit granting or security providing by the limited liability company or its parent firm in connection with the acquisition of company shares by a third party were modified, i.e. allowing financial aid to the buyer at the maximum of the company's distributable reserves, under the condition that the general meeting resolves this aid. The previous prohibiting regulation prevented targeted Norwegian portfolio companies from engaging as co-borrowers or sponsor of acquisition-related debt financing. The recent business-friendly amendments may not only impact the number of M&A activities, in particular buyout deals, but also the financing structure owing to the higher flexibility (Wiese-Hansen and Nordal (2014), Hammerich and Heistad (2015)).

On July 1, 2014, the 'EU Alternative Investment Fund Managers Directive' (AIFMD) was implemented in Norway through the AIF Act and several transitional provisions, expiring by the end of 2014. This new regulation may trigger organizational changes and potentially some private equity manager's offshoring to countries outside the EEA (Hammerich and Heistad, 2015). Previously, private equity managers in Norway were unregulated and thus had no disclosure and fiduciary duties (Wiese-Hansen and Nordal, 2014). Norwegian private equity managers are now required to be registered or authorized by the regulator. Authorization is required for managers having assets under management of €100 million, with the exception of unlevered funds having no redemption rights within five years, for which the threshold increases to €500 million. The majority of Norwegian private equity managers falls below this threshold, but will likely be affected by the authorization requirement for cross-border management or targeting non-professional investors in Norway. The AIFMD triggers new reporting requirements in the event of acquisitions and regulations, preventing 'asset stripping' of portfolio companies for private equity managers. Even though the terms of control acquisitions remain confidential, the

timing will become public faster than before. Furthermore, since Norway is not part of the EU system of financial supervision, EU legislative acts relying on the system have not been incorporated into the EEA agreement, implying a potential deny of marketing passporting rights of Norwegian private equity managers by EU member states, i.e. restricting their market access. Through Norway's recent agreement with the EU to partially integrate into the system of financial supervision, several other EU legislative acts such as CRD IV, Solvency II, MiFID II, UCITS V, EMIR and the short selling regulation will be implemented. Additionally, the new EU regulations on venture and social entrepreneurship funds, as well as the proposed regulation on long-term investment funds will be implemented, enabling easier market access for Norwegian private equity managers and thus allowing more efficient fundraising (Hammerich and Heistad, 2015).

The Norwegian state encourages private equity investments through funding via designated investment companies such as Investinor and Argentum. To enhance the capital assess for early-stage companies, Investinor AS was established in 2008 by the government as an investment company for the venture segment. Argentum Fondsinvesteringer AS is a private equity investment company, backed by the Norwegian government, which was founded in 2001 and invests in primary and secondary markets as well as in most Norwegian and Scandinavian private equity funds, with expanding activities outside Scandinavia (Hammerich and Heistad, 2015).

Based on EVCA data, the Norwegian private equity market raised a total of €0.24 million in 1989, whereas €495.79 million in 2012, with an intermediate peak of €1,765.58 million in 2008. Generally, fundraising, investment and divestment activities in Norway are very cyclical and at a low in 2012. Of total funds raised in 2012, €263.78 million (53.2% of total funds raised) were raised by three buyout funds and €232.01 million (46.8%) by six venture capital funds. In 2008, buyout and venture capital funds raised €1,338.85 million (five funds) and €413.41 million (five funds), respectively. Similarly to other countries, the Norwegian private equity market was affected by the financial crisis. In 2009, no buyout fund were raised and total funds raised plumbed to €16.57 million, constituting the lowest value since 1992. In the following two years, the private equity market recovered and raised a total of €1,654.58 million in 2011. Within the last two years, the private equity market recovered from the low in 2012, i.e. total funds raised of €495.79 million, and peaked with an all time high of €1,932.4 million in 2014. This is largely due to the largest fundraising to date by a Norwegian manager, i.e. the fund HitecVision VII, who raised in total NOK 11.4 billion in 2014 according to Hammerich and Heistad (2015). The amounts raised by venture funds increased moderately by 6% compared to its level in 2012.

Considering the entire Nordic area (i.e. Denmark, Finland, Sweden and Norway), fundraising of private equity is very cyclical and largely driven by Sweden, the biggest private equity market. For instance, private equity raised a total of €1,798.65 million

in 2012, whereas €6,962.24 million in 2013 and €5,874.01 million in 2014. Swedish fundraising accounted for 22.4%, 80.5%, and 54.7%, respectively, which highlights the large dependency by explaining the volatility in the aggregate amount. The Norwegian private equity market represents 32.9% of the total Nordic private equity market in terms of fundraising (27.6% in 2012).

Investment activity in Norway is firstly analyzed in terms of industry statistics, i.e. the investment activity of Norwegian private equity firms, and secondly in terms of market statistics, i.e. investments undertaken in Norwegian portfolio companies. Whereas Norwegian private equity firms started to invest in venture capital investments in the 1980s, the first buyout investments were made in 1992 with a total transaction value of €1.11 million, distributed among three investments. To exemplify, in 1992 an aggregate amount of €21.88 million were made as venture capital investments. Whereas the market for venture investments grew dramatically in the following two years, amounting to €59.73 million in 1994, no buyout investments occurred in the same period. Only in 1995, the buyout market started to develop with a total transaction volume of €0.62 million, i.e. divided by four transactions. By 1999, a transaction volume of €35.23 million (18 investments) was reached, whereas venture capital investments amounted to €172.2 million (144 transaction). In 2000, buyout transactions dropped, whereas venture investments experienced a significant increase to €291.18 million, distributed among 251 investments. By 2003, the buyout market seemed to recover with a transaction value of €29.65 million (12 small buyout transactions). In the following periods, the buyout market increased significantly up to €340.6 million (20 transactions) in 2007, whereas venture capital investments amounted to €285.71 million, peaking in 2005 with €329.47 million. The buyout market remained stable in 2008 and 2009 with a total transaction volume of approximately €380 million. Until 2012, the aggregate buyout transaction value increased to €545.89 million with 17 investments, but peaked in 2010 with a value of €625.4 million with 14 investments. However, venture capital investments decreased to €130.26 million in 2012. To sum up, contemplating the period from 1989 up to 2006 with the first buyout investment undertaken in 1992, a total of 158 buyouts (1997-2006: 129 companies while 147 investments) occurred with an additional 89 companies involved in the period of 2007 up to 2012.[4] In total, between 1989 and 2012, an aggregate buyout transaction value of €3.22 billion was made by Norwegian private equity houses.

As depicted in table I, the Norwegian economy is rather small compared to the large economies in Europe. However, within the Nordic countries, Norway comprises an important role as the second largest economy, close behind Sweden. In comparison to the provided industry and market statistic of the European average, the invested amount in Norwegian companies and the amount invested by Norwegian private equity firms differ significantly. The same holds for the other Nordic countries. The Norwegian market statistic is larger than the industry statistic, implying that more money is invested in Nor-

wegian portfolio companies than Norwegian private equity firms invest. To exemplify, in 2014, the aggregate investment amount, which was undertaken in Norwegian portfolio companies, represented 0.59% of Norway's GDP, while Norwegian private equity firms invested only 0.34% of the corresponding GDP value. Hence, Norway is an attractive target for foreign private equity firms. Similarity exists for Denmark and Finland, while the statistics for Sweden do not provide such clear evidence.

In 2014, a total of €5,594.35 million was invested in portfolio companies of the Nordic area. Norwegian companies represented 39.5%, whereas only 25.4% were invested in Swedish companies. Between 2007 and 2014, a total of €10,660.9 million private equity funds was invested in 1,250 Norwegian portfolio companies, of which 77.17% constituted buyout investments. Of total companies receiving private equity funding, 173 were classified as buyout and 910 as venture capital investments. In 2007, a total of €852.173 million was made as buyouts, while this figure increased to €1,873.96 million by 2014, implying a compound annual growth rate of 11.92%. In 2014, 34.78% of total buyout transactions occurred in the computer and consumer electronics industry, 21.35% in the financial services industry, 14.61% in the energy and environment industry, and 11.54% in business and industrial services. These four industries represent 82.28% of total buyout investments. Of total private equity investments in Norwegian companies, 58.19% were undertaken by local private equity firms in 2014. Between 2007 and 2014, local private equity firms accounted on average for 68.45% of total investments.

The chosen divestment form differs based on the particular case. The attractiveness of the portfolio company will strongly determine the choice as well as the time horizon, in which the exit will be executed. Generally, Norwegian funds divest their investment through a structured auction process, addressing only a few potential buyers, being industry actors, other funds or both, depending on the considered company. Obviously, the divestment is a process which time and success is greatly influenced by the prevailing market conditions as well as certain characteristics of the portfolio company. In Norway, few general rules exist governing private equity exits. In the event of an asset sale, labor law will be relevant, because of the employment transfer. At the moment, Norwegian tax regulation will usually lead to a preference of an equity transaction over an asset sale (Hammerich and Heistad, 2015).

Since 1990, Norwegian private equity firms divested €3,862.53 million of their investments. Owing to the young development stage of the Norwegian private equity market and its recent substantial growth, 75.11% of total divested capital was made within the last 10 years. Considering total funds invested by Norwegian private equity firms of €10.08 billion between 1989 and 2014, a total of 38.33% have been divested. An aggregate amount of €4,493.37 million private equity funds invested in Norwegian portfolio companies was divested between 2007 and 2014. This corresponds to 364 different divestments. Classified as former buyouts investments were 97 divestments, corresponding to

an aggregate volume of €3,565.65 million. In 2014, a total of €1,619.02 million private equity capital was divested, whereby 48.08% and 32.34% was divested by a sale to another private equity house and by a trade sale, respectively. Since, the divestment of former buyout investments represents most of the divestment activity, i.e. aggregate amount of €1,541.60 million (29 divestments), the percentage values are similar. Though, six divestments were made as secondary buyouts and 13 divestments as a trade sale, implying the higher divestment volumes involved in secondary buyouts. On an annual average over the period between 2007 and 2014, 44.88% of buyouts investments were divested as secondary buyouts and 23.37% as trade sales. Interestingly over the period covered, in 2008, 66.85% of total buyout divestments (in value) was divested via a sale to financial institution and, in 2009 88.65% as write-offs. However, in other years, few buyout exits occurred as sales to financial institutions or write-offs. In contrast to European benchmark values, only few buyout investments were exited through public offerings.

In terms of performance, Preqin reports within its performance analysis 17 buyout funds with a Norwegian focus, covering vintage years from 1980 up to 2014. Those funds have an aggregate total fund size of $16.03 billion, with only 10 funds providing a net IRR measure. The fund Procuritas MBO Invest, established in 1990, generated a net IRR of 72%, followed by the Segulah I (vintage year is 1997) with an net IRR of 64.3%. With a Nordic focus, Preqin reports 49 buyout funds with a net IRR for 35 funds. Those funds have an aggregate total fund size of $47.16 billion.

In conclusion, the Norwegian private equity market has vastly developed in terms of fundraising and investments within the last 15 years. Due to its young development stage and thus small size, most investments have not yet been divested, with an investment activity being very cyclical. However, private equity has been acknowledged for its beneficial effects on economic growth and innovation in Norway. Especially, as some Norwegian private equity funds offered an exceptional internal rate of return, highlighting the regional investment potential.

The future of the Norwegian private equity market will be determined and influenced by any long-term effects of the financial crisis, the recent oil price reductions as well as regulatory changes initiated in the EU. The financial crisis as well as the following European sovereign debt crisis did not affect Norway by far as other countries. As a consequence of the crisis, the availability of bank financing for private equity and similar transactions relatively declined. However, Norwegian sponsors have financed their deals by a lesser amount of debt compared to other jurisdictions. Additionally, Norwegian banks have been affected to a lesser extent by the crisis. Consequently, Norwegian private equity firms still finance their deals mainly with bank and mezzanine financing. Additionally, funds exposed to the energy sector may experience lower returns in the future due to the low oil price and thus reduce their investment activity (Hammerich and Heistad, 2015). However, as seen in the previous market analysis, the Norwegian private equity invest-

ment volume depends to a large extent on international investors, who have to adapt to new conditions and thus may structure their deals differently. To sustain current growth, Norwegian private equity firms will continue to increase their professionalism and try to become more international. Likewise, Norwegian companies, applying for funding, will have to adapt more to international standards, such as IFRS accounting.

II. Related Literature on Private Equity

In this section, existing academic literature on private equity performance will be explored. Private equity funds may either provide value to investors by value creation within the invested firm or by value appropriation from e.g. the vendor through buying undervalued assets or a combination of both (Wright et al., 2009). Hence, the performance source needs to be evaluated carefully since it may not be true added economic value, but instead only a value transfer from other stakeholders (Tykvová and Borell, 2012).

Research has investigated several areas concerning the existing controversy on the private equity's key source of success. In the following, the body of work is examined under the five areas of interest: financial performance, profitability and productivity (operating performance), financial distress risk, the impact on employment and wages, and the effect on innovation. To provide a comprehensive overview on the entire subject and determinants of performance, the following literature review covers, in addition to the academic research on firm-level data used in the subsequent empirical analysis, the existing research using fund-level data.

A. Financial Performance

Academic studies have attempted to deepen the knowledge about private equity value creation by using both fund-level and firm-level data. Most of this research has been conducted on U.S. data in the 1980s, estimating risk-adjusted rates of return or benchmarking the generated returns to investments in listed securities.

Studies on fund-level data provided by the EVCA and national venture capital associations show consistently higher IRRs as well as return variance for buyout funds compared to other forms of private equity investments (Wright et al., 2009). However, this does not necessarily imply superior returns for the limited partners compared to other investment opportunities. Firstly, portfolio companies are often purchased in competitive auctions or from public shareholders involving certain premia. For instance, KKR paid a premium on the order of $10 billion to public shareholders of RJR Nabisco. In the aftermath of the transaction, KKR earned a low return for its limited partners since it had to pay out most, if not all, of the benefits to RJR's public shareholders. Secondly, limited partners have to pay meaningful fees to the fund managers (Kaplan and Strömberg, 2008). For

the median PE fund, Metrick and Yasuda (2010) estimate a fee of $19 in present value per $100 of capital under management. Hence, the return to investors will be lower than the return on the PE fund's underlying investment. To exemplify, evidence from the U.S. shows that LBO fund returns exceed those achieved by the S&P500 on a gross-of-fees basis (Groh and Gottschalg, 2006), but are slightly less on a net-of-fees consideration (Kaplan and Schoar, 2005).

For the comparison of returns, three relevant factors need to be contemplated. First of all, a data set might suffer from sample selection bias since buyouts do not follow a random distribution in the population. Secondly, return findings might suffer from survivor bias since only surviving companies remain in the sample. Finally, distortions in the raw data might be caused due to the fund managers valuations, at which non-exited investments are carried, instead of its market valuation (Driessen, Lin, and Phalippou (2008), Wright et al. (2009)). If corrected for these biases, separate evidence demonstrate that the average fund performance shifts from a slight overperformance to an underperformance of 3% p.a. compared to the S&P 500 (Phalippou and Gottschalg, 2009). In contrast to Kaplan and Schoar (2005), Phalippou and Gottschalg (2009) did not incorporate the net asset values (NAVs) for funds having no cash flow activity over the last 10 years in their analysis. However, both relied on the database obtained from Venture Economics (Harris et al., 2014). Stucke (2011) identifies a substantial problem with this particular database as he finds convincing evidence that many funds stopped being updated around 2001, but remained in the data. Hence, no further cash flows were recorded and the NAVs were simply rolled forward, implying that the fund-level IRRs decline over time. Consistently, Harris, Jenkinson, and Stucke (2010) report that returns based on data from Venture Economics are lower for many vintage years compared to other commercial data providers such as Preqin, Thomson Reuters and Cambridge Associates. This bias suggests that the reported returns by Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009) understate the true performance, especially for buyout funds. Harris et al. (2014) analyze 1,400 U.S. buyout and venture capital funds using the database Burgiss. They find a higher fund performance than has previously been documented with consistent higher performance than the public market, using the public market equivalent (PME) method of Kaplan and Schoar (2005). Buyout funds outperformed the S&P 500 by averages of 20% to 27% and annually by more than 3%. Similar overperformance remains using other benchmarks such as the Nasdaq or Russel 2000. These findings are consistent with the evidence obtained by Robinson and Sensoy (2011) and Ljungqvist and Richardson (2003). On the contrary, venture capital funds outperformed their public benchmarks in the 1990s, but not in the 2000s (Harris et al., 2014). Phalippou (2014) finds an average (median) PME (compared to the Vanguard S&P 500 index) of 1.20 (1.13), analyzing 392 U.S. buyout funds, translating into an outperformance of 5.7% p.a., by using an effective holding period of 3.3 years. This result is similar to what industry

associations report as well as previous academic results of Harris et al. (2014) (Phalippou, 2014). However, analyzing the portfolio companies, Phalippou (2014) shows that buyout funds mainly invest in small and value firms with an average buyout fund performance similar to small-cap indices. If levered up and benchmarked to small and value indices, the average buyout segmented fund underperforms by 3.1 % p.a. Under this perspective, the previously used benchmark, i.e. mostly S&P 500 index, has to be challenged. Owing to changes in the characteristics of targeted firms and the transaction structure, future research has to extend previous methodologies to account for these aspects.

If adjusted for risk, venture capital funds appear to generate on average higher returns (Jones and Rhodes-Kropf, 2004). Moreover, venture capital funds earn higher revenue per managed dollar than buyout funds (Wright et al., 2009). Phalippou (2010) analyzes private equity funds risks and returns. He reports a moderate market risk for buyout funds with a significant exposure to liquidity risk and distress risk. With their beta around unity, buyout funds have a cost of capital of 18% in excess of the risk-free rate. In contrast, they report a cost of capital for venture capital of 20% in excess of the risk-free rate, implying a beta of approximately three.

Obviously, financial performance can stem from various sources, such as changes in the invested portfolio company or simply the general market condition. For instance, performance is influenced by the timing of fundraising. Evidence from the U.S. indicates that private equity returns of funds raised in the 1980s appear to be higher compared to its counterparts in the 1990s. Furthermore, funds raised in economic booms seem less likely to raise follow-on funds, suggesting that they perform less well (Kaplan and Schoar, 2005). Moreover, low financing conditions have a potential beneficial effect on financial performance by levering not only the GPs profit margin, but also investment possibilities.

Private equity has been criticized on the motivation to exploit tax shields and loopholes in order to minimize the tax burden. As mentioned above, a country's tax system influences the GP's decision on the fund's establishment location. Increasing tax shields and the exploitation of loopholes increase the fund's performance. Kaplan (1989a) show that for U.S. MBOs tax benefits are an important source of wealth. However, the magnitude varies significantly, depending on the various underlying assumptions, which have to be made. Nevertheless, research is missing and complicated in various aspects considering tax benefits.

Furthermore, controversy exist whether buyout performance is only created through asset sales since such sales may mitigate business growth. However, if private equity firms stimulate the sale of underperforming activities, the remaining business's performance might be enhanced. Furthermore, the proceeds may be invested in other growth opportunities. Evidence from buyouts in the U.S. during the 1980s suggests that larger deals, involving P2Ps, undertake substantial asset divestments (Bhagat, Shleifer, Vishny, Jarrel, and Summers (1990), Seth and Easterwood (1993), Wiersema and Liebeskind

(1995)). Seth and Easterwood (1993) suggests that acquisition and divestment decisions are intrigued by a focus on related business activities. Wiersema and Liebeskind (1995) find evidence that size as well as the scope of the firm decline after the buyout, analyzing not only large buyouts. Such reductions can be either in the form of selling a whole business and thus narrowing the strategic focus or restructuring the capital structure. Unfortunately, studies have not distinguished among those (Wright et al., 2009).

An interesting point is still whether the benefits remain and are sustained after the private equity fund's exit. Evidence from the U.S. show that leverage and management equity decrease after a reverse buyout, but are still high compared to peer listed companies (Holthausen and Larcker, 1996). Prior to an IPO, the accounting performance of a buyout is significantly higher than the buyouts' sector median. Even after the IPO, this performance lies significantly above the company's sector for four years, but decreases during the period with this change being positively related to inside ownership changes and not to leverage. Agency problems do not immediately reappear, but take several years to re-emerge. Cao and Lerner (2009), analyzing 526 reverse buyouts in the period of 1981 and 2003, find in comparison to other IPOs and the entire stock market, that the stock performance over a time horizon of three and five years appear to be equally good or even better, which depends on the specification. However, Cao and Lerner (2009) also find evidence that returns deteriorate over time. Nevertheless, long-term performance considerations are bound to be premature since most transactions occurred only recently. As mentioned above, Kaplan and Strömberg (2008) report that 54% of the 17,171 transactions between 1970 and June 2007 were not exited by the end of November 2007. Hence it follows and being illustrated above with the debate on NAVs, empirical studies, especially on fund-level data, will likely to suffer a selection bias to the extent that they only look at realized investments to avoid estimates undertaken by the fund managers.

Evidence on firm-level data also suggests value creation by leveraged buyouts. Prior studies, focusing on the first private equity wave, assessed the performance of portfolio companies through stock or accounting data, by either benchmarking with the corresponding industry or by comparing to pre-buyout levels (see e.g. Kaplan (1989b), Muscarella and Vetsuypens (1990), Opler (1992)). Such early studies suggest that buyouts enhance financial performance (Cumming, Siegel, and Wright, 2007). More recent studies have assessed the performance in comparison to other relevant peers (see e.g. Guo et al. (2011), Jelic and Wright (2011), Wilson et al. (2012), Scellato and Ughetto (2013)). A study of 199 U.S. buyout fund investments in the period of 1984 to 2004 by Walz and Cumming (2004) suggests a significant positive effect of buyouts, examining the returns to exited buyouts at the deal level. Nikoskelainen and Wright (2007) study firm-level data of exited buyouts in the UK and find an average (median) return of 22.2% (-5.3%) net of market returns, with the difference between mean and median indicating a skewness in

the return distribution. Wilson et al. (2012), analyzing several profitability ratios such as return on assets, find evidence that portfolio companies backed by private equity achieve superior financial performance relative to their peer companies before and during the recession in 2008. Scellato and Ughetto (2013) use propensity score matching to identify and select peer companies, to whom the performance of 241 buyouts are benchmarked with. By analyzing size, profitability and productivity, Scellato and Ughetto (2013) find a positive impact of buyouts on asset growth, while results on profitability are mixed. The latter study elucidates the close link in empirical studies between financial performance and profitability, i.e. operating performance. Due to the existing correlation, improvements in profitability usually conclude in higher financial performance. However, the actual impact is influenced by various factors. For instance, on the one hand, profitability might be improved by the implementation of a large restructuring program, but on the other hand, financial performance might suffer from costs stemming from layoffs, advisors or other expenses such as asset impairments. Consequently, both need to be evaluated separately, especially, in the context of buyout performance.

B. Operating Performance

Academic research on the effects of buyouts on operating performance exists as profitability assessments, measuring cash flows and other accounting metrics (Kaplan (1989b), Opler (1992), Wright, Thompson, and Robbie (1992), Desbrières and Schatt (2002), Guo et al. (2011), Jelic and Wright (2011), Wilson et al. (2012)), as well as efficiency studies on the entire corporation and on the level of establishments (Lichtenberg and Siegel (1990), Amess (2003), Harris, Siegel, and Wright (2005), Wilson et al. (2012)).

U.S. evidence on the beneficial effect of buyouts on profitability and cash flows during the 1980s suggests a substantial average improvement two to three years after the transaction compared to the year prior to the buyout (Bull (1989), Kaplan (1989b), Malone (1989), Singh (1990), Opler (1992), Muscarella and Vetsuypens (1990)). Similar evidence exists for Europe, although conclusions are more mixed and mostly based on the UK (Scellato and Ughetto, 2013). As mentioned above, these early studies assessed the performance by either benchmarking with the corresponding industry or by comparing to the pre-buyout level. Kaplan (1989b) finds a net increase of cash flows and net income along a decrease of capital expenditures, analyzing 76 large U.S. buyouts. Similarly, Muscarella and Vetsuypens (1990) report significant increases in various accounting measures, which are mainly due to the companies' ability to reduce costs.

By analyzing buyouts in the UK, Wright et al. (1992) find that the vast majority during the 1980s show clear improvements in working capital management and profitability. Desbrières and Schatt (2002) demonstrate that French MBOs outperformed its comparables both before and after the buyout, but the relative performance declined after the

transaction was consummated, with this decline being especially notable in buyouts involving former family businesses. Whereas former group subsidiaries reported on average an increase in return on assets in the first subsequent year.

More recent studies do not provide a clear conclusion whether buyouts enhance profitability. Guo et al. (2011), who analyze U.S. LBOs occurring between 1990 and 2006, find evidence that the increases in operating performance are either comparable or slightly exceed their benchmark companies. While Wilson et al. (2012) find superior performance for private equity-backed companies compared to their peers, Jelic and Wright (2011) find no significant changes in profitability and efficiency for UK MBOs, which occurred between 1980 and 2009, but find improvements in output and employment.

Studies on productivity are primarily based on plant-level data. Theory predicts a higher resource utilization due to reallocation as well as better corporate governance structures, which incentivizes managers and thus enhances efficiency after a buyout transaction (Scellato and Ughetto, 2013). Lichtenberg and Siegel (1990) analyze U.S. plant-level data and report gains in total factor productivity (TFP) for MBO plants up to three years after the owner change compared to industry benchmarks. They also find higher productivity prior to the buyout. This enhancement could not be attributed to reductions in wages, R&D, capital investments or layoffs (Wright et al. (2009), Scellato and Ughetto (2013)). On the contrary, Harris et al. (2005) show that for MBOs in the UK, establishments were less productive than comparable non-buyout plants prior to the owner change, but experienced a substantial increase in productivity after the buyout, with these gains being pervasive across industries. The productivity gains appear to exist because of rationalization in the production process. Amess (2002) and Amess (2003) analyze firm-level data of UK MBOs and find evidence that efficiency improved significantly up to four years after the buyout event compared to non-buyout firms.

Focusing on financial and operational performance in terms of key accounting ratios might be flawed due to several aspects. To commence with, relying on accounting data based on the entire firm is inappropriate if the buyout occurs below the firm-level. Furthermore, it is questionable whether the event study methodology, which is often used by researchers using public data, reflect true economic performance, since many scholars become increasingly skeptical about the underlying efficient market hypothesis. The alternative use of accounting data can be biased as such data is subject to managerial manipulation. Even if accounting data is perfectly measurable, there is no perfect correlation between accounting profits and real performance. Consequently, establishment/plant-level data are more appropriate to measure the economic impact of buyouts, especially, as it provides comprehensive information on intermediate materials and capital which is necessary in constructing TFP metrics and is often not provided on a firm-level data. Furthermore, estimates on productivity depend on the accuracy of price deflators for inputs and outputs. However, as large corporations engage in diverse industries and thus

operate various plants, the usage of a single deflator is inappropriate as different industries are affected by different substantial price changes (Cumming et al., 2007). Using a single set of deflators can introduce substantial errors into the TFP measures as demonstrated by Lichtenberg and Siegel (1990).

Managerial equity and the size of its shareholdings have a higher impact on relative performance than capital structure, in both U.S. and UK MBOs (Malone (1989), Wright et al. (1992), Phan and Hill, Charles W. L. (1995)). Incentivizing managers through ownership contributes substantially to performance, but the equity stake depends also to the deal price paid or to the selection of attractive deals. Obviously, the possible scope for managerial equity is greater when the price paid is lower. The purchase price multiple may affect the management's equity stake size since it influences the amount of external funding needed (Wright et al., 2009). Despite its impact, the source for performance improvements are heterogeneous, i.e. might be due to an increase in efficiency or growth opportunities otherwise not realizable. This heterogeneity requires the need for different levels of leverage, types of private equity companies and stakes of managerial equity (Wright, Hoskisson, Busenitz, and Dial (2000), Wright, Hoskisson, and Busenitz (2001)).

As private equity firms take on active investor roles, such investments are usually accompanied by renewed corporate governance mechanisms that enhance the alignment between the incentives of investors and managers. Such ownership changes should exert a positive impact on the portfolio company's performance, according to the theoretical framework developed by Jensen (1989). Active monitoring and involvement contributes to enhanced performance (Cotter and Peck (2001), Guo et al. (2011), Cornelli and Karakaş (2008). However, monitoring by creditors, providing debt financing, may be more important in smaller cases (Robbie and Wright, 1995). In particular, an industry specialization of the GP adds significantly to operating performance (Cressy, Munari, and Malipiero, 2007), with those focusing on small sectors creating repeatedly real and lasting value, i.e. develop and leverage expertise through focus. Moreover, established funds are experienced in transactions and thus have relationships to intermediaries, who provide them with certain exclusive deal opportunities (Wright et al., 2009).

C. Insolvency Risk

Some researchers argue that there are potential negative effects arising from leverage increases associated with buyout transactions. Private equity returns in the form of exploited tax shields represent a transfer from taxpayers and thus from the corporation's stakeholders, rather than a true economic value creation (Guo et al., 2011). Furthermore, it is not uncommon that debt levels are increased in order to pay out special dividends to the private equity investors themselves (dividend recaps). Moreover, the risk of bankruptcy and financial distress is increased (see e.g. Kaplan and Stein (1993)),

thus harming other shareholders and debtholders. In addition, financial institutions, providing the transactions financial resources, may be negatively affected by increases in bankruptcy rates, transferring value private equity investors and thus harming the financial system. Therefore, policy-makers often debate on the destructive effects of excessive debt levels, the inevidently higher financial distress risks and bankruptcy rates in portfolio companies, the broader negative implications on financial institutions given that large buyout portfolio companies fail to serve its debt obligations, and the impact on the stability of the financial system as a whole. On the contrary, the ability to service interest payment can be considered favorable. Jensen (1989) agitated the positive effect of higher debt financing in incentivizing managers to invest available cash flows as best as possible in order to enhance the company's productivity and efficiency (Tykvová and Borell, 2012).

Evidence on large U.S. buyouts show that leverage is highly driven by the economic-wide borrowing costs, which indicates an impact of financing availability in booms and downturns on the private equity market (Kaplan and Stein (1993), Axelson, Jenkinson, Strömberg, and Weisbach (2013)). Axelson et al. (2013) also finds that there is an association of higher leverage in transactions and higher deal prices, resulting in lower buyout fund returns. This implies that private equity firms overpay in times when credit access is eased. U.S. and UK studies show an increased failure probability with higher debt amounts involved (Bruner and Eades (1992), Kaplan and Stein (1993), Wright, Wilson, and Robbie (1996)). P2Ps, entering consequently receivership, have higher initial default probabilities, than P2Ps exited through IPOs, trade sales or secondary buyouts, determined through the usage of an options pricing model (Wright, Sudarsanam, and Huang, 2007). Tykvová and Borell (2012), who analyze European buyouts between 2000 and 2008, report coherently to other research, a lower level of financial distress risk in buyout than comparable companies, identified using propensity score matching, prior to the buyout event, with an increase afterwards, but still to a lower level than their comparables. In spite of the increase in financial distress, measured using accounting data, the bankruptcy rates of the portfolio companies are not higher than the respective values of the comparable non-buyout companies. Furthermore, results obtained from Tykvová and Borell (2012) indicate that experienced investors are better in managing distress risk, as such companies have lower bankruptcy rates. Moreover, linked to the analysis of Axelson et al. (2013), Tykvová and Borell (2012) do not find higher bankruptcy rates in portfolio companies, of which the buyout event occurred in a period with cheaper access to debt financing.

Strömberg (2007) reports an annual default probability of 1.2% and a declining financial distress frequency over time for buyouts. In comparison to publicly traded U.S. firms, having an annual default probability of 0.6% over a similar time horizon, the default probability is higher for buyouts, given its higher involved leverage. However, the default

rate is below the corporate bond issuer default probability of 1.6%. In case of successful exit, Strömberg (2007) finds evidence that divisional buyouts are significantly less likely to file for bankruptcy, but otherwise no significant relationship between investment size and insolvency.

Unfortunately, few research has been conducted in the area of distress risk. Thus, various interesting aspects, concerning the area of private equity investments, have yet not been explored. For example, no research has been undertaken to analyze the failure probability of fund managers. Unlike portfolio companies, no traditional insolvency process applies for such as private equity firms mainly fail to raise future funds. However, the characteristics of the fund manager fundamentally impact the financial performance and thus is generally assessed by the investors beforehand, implying a profound research gap.

D. Employment

The center of criticism on buyout transactions has been on its effects on employment. Even though there has been much research in this area, evidence is mixed. By analyzing buyouts in the U.S., Kaplan (1989b) finds small increases in overall firm employment. Lichtenberg and Siegel (1990) find that increases are below industry averages. Amess and Wright (2007b) explore buyouts in the UK within 1999 to 2004 and report a higher employment growth of 0.51% for MBOs, whereas a lower 0.81% for MBIs. In a subsequent study, Amess and Wright (2007a) find no significant difference to non-buyout and other non-private equity deals. Cressy et al. (2007), who analyze UK deals, find that the employment of private equity-backed companies falls relative to its control group during the first four years after the transaction and increases in the fifth year, suggesting initial rationalization as a basis for a more viable employment creation. Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda (2014) analyze 3,200 firms and their 150,000 establishments, which were involved in U.S. buyouts between 1980 and 2005. They find modest net job losses in the aftermath of a buyout, but substantial increases in gross job creation and destruction. Furthermore, Davis et al. (2014) report gains in total factor productivity at portfolio firms owing to exits of less productive establishments and higher entry of higher productive plants.

The selection process of the private equity firm is non-random. To exemplify, an outperforming firm would unlikely be chosen, since only few gains could be realized through restructuring. As UK evidence suggests for MBOs and MBIs, buyout targets' plants have lower total factor productivity than non-buyout peers, leading to the implementation of rationalization programs and thus a more viable basis, reducing the likelihood of subsequent failure (Wright et al., 2009).

Due to methodological issues, associated with the varying effects of acquisitions and

divestitures as well as shifts from full-time to part-time working, the analysis of employment effects remains a complex assignment. Usually, there is a lack of public available data on the employment size of engagements, that are acquired or disposed after the buyout transaction. Establishment level data indicates at least partially the actual change in employment, but fails to correctly assess the overall effect if additional acquisitions are made or new establishments are started. Davis et al. (2014) addresses these issues. Changing from full-time to higher part-time working may have an upward effect on total headcount in the company, but not in the terminology of full-time equivalent employees (FTEs), since the latter constitute and may substitute for standard wage payments.

Despite tracking the portfolio company's headcount and FTEs, research has investigated the impact of buyouts on wages and remuneration. Even though, the FTE measure reduces, the general quality of employment might be enhanced by hiring higher qualified people. A study on U.S. buyouts, occurring in the 1980s, indicate a decline in the relative compensation of non-production workers (Lichtenberg and Siegel, 1990). In the period of 1999 to 2004, UK evidence shows a lower wage growth for both MBOs and MBIs, i.e. 0.31% and 0.97% lower than comparables, respectively. However, these findings need to be interpreted cautiously, because pre-buyout remuneration may not have been sustainable if the target has been underperforming. Furthermore, it is problematic to incorporate weekly/monthly wage aspects and possible benefits from employee ownership schemes at the buyout firm. Those factors create difficulties to draw conclusions on the real effect buyouts have on wages (Wright et al., 2009).

E. Innovation

Buyouts often lead to the reassessment of the strategic position and refocus of the portfolio company's activities, in particular, for listed companies and those in distress (Baker and Wruck (1989), Lei and Hitt (1995), Wiersema and Liebeskind (1995), Easterwood (1998)). Evidently, such a firm's repositioning often involves restructuring and rationalization programs, which might suppress innovative activities. Furthermore, controls which arise from high leverage and thus monitoring will likely limit individual managerial discretion, flexibility and risk-taking. Moreover, managerial time spend on restructuring the company will be most likely at the expense of innovative activities. Additionally, owing to the limited investment horizon of private equity houses, there are no shareholder specific incentives for long-term investment opportunities, but instead an incentive for an immediate value-maximizing approach. Coherently to this view, resources of portfolio companies might be spend in less risky and less expensive short-term projects at the expense of developing highly innovative projects (Ughetto, 2010).

Studies on R&D have been rare due to data limitations, and those being conducted do not provide clear evidence. Lichtenberg and Siegel (1990) do not find evidence that R&D

intensity, measured as R&D expenditures divided by sales, significantly decreases after a buyout. On the contrary, Long and Ravenscraft (1993), who analyze U.S. LBOs during the 1980s, find a drop by up to 40% compared to pre-buyout levels. This immediate decrease is mainly a result from the increased leverage and not attributable to a short-term investment strategy by the private equity fund (Ughetto, 2010). The evidence is consistent with the view that portfolio companies are cash-constrained and underinvest. Moreover, it is consistent with the view that the new governance structures induces managers to reduce non-value maximizing capital expenditures (Wright et al., 2009). Both, Lichtenberg and Siegel (1990) and Long and Ravenscraft (1993) find an about 50% lower R&D intensity for pre-buyout firms compared to others. Evidence form Long and Ravenscraft (1993) also indicates that R&D-intensive LBO firms outperform its peers, suggesting that LBOs use R&D expenditures effectively (Zahra, 1995). Furthermore, by studying the causal relationship of restructuring processes on research spendings in 2,500 U.S. firms, within the period of 1974 and 1987, Hall (1990) considers 76 P2P transactions and finds that the same patterns in R&D investments are maintained and that their impact on cumulative innovation is rather slight, indicating that buyouts are undertaken in sectors, in which innovation is not important.

On the contrary, evidence from the UK, the Netherlands and the U.S., investigating the first private equity wave, demonstrates significant increases in new product developments and other corporate entrepreneurial aspects, such as engagements in technological alliances, new entrepreneurial ventures and R&D staff size increases in the aftermath of a buyout transaction (Bull (1989), Green (1992), Wright et al. (1992), Zahra (1995)). Divisional buyouts loosen internal markets and thus enable new product developments, which would have been prevented otherwise (Wright, 1986). Nowadays, private equity firms have been acknowledged as assistants in new ventures to broaden markets, as contributors to keep value-adding strategies and as being able to assess investments in new products (Bruining and Wright, 2002). Moreover, they contribute to the development of management control that supports strategic change (Bruining, Bonnet, and Wright, 2004). Furthermore, Wright et al. (2001) find evidence that for buyouts, operating in technology-based sectors, R&D, product and technology development as well as patenting activity significantly increase after a buyout transaction. Lerner, Sorensen, and Strömberg (2011) analyze patenting activity of U.S. companies, involved in 472 LBOs, and find no evidence for a sacrifice in long-term investments. Instead, evidence indicates a higher quality (economic importance) of LBO patents, given a higher citation, no shifts in the nature of research as well as a higher concentration on more important areas of the companies' innovative activities.

III. Data

A. *Sample Selection*

The data collection process is divided into three main steps, i.e. the gathering of the underlying accounting data, the identification of Norwegian buyout companies and the supplementation with additional information such as stock market data.

To realize the empirical aim of this thesis, detailed accounting data for a large number of Norwegian companies is needed. Fortunately, the Institute for Research in Economics and Business Administration AS (SNF) and the department of finance at the Norwegian School of Economics (NHH) have created a database, containing company and consolidated accounts for all private and public Norwegian enterprises and groups for the years 1992 to 2012, with few missing in early years (Berner, Mjøs, and Olving, 2014). This comprehensive data set, incorporating a myriad of accounting information on all Norwegian companies, builds the foundation of the entire analysis. Furthermore, it provides company-specific information from other resources, such as data on insolvency of the register of bankruptcy from Brønnøysund Register Centre, covering the period September 1993 to June 2014, and data on employment through the register of employers and employees, provided by the Brønnøysund Register Centre, covering the period from 1995 to 2012, with the Norwegian Labour and Welfare Service (NAV) as the original source (Berner et al., 2014).

Based on the unique Norwegian organizational number, portfolio companies involved in private equity investments, such as buyout transactions, can be identified in the accounting database and its performance be tracked. To identify buyout investments, this thesis uses a novel database created by the Argentum Centre for Private Equity (ACPE) at the NHH. Founded in February 2012 with the initiation of HitecVision, Energy Ventures, PricewaterhouseCoopers, Norvestor Equity, Northzone Ventures, BA-HR and Argentum, the ACPE is an independent academic research institution aiming at further developing research in the area of private equity with a focus on the Nordic market.[5] Since then, the ACPE has collected information and data from various sources in order to build a holistic database covering private equity investments in the Nordic area.

To begin with, all private equity investments labeled as buyouts with the portfolio company's headquarter in Norway are extracted in order to provide a profound overview on buyout activity in Norway. Essentially, the focus lies on transactions undertaken in the period between 1992 and 2012. Hence, the investment in Liva Bil in 1991, which was exited in 1993, is not included as well as 13 other buyouts, occurring in 2013 and 2014, of which three were secondary buyouts. The available information on buyout transactions such as the registered name of the portfolio company, its headquarters location, the entry and exit date, the information on the fund and the private equity firm have

been checked with available information, primarily on the webpage of Argentum using the public available database[6] and if insufficient on the webpages of the portfolio companies and the invested funds. Furthermore, Factiva as well as Zephyr's M&A database, covering Norwegian deals, have been used. Differing information have been revalidated and changed accordingly. Afterwards, buyouts with missing information as well as misclassified transactions, being actually venture or seed investments, have been discarded. Consequently, 203 different buyout transactions have been identified. Table II provides the timely distribution of the transactions in contrast to information retrieved from the Argentum public market database.

Considering the typical buyout transaction, the private equity firm rarely invests directly into the portfolio company, but instead implements a new holding company, i.e. special purpose vehicle, which holds the equity investment of the portfolio company. Usually, as described in Section I.B, each funds itself is a registered company, having a portfolio of different holding companies invested in the portfolio companies. The importance of the new holding structure is highlighted by the fact that the necessary debt amount to finance the deal is borrowed at the holding level, especially, since Norwegian law prohibited security providing and credit granting for companies before 2013. Thus, in order to appropriately estimate insolvency risk under the consideration of the total debt amount used, the highest holding company below the private equity fund needs to be identified for each portfolio company and included in the sample. To identify the entire ownership structure a separate database, provided by the department of finance at the NHH, has been used. This database provides information on private and corporate owners with their share of ownership for a particular year on Norwegian corporations. In total, 172 new holding companies have been identified.

To supplement the analysis with a performance assessment under risk acknowledgment, data from the 'Børsprosjektet' ('Stock Market Project') is used, i.e. a database with stock prices and financial data of public Norwegian firms, maintained by the department of finance. Monthly closing prices, adjusted for dividends and other events, of all Norwegian companies listed on the Oslo stock exchange have been used to acquire a monthly equity beta estimate for each company within the period of January 1991 up to December 2012 as well as the original Altman Z-score based on the market value of equity. The first available estimate is obtained for December 1995, since the beta estimation is based on the preceding five years and first sample buyout transaction occurred in 1996. In order to acquire a link between the organizational number and the security's ISIN for missing companies (valid link exists for 462 Norwegian companies), the database Orbis has been used, identifying 30 more companies. Furthermore, the analysis on bankruptcy risk is supplemented by data of the register of bankruptcy, retrieved from the Brønnøysund Register Centre, with distinguished information on the type of bankruptcy as well as economic data, obtained from Datastream to account for general

economic conditions.

In addition, the Orbis database has been analyzed extensively for supplementing information. In terms of employment, data has only been available from 2005 onwards and very insufficient, as for lots of companies no information are included but labeled as not available (i.e. 'n.a.'), which the database understands as a value. In terms of innovation, the database contains information on 12,381 patents published by Norwegian companies, providing certain information such as the publishing date, publication ID and so on. Counting the yearly number of published patents as a proxy for innovative activity is inappropriate as the patent publishing process, i.e. the consumed time between the initial patent application to its actual publishment, can be substantial (Ughetto, 2010). Similarly, only patents later being granted and thus published should be considered when innovative performance is measured. Even though, the specific application date is not provided, it can be inferred from the application number since the actual application date is represented in the last eight digits. This approach has not been applicable for 80 patents, of which only 13 were published after 1980. Those being discarded, the remaining patents are further analyzed considering the priority right number, i.e. the application number on which priority is claimed. It represents the first filling date of the patent application and thus should be considered as the effective date of first filling the innovation. Therefore, if a priority right exists, the filling date (last eight digits) is taken as the application date. With these information, an annual application count as well as patent stock is created for each individual company in the data set. In comparison to the Norwegian patent office ('Patentstyret'), which fails to provided an organizational number for its patent information and thus could not be used in this analysis, the Orbis database seems to provide a comprehensive database. To clarify, the 'Patentstyret' reports a total of 88,230 patents that were published by the end of 2014. However, only 13,370 patents are owned by Norwegian companies (applicant or inventor) implying an Orbis coverage of approximately 93%.

Recent research on innovation performance made use of citation information of patents as a quality proxy. Unfortunately, Orbis does not provide information on patent citation for Norwegian companies. Therefore, additional patent information have been retrieved from PATSTAT, i.e. the 'European Patent Office (EPO) - Worldwide Patent Statistical Database', being a snapshot of the EPO master documentation database (DOCDB), covering patent information on a worldwide basis. The database contains information on 17,818 patents for Norwegian applicants and inventors and 18,130 patents including also Norwegian representatives. Unfortunately, the retrieved data fails to provide the organizational number of the inventor or applicant and thus cannot be matched within the existing database. Also, the EPO application number cannot be used to match with the application number provided by Orbis.

To gain a more profound understanding of employment development, a M&A database

Table II
Buyout Distribution by Entry Year

This table provides an overview on the buyout distribution by entry year, differentiated per industry, in which the portfolio company operates (Panel A) and according to the investment stage (Panel B). The industry and investment stage classification is retrieved from the public available market database from Argentum, for which the coverage is reported in Panel B.

Panel A: Buyout distribution per industry

Entry year	Cleantech	Consumer	Energy	Health Care/ Life Science	ICT	Industrials	Other
1992	-	-	-	-	-	-	-
1993	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-
1996	-	-	-	-	-	1	1
1997	-	1	-	-	-	1	2
1998	-	1	1	-	-	-	3
1999	-	1	1	-	1	3	2
2000	-	-	1	-	-	2	3
2001	-	2	-	3	-	-	1
2002	-	1	-	-	1	1	2
2003	-	2	3	1	2	1	4
2004	-	5	3	3	-	1	1
2005	-	7	1	1	1	1	2
2006	-	7	7	1	2	1	1
2007	1	4	5	4	2	4	5
2008	1	6	3	-	4	6	2
2009	-	1	4	-	4	2	-
2010	-	6	9	2	5	1	-
2011	-	2	2	2	2	6	-
2012	-	2	7	-	1	3	1
Total	2	48	47	17	25	34	30

provided by the department of finance as well as from Zephyr have been analyzed. The idea is as follows. If the private equity fund implements a restructuring program into the portfolio company and as a result divests underperforming units, the employment level as well as remuneration should drop, even though, from an economic perspective new unemployment is not created. Ideally, such transactions should be recorded as an M&A transaction in those databases. According to the aforementioned data sets, the sample portfolio companies have not been subject to any further transactions. Hence, no employment adjustments have been undertaken. Recent research studying the effects of M&A and in particular private equity investments on the portfolio company's employment development have used establishment-level data. Unfortunately, such data is unavailable for Norwegian companies, though, efforts have recently been made to gather information on individual establishments.

Table II (continued)

Panel B: Buyout distribution per investment stage

Entry year	Buyout	Large-Cap Buyout	Lower Mid-Cap Buyout	Small-Cap Buyout	Sample	Argentum database
1992	-	-	-	-	-	-
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	-	-	-	-	-	-
1996	-	-	2	-	2	2
1997	-	-	4	-	4	3
1998	2	-	3	-	5	4
1999	-	-	8	-	8	7
2000	-	-	6	-	6	6
2001	-	1	5	-	6	6
2002	-	1	4	-	5	4
2003	5	-	8	-	13	10
2004	4	-	9	-	13	12
2005	4	2	7	-	13	12
2006	5	-	13	1	19	21
2007	5	-	19	1	25	26
2008	7	-	15	-	22	19
2009	4	1	5	1	11	12
2010	6	1	15	1	23	24
2011	7	-	7	-	14	19
2012	10	-	4	-	14	19
Total	59	6	134	4	203	206

B. Descriptive Statistics

Table II, Panel A provides an overview of the buyout distribution per entry year and industry, in which the portfolio company operates. In total, the base sample covers 203 buyout transactions involving Norwegian portfolio companies, which occurred between 1992 and 2012, with no buyouts during the first four year. Within the second half of the 1990s, the sample covers 19 buyout transactions, whereas this number increases to 43 and 90 in the first and second half of the 2000s, respectively. Between 2010 and 2012, the sample counts 51 Norwegian buyouts. The most targeted sector is the consumer industry, followed directly by the energy sector with a total of 48 and 47 transactions, respectively. Panel B provides the sample distribution differentiated along the investment stage by entry year. To clarify, the industry and investment stage classifications are adopted from the public Argentum market database. Within the sample of 203 buyouts, 134 are classified as lower mid-cap buyouts, 59 as buyouts, six as large-cap and four as small-cap buyouts. Additionally, Panel B provides the coverage of buyout transactions by entry year as available on the Argentum market database. In comparison, the sample coverage by entry year is equal or slightly higher up to 2005 and close afterwards. A general discrepancy exists as the sample, in contrast to the Argentum market database, does not cover secondary buyouts as new transactions. For instance, in 2011 and 2012, the sample counts seven exits through secondary buyouts, which ultimately explains the large

difference between the sample and the Argentum market database within this period. The higher amount of transactions covered by the sample per individual year is owing to the fact that the ACPE has gathered information from various different sources.

The sample covers 41 different private equity firms managing a total of 87 funds, whereby 16 are unknown funds and thus might be attributable to others. The most active private equity house in the sample is NorgesInvestor, engaging in 21 buyouts, followed by Herkules Capital and Reiten & Co. Capital Partners, with each having undertaken 20 transactions. HitecVision and Norvestor Equity also capture an important role within the sample with 19 and 12 buyouts, respectively. Following the Norwegian private equity firms, eight buyouts were undertaken by the Finish CapMan Capital Management and seven by the Swedish Altor Equity Partners. In total, 150 buyouts were undertaken by Norwegian, 27 by Swedish and 8 by Finish private equity firms.

The median buyout entry year is 2007. By the end of 2012, 73 investments were exited, of which 11 were exited through a secondary buyout (two of them have been divested by the end of 2012). By the end of 2014, 112 investments were exited. For the exited investments by the end of 2012, the median holding period was four years on a yearly consideration. Based on the exact entry and exit date, the mean holding period was 4.21 years for investments exited by the end of 2012 and 5.11 for investments exited before the end of 2014.

As Preqin provides detailed performance statistics on buyout funds on a worldwide basis, the entire data set on fund statistics has been retrieved. Preqin covers 589 buyouts funds globally, of which 49 have a Nordic focus. Ideally, the sample buyout funds would be included in the data set obtained from Preqin, so that performance (based on provided metrics by Preqin) can be analyzed in terms of persistence, size and sequence number (see e.g. Kaplan and Schoar (2005)). Unfortunately, only six funds from the sample, which engaged in 13 transactions are covered in the Preqin data set. These six funds have an aggregate fund value of €7,592.05 million. The GP's location is for five of these funds Sweden and only for the HitecVision Private Equity III Norway. These six funds provided to their investors an average (equally weighted) net multiple of 2.6.

Nevertheless, based on the sample coverage in the Argentum database, the sample seems to represent the actual buyout activity in Norway for the respective time period. However, as only transactions with valid information on entry dates and other variables are included, the sample might suffer from a selection bias, since missing information may be not random. Especially, it seems that smaller private equity houses did not provide complete information and are not reassessable (small-cap buyouts are low in numbers). Comparing the coverage to the EVCA market statistic on buyout investments yield similar close values. The EVCA counts 114 portfolio companies involved in buyouts, whereas the sample reports 109 buyout transactions between 2007 and 2012.

IV. Empirical Analysis

A. Methodology

The empirical aim of this thesis is to assess if there exists a causal relationship between the company's development and the received private equity funding. In particular, Norwegian private equity investments, classified as buyouts, are analyzed on their economic impact on its portfolio companies in terms of five categories: investor returns proxied by the financial performance, profitability and productivity improvements, the impact on employment and wages, innovative activities, and the portfolio company's financial distress risk. To extract the differential effect of private equity on the various performance aspects, the outcomes of the relevant variables for the buyout firms and its counterfactuals, i.e. the outcomes of the respective variables in comparable non-buyout firms, is analyzed. Thus, a crucial feature in the analysis is the selection of a valid control group with the private equity-backed companies being the treatment group. However, unlike in an experiment, no systematic methods of experimental design can be used to obtain a control group. To approximate the counterfactual outcome with the mean/median outcome of non-buyouts is inappropriate, since buyout firms differ in their characteristics as the private equity selection process is not random (Caliendo and Kopeinig, 2008).

Several reasons account for the infeasibility of treatment randomization in private equity investment decisions. To begin with, the geographic as well as the industry investment distribution is not random. Recent empirical studies suggest that private equity investors are usually specialized and thus have preferences for particular industries (see e.g. Cressy et al. (2007)). After the specification on the country and industry is made, private equity investors undertake a due diligence in order to assess the strengths and weakness of potential target companies and decide to invest in the 'right' company based on certain key characteristics. Those characteristics influence the company's performance after the transaction. Additionally, companies themselves may at least to a certain extent influence whether they receive private equity funding or not. To account for the sample selection bias and self-selection effects due to observational differences between the comparison group and treated buyout group (Dehejia and Wahba, 2002), propensity score matching as suggested by Rosenbaum and Rubin (1983) is applied in this thesis.

Matching comprises pairing the treated observations with the untreated comparison units that have similar key characteristics. An unbiased estimate of the treatment effect can be yielded by matching if the relevant differences can be captured by observable covariates, which occurs when outcomes are independent of assignment to the treatment conditional on pretreatment covariates. To be more precise, in order to estimate the treatment effect on the treated, the outcome in the untreated state must be independent of the treatment assignment, i.e. unconfoundedness/ conditional independence

(Dehejia and Wahba, 2002). The average treatment effect on the treated (ATT), i.e. $\tau_{ATT} = E(\tau|D = 1) = E[Y(1)|D = 1] - E[Y(0|D = 1)]$, is calculated as opposed to the average treatment effect (ATE), i.e. $\tau_{ATE} = E(\tau) = E[Y(1) - Y(0)]$. The ATE calculates the effect on the outcomes if the individuals are randomly assigned to the treatment. The ATT focuses on the treated individuals and is equal to the difference between the expected outcome values with and without treatment. If randomization were possible, $E[Y(0|D = 1)$ would be equivalent to $E[Y(0|D = 0)$, i.e. the average of non-participants, and thus τ_{ATT} and τ_{ATE} as well. With more essential pretreatment covariates the dimensionality increases, introducing the difficulty of determining along which dimension to match or which weighting scheme to apply. Rosenbaum and Rubin (1983) suggests to use a balancing score $b(X)$, which is a function of the observed covariates X, so that given $b(X)$ the conditional distribution of X is independent of treatment assignment. The propensity score, i.e. the probability of participation in the program given the observed key characteristics X, is one possible balancing score (Caliendo and Kopeinig, 2008).

Estimating the propensity score involves a decision on the estimation model to be used as well as the variables choice to include in the model. The linear probability model is disregarded due to its shortcomings (see e.g. Smith (1997)). This thesis applies the logit probability model, although in a binary treatment case both the logit and probit model yield similar results according to Caliendo and Kopeinig (2008). However, the logit model is preferred, because of its higher density in the bounds. The set of chosen variables needs to satisfy the conditional independence requirement for matching. Omitting important variables lead to increased bias in the resulting estimates as Heckman (1997) and Dehejia and Wahba (1999) have shown. Only variables that simultaneously influence the outcome variable and participation decision should be included, but also are unaffected by the participation decision or its anticipation. Therefore, variables should either be fixed over time or measured before the participation. Bryson, Dorsett, and Purdon (2002) point out that over-parametrized models should be avoided, because it increases the variance in the propensity score estimates and it may happen that the inclusion of extraneous variables in the participation model exacerbates the support problem, although the inclusion of non-significant variables will not have an impact on the bias or its consistency. In contrast, Rubin and Thomas (1996) argue in the name of parsimony against leaning the model. Accordingly, variables should only be excluded if the variable is either unrelated to the outcome or not a proper covariate. If doubts remain, they advise to include the variable in question in the propensity score estimation (Caliendo and Kopeinig, 2008).

In consideration of the given Norwegian sample, certain adjustments are necessary before matching can be applied. Since the performance assessment is restricted to available accounting data up to the year 2012, the main empirical analysis captures the development up to three years following the buyout event, implying a restriction of the

base sample, i.e. 203 buyout transactions between 1996 and 2012 (no transactions between 1992 and 1995), to 152 buyouts occurring before 2009. Afterwards, the analysis is complemented by an immediate and long-term analysis, implying a sample extension to include all years before 2011 in the former (base sample of 189 transactions) and a sample restriction to 2007 in the latter case (base sample of 119 transactions). Owing to the portfolio company's unique organizational number and the information on the buyout year, provided by the ACPE's database, the development of each particular buyout firm can be assessed. Since the accounting data only provides end-of-year financial data, the entire base sample has to be revised for investments in the identical firm occurring within the same year. This applies for five transactions, i.e. Dynal Biotech (Ratos and Nordic Capital in 2001), Lindorff (Altor Equity Partners and Sponsor Capital in 2003), Scandi Standard (CapMan Capital Management and Staur Private Equity in 2005), Aibel (Herkules Capital and Ferd Capital in 2007) and Visma (KKR and Montagu Private Equity in 2010).

Matching should be ideally undertaken on characteristics in the year prior to the buyout, using the portfolio company within the holding structure, in which the fund directly invests. If a new holding company is implemented by the private equity fund in the year of the buyout, the performance of this corporation should be assessed in comparison to the control group if consolidated data is provided. Implementing this identification procedure to the given sample results into a substantial reduction of the total sample size. To exemplify, of buyout transactions occurring prior to 2009 (base sample after extracting second transactions in one year amounts to 148 deals) only 58 firms provide an EBITDA-margin value in the pre-buyout year. Similar values exist for other covariates. Therefore, matching is undertaken on characteristics of the buyout year following Bienz, Thorburn, and Walz (2015), experiencing the same problem with the underlying sample, using the highest company within the holding structure providing consolidated data.

The organizational number of the treated firm is identified based on the following procedure. To begin with, the highest holding for each individual buyout firm is chosen, i.e. the portfolio company reported by the private equity fund is the bottom company within the identified holding structure, whereas the fund is directly invested in the top holding company. If the company does not provide consolidated data within the accounting database, the company one level below is chosen and validated again on consolidated data. This procedure is repeated until the lowest level within each transaction structure. Therefore, if the holding or even holding companies do not provide consolidated data, the actual targeted portfolio company (lowest level) is chosen.

In order to account for the yearly differing economic environment as well as different company specifics, the entire sample consisting of buyouts and all other Norwegian companies is first split into yearly subsamples in which separate logit propensity score

regressions as well as matching is undertaken. In this context, the matching procedure and quality assessments consider all buyout transactions up to the year 2011 owing to the immediate performance assessment within the following empirical analysis. By matching the buyouts only to control companies within the same country, i.e. only Norwegian companies in the data set, concerns that a non-random country and time distribution of buyouts could affect the results is mitigated. A further subdivision into industry groups based on the industry classification provided by the underlying accounting database of SNF (NACE, five digits) entails the thin common support problem since only few observations remain in each subcategory as Appendix C illustrates.

As key variables, which influence not only the investment decision but also the performance outcome after the transaction, the company's size, sales volume, EBITDA-margin and its fixed asset ratio are chosen. To account for different industry characteristics, the industry classification is used as an additional covariate. Appendix B provides an overview of all chosen variables with detailed descriptions. Using this model specification, the propensity scores are balanced. Other covariates such as age and leverage, which are used in other academic research, are not applicable due to the matching procedure in the year of buyout. As a matching algorithm, the five-to-one nearest-neighbor method (uniform weight) is applied. Table III depicts matching results which indicate substantial bias reductions in covariates between the unmatched and matched sample.

As alternative matching procedures, one-to-one nearest-neighbor matching, radius matching, and kernel matching have been performed. Replacement is allowed since the average matching quality is increased and bias is decreased. Using the matching procedures without replacement would thus increase the variance in the estimator. Oversampling involves an increased bias, but reduced variance due to the use of more information. To account for the risk of matches having very different propensity scores, radius matching has been used to compare the resulting bias by imposing a tolerance level on the maximum propensity score distance. In contrast to nearest-neighbor matching, average quality might increase, i.e. bias decreases and variance increases, but the tolerance level is difficult to decide on a priori. By using five-to-one nearest-neighbor matching, the maximum difference in propensity score is 0.0000257. Hence, radius matching is performed with a caliper of 0.00001 and 0.00002. As a non-parametric alternative, kernel matching has been performed using all control individuals to construct the individual counterfactual outcome. Individual weighting depends on the type of function used. Kernel matching is advantageous due to its resulting low variance, but results in an increased bias owing to bad matches. In this setting, the Epanechnikov function is used with a bandwidth of 0.00003. Since the ATT is only valid within the region of common support, a restriction on this area has been made in all matching procedures within the analysis following Dehejia and Wahba (1999).

Matching quality is depicted in table IV. To assess matching quality, a two-sample

Table III
Assessment of Bias Reduction in Covariates

This table provides the bias assessment before and after five-to-one nearest neighbor matching has been applied. Using the five covariates size, sales, EBITDA-margin, fixed asset ratio and the industrycode, the mean is depicted for the buyout companies as well as control group before and after matching. In addition, the standardized percentage bias (the percentage difference of the means in the treated and non-treated groups as a percentage of the square root of the average of the respective sample variances) is shown as well as the absolute percentage reduction in bias achieved through matching. Finally, a t-test is performed to assess matching quality.

Five-to-one nearest neighbor matching							
		Mean		Percentage	Abs. Perc.	T-Test	
Variables	Sample	Buyout	Control	Bias (in %)	Reduct. Bias	T-Statistic	p-Value
Size	Unmatched	12.50	7.79	272.40		28.58	0.000
	Matched	12.50	12.49	0.80	99.70	0.08	0.939
Sales (in million NOK)	Unmatched	390	33.7	31.80		2.92	0.004
	Matched	390	460	-5.50	82.70	-0.50	0.615
EBITDA-Margin	Unmatched	-0.89	-0.53	-0.70		-0.06	0.952
	Matched	-0.89	-0.25	-1.30	-77.70	-0.64	0.521
Fixes asset ratio	Unmatched	0.55	0.38	55.10		5.56	0.000
	Matched	0.55	0.61	-19.30	65.00	-1.71	0.089
Industrycode	Unmatched	1.95	2.01	-9.60		-1.23	0.218
	Matched	1.95	1.92	5.20	45.60	0.39	0.693

t-test, the pseudo-R^2, and a likelihood ratio test on the joint significance of all regressors is investigated. Furthermore, following Rubin (2001) the number of standard deviations between the group means (denoted as B) as well as the variance ratio (denoted as R, treatment variance divided by control group variance) is analyzed. Comparing five-to-one nearest-neighbor matching to one-to-one matching, radius matching (caliper of 0.00001) as well as kernel matching using the Epanechnikov kernel type with a bandwidth of 0.00003, the resulting remaining bias and variance is controverse. Before matching, the mean total bias was 73.8 and the pseudo R^2 0.203. Of all matching algorithm applied, one-to-one matching led to the highest bias reduction, the lowest pseudo R^2 and the lowest likelihood ratio chi-squared test statistic. However, compared to five-to-one nearest neighbor matching, it results in a higher variance, i.e. lower R. Radius and Kernel matching provide an even higher variance in the control group. Thus, five-to-one nearest neighbor matching is chosen as it provides the best trade-off between bias reduction and resulting variance through matching and is robust compared to the other algorithms.

As a result, the final sample, considering buyout transactions before 2009, consists of 113 portfolio companies being involved in buyout transactions and 565 corresponding matched control firms. The further reduction in the sample size compared to the base sample is a result of missing information in the underlying accounting database, as the

Table IV
Assessment of Matching Quality

This table provides the quality assessment on the different matching algorithms used. In addition to the pseudo R^2 and the likelihood ratio test on the joint significance of all regressors, the number of standard deviations between the group means (denoted as B) as well as the variance ratio, i.e. treatment variance divided by control group variance (denoted as R) are analyzed.

Matching algorithms						
	Unmatch. sample	Five-to-one M. with replacem.	One-to-one Matching*	Radius M. (0.00001)	Radius M. (0.00002)	Kernel M. (epan) bwidth. 0.00003
Pseudo R^2	0.203	0.012	0.003	0.01	0.008	0.009
LR chi-square test	605.99	4.71	1.27	3.82	3.16	3.67
Bias (mean)	73.9	6.4	3.9	6.1	6.1	6.7
Bias (median)	31.8	5.2	2.6	5.6	5.9	6.3
B	269.6	25.8	13.4	22.9	19.1	20.7
R	0.51	0.44	0.38	0.24	0.16	0.16

* equal values for with and without replacement

matching procedure only considers observations with complete information, as well as the implementation of the common support requirement. Two further samples are created to complement the prevailing main analysis. Firstly, the sample is extended covering buyouts up to the year 2011, allowing an immediate effect analysis. This sample covers 140 portfolio companies and 700 matched peers. Secondly, the main sample is restricted for buyout transactions occurring before 2007, allowing an assessment of the fifth year after the transaction. This sample consists of 87 buyout-backed portfolio companies and 435 control firms.

B. Empirical Results

Performance effects due to buyout transactions have been investigated by scholars based on various accounting measures, such as sales and employment growth (Muscarella and Vetsuypens (1990), Jelic and Wright (2011), Wilson et al. (2012)), profitability (Kaplan (1989b), Wright et al. (1992), Desbrières and Schatt (2002), Guo et al. (2011), Jelic and Wright (2011), Wilson et al. (2012)) and cash flows (Kaplan (1989b), Opler (1992)). Efficiency gains are being considered as enhancements in productivity (Lichtenberg and Siegel (1990), Amess (2003), Harris et al. (2005), Wilson et al. (2012)) or as expenditure decreases (Kaplan, 1989b). Other research focuses on innovative activities and technological progress (Long and Ravenscraft (1993), Ughetto (2010), Lerner et al. (2011)).

An overview on the variables used in the empirical analysis, complemented with a brief description is provided in Appendix B. Results are presented in the following way. To begin with, the main empirical analysis is performed, investigating the performance of the sample comprising all buyout transactions before 2009 for a period of up to three years following the buyout year. In this context, results are presented for means including

the average treatment effect on the treated (see table V) and more detailed for medians to control for outliers that dominate the means. Differentiated for buyouts and control firms, the median end-of-year value for the individual performance ratio is reported along its percentage change compared to the buyout year. The percentage change represents the difference in the metric values relative to the absolute value of the reference. The reported percentage change is not equivalent to the simple percentage calculation of the reported median end-of-year values. This is due to the fact that some firms reported values in the buyout, but not in the subsequent year and vice versa, leading to an unequal observation count and thus depicted median value. Furthermore, the median individual differential effect is calculated, measuring the median difference between the buyout firm and the mean of its respective control group. In an experimental setting and thus no existing bias, the difference in the buyout year would be zero. As seen before, propensity score matching substantially reduces the existing bias in the matched sample in comparison to the unmatched situation. However, as bias still exists and the chosen covariates may not explain all differences between the outcomes of interest, a certain difference, depending on the considered variable, still exists in the buyout year. Therefore, the central metric in this analysis is the percentage change of the differential effect for each individual performance ratio as it captures the impact of private equity funding on the specific portfolio company in relation to its peers over time. In this context, the measure is similar to the difference-in-difference (DID) estimator, but instead provides the relative change of the initial difference in the buyout year. The actual DID-estimate for each metric and individual period (based on median values) can be obtained by subtracting the median percentage change of the control group from the corresponding percentage change of the buyout firms.

Significance levels in mean differences are tested using the paired student t-test. The Wilcoxon rank-sum test is used to test the equality of distributions, while the Wilcoxon signed-rank test is used to test whether the relative median change is significantly different from zero. All significance levels are based on a two-tailed test.

Following the main analysis, an immediate effect as well as long-term analysis is made. Within the immediate effect analysis, the buyout sample covered is extended to the year 2011, thus analyzing only the immediate year after the buyout. The long-term analysis restricts the main sample to buyouts occurring before 2007 and considers further the performance development in the fifth year after the buyout.

Table V
Performance Ratios - Mean Values

This table reports the mean values for the performance ratios in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. Based on a paired t-test, ATT levels that are significantly different from zero at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	+1				+2				+3			
	Buyout	Control	ATT	SE(ATT)	Buyout	Control	ATT	SE(ATT)	Buyout	Control	ATT	SE(ATT)
A. Financial performance												
Net income/total assets	-3.58%	-0.36%	-2.85%	(0.045)	-2.35%	-8.05%	5.74%	(0.093)	-4.61%	2.61%	-7.09%**	(0.029)
EBITDA/total assets	6.28%	8.17%	-1.87%	(0.019)	5.31%	-6.02%	12.36%	(0.127)	3.11%	7.67%	-4.41%*	(0.025)
Net cash flow/total assets	-5.58%	17.22%	-23.05%**	(0.099)	-0.44%	12.37%	-12.30%	(0.080)	-1.29%	7.26%	-8.66%**	(0.039)
Net income/equity	-19.54%	-3.32%	-15.08%	(0.415)	79.51%	12.79%	65.71%	(0.440)	-95.58%	17.06%	-111.14%	(1.092)
EBITDA/equity	35.59%	31.60%	3.95%	(0.326)	63.94%	49.85%	13.17%	(0.440)	-60.26%	2.63%	-56.62%	(1.144)
Net cash flow/equity	-47.15%	35.52%	-82.80%	(0.884)	77.10%	35.67%	41.77%	(0.558)	-104.92%	-3.66%	-108.49%	(1.238)
B. Operating performance												
Inflation-adjusted sales	2.653	7.283	-5.133	(6.454)	4.252	10.492	1.391	(1.279)	6.325	5.338	1.198	(3.336)
Return on sales	-22.92%	226.88%	-258.04%	(2.084)	-9.69%	2,112.98%	-2,419.97%	(25.926)	117.69%	-2,502.71%	3,133.15%	(32.921)
EBTIDA-margin	-11.36%	-297.54%	177.65%	(1.804)	-5.96%	7.57%	-2,419.97%	(0.163)	-101.34%	-1,251.93%	1,359.37%	(12.266)
Asset turnover	1.149	0.704	0.441***	(0.094)	1.130	0.657	0.473***	(0.091)	1.112	0.641	0.487***	(0.101)
Current ratio	1.717	199.117	-15.107**	(6.946)	1.794	16.332	-15.478**	(6.962)	1.684	172.179	-23.800	(14.417)
Coverage ratio	-839.894	354.440	-1338.480	(911.10)	-15.354	471.633	-645.932	(581.16)	-50.214	88.054	-134.212	(502.95)
C. Insolvency risk												
Leverage	72.08%	72.33%	-1.24%	(0.078)	72.58%	78.05%	-7.06%	(0.122)	73.23%	79.05%	-6.86%	(0.139)
Long-term leverage	32.92%	38.94%	-6.80%	(0.079)	32.38%	36.00%	-4.13%	(0.048)	30.78%	37.16%	-7.07%	(0.057)
ZM-score	-0.134	0.680	-0.164	(0.733)	-0.076	-0.597	0.475*	(0.284)	0.094	0.058	0.636*	(0.325)
O-score	-0.605	-1.780	-0.295	(1.257)	-0.621	-0.424	-0.674	(1.368)	0.978	-12.840	20.511	(21.360)
Z'-score	1.358	84.373	-2.030**	(0.806)	1.516	5.507	-4.134*	(2.097)	1.267	73.273	-10.312	(7.451)
D. Employment and wages												
Employees (FTE)	76.86	158.09	-31.44	(28.532)	85.67	138.13	-23.45	(29.149)	79.39	128.97	-39.54	(32.891)
Wages (in thousand NOK)	168,205	114,592	56,048*	(30,497)	189,057	109,590	81,861***	(30,813)	188,779	112,445	77,805**	(31,703)
E. Innovation Performance												
R&D-intensity	3.94%	25.16%	3.50%	(0.041)	-0.28%	-3.33%	3.68%	(0.040)	-5.03%	0.40%	-5.34%	(0.065)
Patents (balance sheet)	47,061	15,008	31,947**	(12,984)	49,541	16,965	33,569**	(12,995)	34,457	18,134	17,281*	(9,426)
Patents applications	1.154	0.762	0.000	(0.000)	1.429	0.800	0.000	(0.000)	1.333	1.114	0.000	(0.000)
Patents stock	4.811	4.552	1.928	(0.000)	5.226	5.226	1.639	(0.000)	4.825	4.870	1.393	(0.000)

B.1. Financial Performance

The portfolio company's financial development is captured by the provided return on assets (RoA) and the return on equity (RoE). Though, the return on equity metric is known to be highly affected by managerial accounting and thus often considered to be inappropriate as a performance ratio, it might be beneficial to consider as a proxy for the private equity firm's equity holding due to the high leverage involved. At first, the RoA is measured as the profit/ loss of the year divided by total assets and for the RoE by the book value of equity. Alternatively, the nominator is changed to EBITDA and net cash flow, i.e. EBITDA minus capital expenditures. By varying the nominator variable to EBITDA, distortions due to managerial accounting choices are diminished, as opposed to using net income. Similarly, the choice of net cash flow provides the opportunity to identify sacrificed financial performance for capital expenditures to provide future competitive edge (Guo et al., 2011). In contrast to net income, EBITDA and net cash flow are measured before tax reduction and thus enable an impact investigation of the actual tax rate of the portfolio company.

As depicted in table V, the analysis on the average treatment effect on the treated is biased by outliers within the sample. The results report significant differences between averages of private equity-backed portfolio companies and their matched peers in the net cash flow to total asset ratio in the first and third year. The average treatment effect on the treated differs substantially between periods. For instance, the average difference of EBITDA in relation to total assets between both groups is negative in the first year, positive in the second and again negative in the third year. This result is mainly driven by high fluctuations in the performance of the peer group, which indicates large outliers in the matched companies and thus, at least partially, buyout firms. A further analysis has been undertaken to identify existing outliers. Certain distortions may be systematic and thus could be excluded if identifiable. However, outliers exist in both tail ends and differ across the individual considered ratios. Furthermore, outliers not only exist for buyout firms, but also for control firms not matched to buyout outliers, thus imposing an impossibility to a reasonable academic procedure to a sample adjustment. To a certain extent, biases are created due to the underlying database, as for some firms values of zero are recorded in the database, instead of leaving a missing value. A systematic review on this particular problem cannot be provided at this stage. Therefore, the analysis focuses in the following on median values, instead of mean ratios.

Median results of the RoA and RoE ratios are reported in table VI. Differences in observations over time arise from missing observations for individual companies. Results report significant different median distributions for the ratios net income and net cash flow to total assets between private equity-backed portfolio companies and their matched peers. The relative change in the differential net income ratio is negative and further

Table VI
Changes in Financial Performance after the Buyout

This table reports the median values and changes for the financial performance ratios in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. Panel A provides the performance measurement using the return on assets metric, whereas Panel B reports the return on equity ratio with varying nominator, respectively. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

Panel A: Return on assets							
	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Net income/total assets							
Differential effect	-3.33%	-1.06%	-4.33%	-2.86%	21.34%	-16.03%	-37.79%
Buyouts	0.85%	0.95%	0.18%	0.41%	-6.14%	-39.58%	-60.52%
# of observations	113	108	105	103	108	105	103
# of pos. observations	65	60	55	54	52	48	41
Control firms	2.61%	2.36%	2.56%	2.35%	-6.70%	2.70%*	2.14%
# of observations	565	547	523	510	547	523	510
# of pos. observations	418	401	385	359	258	270	256
Rank-sum test	0.001***	0.003***	0.000***	0.001***	0.321	0.030**	0.027**
EBITDA/total assets							
Differential effect	-3.60%	0.97%	-0.18%	-1.49%	44.30%**	32.47%**	23.60%
Buyouts	6.71%	8.49%	7.15%	7.50%	7.40%*	-7.02%	1.29%
# of observations	113	108	105	103	108	105	103
# of pos. observations	87	83	77	77	64	48	52
Control firms	7.59%	7.12%	7.56%	6.94%	-2.27%	-0.03%	-9.71%
# of observations	565	547	523	510	547	523	510
# of pos. observations	488	451	433	411	261	261	225
Rank-sum test	0.088*	0.654	0.695	0.947	0.038**	0.660	0.295
Net cash flow/total assets							
Differential effect	-3.07%	-3.27%	-6.08%	-3.84%	9.12%	26.37%	52.14%
Buyouts	-0.66%	-1.66%	0.36%	1.93%	28.28%	-18.01%	21.89%
# of observations	63	108	103	101	62	58	55
# of pos. observations	31	51	52	57	34	27	29
Control firms	3.75%	4.04%	4.67%	3.84%	5.21%	15.75%***	1.66%
# of observations	523	547	521	503	507	484	469
# of pos. observations	328	352	342	324	266	277	240
Rank-sum test	0.073*	0.001***	0.000***	0.153	0.979	0.101	0.850

Table VI (continued)

Panel B: Return on equity							
	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Net income/equity							
Differential effect	-11.41%	-11.85%	-2.70%	-11.23%	-1.07%	3.06%	-24.94%*
Buyouts	6.87%	6.86%	6.66%	5.05%	-10.00%	-13.51%	-51.11%
# of observations	113	108	105	103	108	105	103
# of pos. observations	72	64	64	63	52	51	42
Control firms	11.18%	9.21%	9.45%	8.80%	-7.72%	-1.66%	-9.73%
# of observations	563	545	521	508	545	521	508
# of pos. observations	427	417	393	370	247	257	238
Rank-sum test	0.012**	0.021**	0.204	0.066*	0.530	0.346	0.122
EBITDA/equity							
Differential effect	-13.44%	-3.03%	-0.70%	2.03%	38.03%	22.75%	16.29%
Buyouts	25.79%	28.93%	29.33%	25.71%	13.92%*	-1.04%	-5.99%
# of observations	113	108	105	103	108	105	103
# of pos. observations	90	83	80	80	62	52	49
Control firms	28.03%	24.82%	22.90%	21.06%	-8.25%	-8.98%	-16.84%
# of observations	563	545	521	508	545	521	508
# of pos. observations	476	450	429	409	241	238	218
Rank-sum test	0.231	0.591	0.451	0.698	0.021**	0.304	0.391
Net cash flow/equity							
Differential effect	-2.00%	-28.91%	-13.75%	-2.05%	-23.52%	-11.13%	-16.98%
Buyouts	5.50%	1.32%	4.46%	11.33%	26.06%	-22.78%	65.49%
# of observations	63	108	103	101	62	58	55
# of pos. observations	32	55	54	61	33	28	30
Control firms	12.68%	12.15%	14.81%	10.83%	-5.09%	6.79%**	-13.87%
# of observations	522	545	519	501	506	483	468
# of pos. observations	328	352	342	319	239	250	219
Rank-sum test	0.138	0.001***	0.022**	0.481	0.994	0.506	0.464

decreasing after being positive in the first period. In contrast, the relative change in the difference between the EBITDA ratio for buyouts and control firms is positive over the years, implying a positive impact of private equity funding on operating income. The same holds for the net cash flow ratio. Additionally, the percentage change in the differential effect is increasing over the years, implying decreasing capital expenditures. The obtained results are consistent with Kaplan (1989b), who uses a different methodology, comparing returns to industry peers and pre-buyout levels.

Considering the return on equity ratios, the EBITDA metric remains rather stable with an immediate percentage increase of 13.92%, while this ratio decreases for the matched control firms. Net cash flow in relation to equity increases within the sample by a median of 65.49% up to the third year, while the peer group decreases with -13.87% in the same period.

B.2. Operating Performance

Closely related to a company's financial performance is the development of its profitability. The operating performance is investigated by determining abnormal changes in several ratios, mainly following Muscarella and Vetsuypens (1990), Jelic and Wright (2011) and Guo et al. (2011). The output level of the company is measured by its inflation-adjusted sales level in thousand NOK, normalized to unity in the buyout year ($t = 0$). Profitability is captured by the return on sales (RoS), i.e. the profit/loss of the year divided by sales, and the EBITDA-margin, i.e. EBITDA divided by sales, where EBITDA is equivalent to the operating profit/ loss plus ordinary depreciation and write-downs. Working capital and liquidity is analyzed using the current ratio, i.e. current assets divided by current liabilities. The quick ratio, i.e. adjusting the current ratio by stock in the nominator, has also been investigated, but disregarded since it does not yield additional insights compared to the current ratio. Moreover, operating efficiency is investigated using asset turnover, i.e. sales divided by the book value of total assets. Furthermore, the interest coverage ratio, i.e. EBIT divided by interest payments, is analyzed as a measure for the company's ability to service its debt obligations. Additionally, the dividend payout ratio has been investigated, but not reported in the analysis, because only six buyout portfolio companies reported dividend payments in their annual balance sheets.

The results for the median values of profitability ratios are depicted in table VII. In particular, results demonstrate a significant increase in inflation-adjusted sales. Within the following two years after the buyout, sales increase by 62.31% for buyout firms, whereas sales decrease by -2.34% for the matched control firms. This can be interpreted as evidence that private equity investors seek to increase the overall business potential of the firm in addition to efficiency measures. Similarly, the portfolio companies' median asset turnover increases significantly from a median of 0.773 in the buyout year to 0.922 in the third year, peaking in the first year with 1.009 after the buyout. The median relative change amounts to 16.08% in the third year relative to the buyout year for funded companies, while -2.56% for the matched peer firms. For each year, the relative median change is significantly different from zero based on the Wilcoxon signed-rank test.

The profit margin based on EBITDA or net income is statistically different between the buyout firms and their matched control group. To clarify, buyout firms have a much lower ratio than their comparables in the buyout year and the subsequent years. Furthermore, the development is negative for buyout firms. For instance, return on sales decreases by -15.73% to year three after the buyout. However, the relative change in the adjusted performance measure of the EBITDA-margin supports the evidence of a positive development in EBITDA for buyout firms.

The current ratio decreases significantly for buyout firms from the event year with

Table VII
Changes in Operating Performance after the Buyout

This table reports the median values and changes for the operating performance ratios in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. The variable differential effect depicts the median differential performance effect between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Inflation-adjusted sales							
Differential effect	n/a	0.292	0.621	0.554	n/a	n/a	n/a
Buyouts	1.000	1.365	1.623	1.545	36.54%***	62.31%***	54.48%***
# of observations	108	103	99	96	103	99	96
# of pos. observations	108	100	95	87	73	76	64
Control firms	1.000	0.998	0.977	0.977	-0.15%	-2.34%	-2.30%
# of observations	411	394	373	358	394	373	358
# of pos. observations	411	368	333	308	196	176	171
Rank-sum test	n/a	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Return on sales							
Differential effect	-8.78%	-5.68%	-8.21%	-7.03%	25.36%	-3.35%	21.90%
Buyouts	0.66%	1.09%	0.45%	0.38%	-2.02%	8.66%	-15.73%
# of observations	108	104	99	94	100	96	90
# of pos. observations	61	58	53	48	50	49	44
Control firms	4.74%	5.20%	4.66%	4.52%	0.98%	12.19%**	15.87%**
# of observations	411	384	355	338	369	335	314
# of pos. observations	301	279	262	243	187	178	172
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.706	0.206	0.144
EBITDA-margin							
Differential effect	-18.15%	-18.77%	-21.44%	-18.65%	5.29%	9.30%	16.37%
Buyouts	6.93%	8.17%	5.92%	7.18%	7.10%	-3.11%	-4.65%
# of observations	113	108	102	97	108	102	97
# of pos. observations	87	83	77	76	59	48	47
Control firms	20.53%	16.65%	18.30%	16.32%	-1.19%	-0.60%	-4.50%
# of observations	565	539	502	484	539	502	484
# of pos. observations	490	453	435	411	251	243	213
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.314	0.759	0.994
Asset turnover							
Differential effect	0.123	0.371	0.348	0.342	8.95%***	19.74%***	49.56%***
Buyouts	0.773	1.009	0.931	0.922	6.65%***	11.00%***	16.08%***
# of observations	113	108	105	103	103	101	99
# of pos. observations	108	104	99	93	62	64	59
Control firms	0.213	0.190	0.176	0.160	1.05%	0.04%	-2.56%
# of observations	565	547	523	510	394	374	367
# of pos. observations	411	382	353	337	205	187	170
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.002***	0.000***	0.001***

Table VII (continued)

Current ratio							
Differential effect	-0.936	-0.638	-1.319	-1.174	-4.40%	-67.23%***	-48.14%***
Buyouts	1.494	1.393	1.353	1.301	-7.14%**	-14.90%**	-17.58%**
# of observations	113	108	104	101	108	104	101
# of pos. observations	113	108	104	101	44	35	34
Control firms	1.378	1.386	1.407	1.500	0.10%	-0.15%**	0.15%**
# of observations	560	545	517	505	539	513	503
# of pos. observations	557	543	515	505	271	255	252
Rank-sum test	0.480	0.719	0.100*	0.018**	0.057*	0.003***	0.007***
Coverage ratio							
Differential effect	-5.151	-2.814	-7.282	-6.929	11.37%	-33.62%	21.26%
Buyouts	1.467	0.792	0.824	0.856	-4.25%	-33.91%	-32.64%
# of observations	78	81	81	78	67	65	61
# of pos. observations	53	52	51	51	33	30	27
Control firms	2.072	1.879	2.023	1.771	-7.23%	13.72%**	8.19%
# of observations	407	389	371	350	354	322	301
# of pos. observations	327	297	286	256	166	173	154
Rank-sum test	0.089*	0.009***	0.002***	0.023**	0.684	0.322	0.615

a median value of 1.494 to 1.301 in the third year (median relative change from t_0 to t_3 of -17.58%). On the contrary, the current ratio increases for the control group in the same respective period. However, there is no generally valid optimal current ratio as it depends on several factors, e.g. industry. A reduction of the current ratio implies on the one hand less bound capital, but on the other hand increased liquidity risk. Findings suggest that private equity investors value tighter working capital at the cost of increased liquidity risk. Nevertheless, the findings should not be interpreted as evidence for a more effective working capital management as a more detailed analysis on the firm level would be necessary.

In general, one would expect a drop in the coverage ratio after the buyout as higher interest costs are immediately due to the increased leverage and performance improvements on the EBIT level need more time. Consequently, the coverage ratio should increase over time. Results are coherent with these expectations. In the buyout year, the median coverage ratio for the portfolio companies is 1.467. The coverage ratio drops in the following year to 0.792 and recovers in the following periods. The initial high value in the buyout year, when leverage has already been built up, might be due to interest payments in arrears.

Mean values, depicted in table V, are biases by outliers and underlined by large values in inflation-adjusted sales as well as the current ratio for the control group. Considering operating efficiency, the buyout firm's mean asset turnover is less decreasing than its counterpart of the control firms, leading to a positive differential effect.

To summarize, a strong positive impact of PE funds on the operating performance of their portfolio companies can be observed - especially for sales and asset turnover - implying that PE funds initiate successful restructuring programs. These findings support

the results of several authors, including e.g. Muscarella and Vetsuypens (1990).

Regression analysis of efficiency

In order to examine efficiency differences, a production function is specified as Cobb-Douglas, relating output (value added) to capital and inputs with controls for sector and competition following Wilson et al. (2012). This approach has been used in various empirical studies (e.g. Harris et al. (2005), Lichtenberg and Siegel (1990)).

$$VA_{it} = f(k_{it}, l_{it}, BO_{it}, x_{it}) \tag{1}$$

Model 1 relates value added for each individual company i (with $i = 1, 2..., N$) at time t (with $t = 1, 2...T$) to the production inputs capital and labor. Labor input is represented by l_{it}, i.e. the number of FTE employees at year end, whereas capital input is denoted by k_{it}, i.e. deflated fixed assets of the firm at the end of the year. Furthermore, BO_{it} represents the company type binary variable and x_{it} the vector of the control variables.

The log-linear model specification is as follows 2:

$$lnVA_{it} = \beta_k \ln k_{it} + \beta_l \ln l_{it} + \beta_{BO} BO_{it} + \beta_x x_{it} + \varepsilon_{it} \tag{2}$$

where $\varepsilon_{it} \sim iid(0, \sigma^2)$, $i = 1, 2..., N$ and $t = 1, 2...T$.

To investigate the productivity effects, the panel data is extended with observations for buyout and non-buyout companies prior to the buyout event considering a random effects model. At first, a simple production function is estimated over the entire period and depicted in table VIII, column (1). The positive sign and the significance of the buyout dummy variable suggest a positive productivity differential of portfolio companies over their peers. To further analyze the productivity change, the buyout holding period is compared to the period before the buyout event.

The Model specification with random effects is as follows 3:

$$VA_{it} = f(k_{it}, l_{it}, Period - BO_{it}, x_{it}, \beta) \tag{3}$$

with $i = 1, 2..., N$ and $t = 1, 2...T$. The parameter vector is β, where the focus lies on capital and labor parameters and the pre- and post-buyout indicators, i.e. $Period - BO_{it}$.

The log-linear version of the Model 3 with the base line random effects specification is defined as follows 4:

$$lnVA_{it} = \beta_k \ln k_{it} + \beta_l \ln l_{it} + \beta_{BO} Period - BO_{it} + \beta_x x_{it} + \varepsilon_{it} \tag{4}$$

where $\varepsilon_{it} \sim iid(0, \sigma^2)$, $i = 1, 2..., N$, $t = 1, 2...T$.

The regression specifications include a dummy variable, indicating whether the post-buyout or pre-buyout period is considered. Evidence indicates that targeted companies

Table VIII
Determinants of Productivity

The table presents the regression estimates of the productivity determinants considering the sample buyout and control firms. The dependent variable is productivity, measured by the logarithm of value added (i.e. gross profit). Ln(L) is the natural logarithm of labor (measured by full-time equivalents of employees). Ln(K) is the natural logarithm of capital, which is measured by the deflated amount of fixed assets (inflation adjusted with the GDP-deflator). Furthermore, binary variables for whether it is a buyout firm after the buyout event (Post BO) or before a buyout happened (Pre BO) are included. Size is measured by the logarithm of total assets. A random-effects model specification is assumed. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

Determinants of productivity			
	log(value added)		
	(1)	(2)	(3)
ln(L)	0.207***	0.204***	0.202***
	(0.0152)	(0.0153)	(0.0154)
ln(K)	-0.0371*	-0.0412**	-0.0409**
	(0.0207)	(0.0208)	(0.0208)
Buyout	0.909***		
	(0.148)		
Post BO		0.293***	
		(0.0691)	
Pre BO			-0.108
			(0.0732)
Size	0.750***	0.745***	0.753***
	(0.0273)	(0.0275)	(0.0276)
Age	0.0956***	0.0615**	0.0714**
	(0.0297)	(0.0297)	(0.0303)
HHI	0.192	0.213	0.210
	(0.228)	(0.229)	(0.229)
Constant	0.910***	1.215***	1.144***
	(0.214)	(0.216)	(0.221)
Observations	4,520	4,520	4,520

of private equity firms underperform compared to their comparable companies, having an efficiency difference of -10.8%. After the buyout took place, efficiency is improving leading to a differential of +29.3% (results are presented in table VIII). This provides evidence for the hypothesis that portfolio companies are less productive before a transaction and experience a significant efficiency improvement through private equity funding.

B.3. Insolvency Risk

Following Tykvová and Borell (2012), the risk of becoming financially distressed is analyzed using indicators that are specifically designed for this purpose or adoptable to privately-held companies. In order to measure financial distress risk, the Zmijewski-score (Zmijewski, 1984), O-score (Griffin and Lemmon (2002), Ohlson (1980)), and the Z-score (Altman, 1968) as well as its modification for private firms, relying on accounting data,

(Altman, 2002) are used. In this context, changes in leverage and long-term leverage are investigated, measured by the book value ratio of total liabilities or only long-term interest-bearing liabilities and total assets, respectively.

The Zmijewski-score is calculated as:

$$ZM_{it} = -4.336 - 4.513 * \frac{NI_{it}}{TA_{it}} + 5.679 * \frac{TL_{it}}{TA_{it}} + 0.004 * \frac{CA_{it}}{CL_{it}} \tag{5}$$

where NI represents net income, i.e. the profit or loss for the period, TA total assets, TL total liabilities, CA current assets, and CL current liabilities. Higher financial distress risk is indicated by a higher value of the Zmijewski-score.

The Ohlson-score is given by:

$$\begin{aligned} O_{it} = -1.32 - 0.407 * log(\frac{TA_{it}}{GDPdeflator_t}) + 6.03 * \frac{TL_{it}}{TA_{it}} - 1.43 * \frac{WC_{it}}{TA_{it}} \\ +0.0757 * \frac{CL_{it}}{CA_{it}} - 1.72 * TLdummy_{it} - 2.37 * \frac{NI_{it}}{TA_{it}} - 1.83 * \frac{EBITDA_{it}}{TL_{it}} \\ +0.285 * NLdummy_{it} - 0.521 * \frac{NI_{it} - NI_{it-1}}{|NI_{it}| + |NI_{it-1}|} \end{aligned} \tag{6}$$

where TA represents total assets, GDPdeflator the Norwegian GDP deflator so that an inflation-adjusted measure of total assets is obtained, TL total liabilities, WC working capital, CA current assets, CL current liabilities, TLdummy being a binary variable equal to 1 if total liabilities exceed total assets in the period, EBITDA earnings before interest depreciation and amortization (proxy for FFO, i.e. funds from operations), NI net income, and NLdummy being a binary variable equal to 1 if net income is below zero in both the current and the previous period. Higher financial distress risk is indicated by a higher O-score value.

Altman's Z-score equals:

$$Z_{it} = 1.2 * \frac{WC_{it}}{TA_{it}} + 1.4 * \frac{retEarn_{it}}{TA_{it}} + 3.3 * \frac{EBIT_{it}}{TA_{it}} + 0.6 * \frac{MVEQ_{it}}{TL_{it}} + 0.999 * \frac{Sales_{it}}{TA_{it}} \tag{7}$$

with working capital being abbreviated by WC, total assets by TA, retained earnings by retEarn, earnings before interest and taxes by EBIT, the market value of equity by MVEQ, and total liabilities by TL. The score's subratios represent (i) the relation of liquid assets to company size, (ii) profitability, (iii) the efficiency in operations apart from leverage and tax, (iv) market dimension, (v) sales turnover (Tykvová and Borell, 2012). Higher financial distress risk is indicated by a lower value of the Z-score.

Similarly, the modified Z-Score is defined as:

$$Z'_{it} = 0.717 * \frac{WC_{it}}{TA_{it}} + 0.847 * \frac{retEarn_{it}}{TA_{it}} + 3.107 * \frac{EBIT_{it}}{TA_{it}} + 0.420 * \frac{BVEQ_{it}}{TL_{it}} + 0.998 * \frac{Sales_{it}}{TA_{it}} \tag{8}$$

In comparison to the original Altman Z-score, the coefficients are different and the market value of equity is replaced with its counterpart balance sheet item.

An overview of the financial distress risk metrics chosen is provided in table IX for buyouts and the matched control companies. The Z-score is neglected since only few companies provide market data. Due to the empirical setting, i.e. matching on the buyout year instead of the pre-buyout year, the expected initial increase in leverage cannot be verified. However, decreasing leverage, especially long-term leverage, is observed over time, which is consistent with the notion that private equity initially builds up substantial amounts of debt and subsequently repays according to schedule (similar findings can be found in Muscarella and Vetsuypens (1990)). Consequently, the ZM-score and Z'-score of buyout companies experience a decrease in insolvency risk after the buyout event. The O-score provides contradictory evidence, but is based on substantially less observations. All of these findings, even the contradiction in O-score, are consistent with the findings obtained by Tykvová and Borell (2012).

To investigate the impact of the private equity firm in more detail, a multivariate panel regression on each financial distress risk metric is performed. Therefore, the sample is extended, containing all available years for buyout and control firms. Within the regressions, firm fixed effects as well as time dummy variables are employed to account for time-invariant and unobservable industry or company characteristics as well as time-varying conditions. Standard errors are clustered by company. Furthermore, industry concentration is controlled for by implementing the Herfindahl-Hirschman-index. For each of the financial distress scores two models are specified, i.e. with and without a lagged dependent variable to control for autocorrelation. Results as depicted in table X show a decline in financial distress risk for the ZM-score and O-score as 'Post BO'-coefficients are negative, though, the O-score regressions are again based on substantially less observations. These results are consistent with the hypothesis of declining financial distress risk due to debt repayments. The result for the modified Z-score indicates an estimation bias through outliers as the coefficients are unreasonably high.

The preceding analysis suffers potentially from the caveat that the analysis of financial distress risk is based on accounting data instead of real distress data. In other words, the analysis has not answered the question whether buyouts and its higher debt levels are associated with higher bankruptcy rates, i.e. whether such portfolio companies end up more or less often in bankruptcy than comparable firms (Tykvová and Borell, 2012). To

Table IX
Changes in Insolvency Risk after the Buyout

This table reports the median values and changes for the leverage ratio, measured by total debt divided by total assets as well as using only long-term liabilities, and insolvency risk metrics in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Leverage							
Differential effect	5.73%	3.74%	7.91%	6.69%	14.30%	17.18%*	5.66%
Buyouts	72.59%	73.69%	74.30%	71.42%	1.21%	-0.92%	-2.77%
# of observations	113	108	105	103	108	105	103
# of pos. observations	113	108	105	102	60	51	48
Control firms	71.94%	71.27%	69.11%	69.52%	-0.52%	-1.23%***	-1.32%
# of observations	565	547	523	510	545	523	509
# of pos. observations	563	546	521	509	253	231	230
Rank-sum test	0.470	0.133	0.034**	0.228	0.108	0.130	0.971
Long-term leverage							
Differential effect	3.27%	0.32%	-1.02%	-2.39%	1.61%	-1.51%	-10.28%
Buyouts	31.86%	30.26%	30.43%	28.29%	-7.05%	-8.20%	-13.20%
# of observations	113	108	105	103	93	91	89
# of pos. observations	98	94	89	83	37	37	32
Control firms	26.23%	24.70%	23.03%	24.21%	-2.98%***	-4.59%***	-5.88%***
# of observations	565	547	523	510	419	404	396
# of pos. observations	434	420	391	384	169	161	159
Rank-sum test	0.235	0.276	0.330	0.914	0.392	0.735	0.614
ZM-score							
Differential effect	0.504	0.312	0.621	0.376	-3.80%	17.49%	1.24%
Buyouts	-0.383	-0.401	-0.171	-0.430	0.36%	-10.53%	-28.77%
# of observations	113	108	104	101	108	104	101
# of pos. observations	45	43	45	41	56	45	42
Control firms	-0.383	-0.514	-0.589	-0.592	-0.50%	-3.43%***	-2.05%
# of observations	560	545	517	505	542	516	504
# of pos. observations	217	203	183	185	266	236	244
Rank-sum test	0.156	0.072*	0.004***	0.059*	0.968	0.768	0.349
O-score							
Differential effect	-0.461	0.229	0.978	0.866	14.88%	33.54%	-10.99%
Buyouts	-1.587	-0.872	-0.714	-0.471	-1.82%	5.95%	12.84%
# of observations	41	79	78	69	35	29	28
# of pos. observations	10	23	28	26	16	17	14
Control firms	-1.018	-0.950	-0.908	-0.847	4.17%	-10.01%***	-7.66%
# of observations	405	413	403	394	322	302	290
# of pos. observations	128	125	126	129	173	134	133
Rank-sum test	0.371	0.295	0.093*	0.031**	0.703	0.125	0.973

Table IX (continued)

	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Z'-score							
Differential effect	-0.499	-0.346	-0.464	-0.574	31.08%	23.10%	9.99%
Buyouts	1.089	1.342	1.380	1.310	15.04%***	19.15%***	19.77%**
# of observations	103	102	103	102	98	95	92
# of pos. observations	95	93	96	90	61	56	57
Control firms	1.159	1.185	1.271	1.266	0.02%	5.83%***	2.61%**
# of observations	514	517	513	509	497	475	465
# of pos. observations	489	488	484	480	249	263	241
Rank-sum test	0.542	0.531	0.717	0.785	0.010***	0.120	0.112

Table X
Panel Regressions for Buyouts and Matched Control Firms

This table reports the results of panel regressions with the financial distress risk metrics as dependent variables. The variable Post BO is a binary variable being equal to one in the years following the buyout event and zero otherwise. The variable HHI is the generated Herfindahl-Hirschman-Index measuring market concentration within the sample. A constant, year and firm fixed effects are included in all regressions. The reported standard errors in parentheses are clustered by company. Significance at the 1%, 5%, and 10% level are denoted by the asterisks ***, **, and *, respectively.

Panel regressions for buyouts and control firms						
	ZM-Score		O-Score		Z'-Score	
	(1)	(2)	(3)	(4)	(5)	(6)
Post BO	-1.772*	-1.311*	-2.925**	-1.565	-69.46	-47.39
	(1.043)	(0.768)	(1.236)	(1.300)	(61.32)	(38.65)
Lag. dep. variable		-0.0649		-0.0857***		0.00115
		(0.0704)		(0.0164)		(0.0805)
HHI	-0.841	-0.905	-2.438	-1.006	-106.0	-68.45
	(0.807)	(1.148)	(2.715)	(2.672)	(193.7)	(152.0)
Constant	1.222***	1.000***	-0.740	-1.902**	51.63***	53.17***
	(0.384)	(0.379)	(0.827)	(0.797)	(2.912)	(3.588)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.002	0.006	0.003	0.010	0.003	0.003
Observations	8,949	8,170	6,371	4,835	7,148	6,400

analyze the probability of entering into receivership, the underlying accounting database provides the item 'Year of entering into liquidation proceeding' stating the first year a company started liquidation proceedings based on the register of bankruptcies from the Brønnøysund Register Centre covering the period of September 1993 to June 2014. The data does not provide the concluding year of liquidation since liquidation processes vary in time and companies within the process stop operating in most cases (Berner et al., 2014). Taken as an indicator, the binary variable bankruptcy is generated, indicating liquidation proceedings by the value one and zero otherwise. Overall, the underlying database reports 54,559 companies entering into liquidation proceedings, implying a general bankruptcy probability of 12.36% (underlying database counts 441,485 different Norwegian companies). Of the total 113 portfolio companies being involved in a buyout before 2009, five have entered into liquidation proceedings by June 2014, indicating a bankruptcy probability among buyouts of 4.42%. In contrast, 12 of the corresponding matched control firms entered into liquidation proceedings, which corresponds to a bankruptcy probability of 2.12%. Thus, the bankruptcy probability of buyout firms is higher than the respective value of control firms, but still below the general probability of all Norwegian companies. Considering all buyout transactions up to 2011, no additional portfolio company under financial distress is recorded. For all portfolio companies that entered liquidation proceedings the buyout fund exited the investment in the same year. Thus, the exit is most certainly equivalent with the firm entering proceedings.

Additionally, as mentioned before, a more detailed database on Norwegian bankruptcies has been gathered. This data set differentiates among among firms going bankrupt, firms being under liquidation and firms being under enforced liquidation and thus might provide a more detailed view on bankruptcy risk. Unfortunately, no empirical analysis can be conducted on the main sample since the database only reports one portfolio company being bankrupt and none being under or enforced liquidation.

Furthermore, risk assessments often involve beta considerations. In this context, available stock market data has been used to estimate a monthly equity beta for each public firm (60 months regression estimation using the OSEAX index). Unfortunately, only few companies in the sample are publicly listed companies. Of the 113 buyout firms, 7 were listed in the year of buyout, having a median end-of-year monthly equity beta of 0.668 (the average of the monthly beta estimates during the year). In contrast, 16 control firms were publicly listed in the buyout year, having a median monthly equity beta of 0.971 averaged over the year. In retrospect, it might be the case, that the specific chosen holding company is not publicly traded, but the actual underlying portfolio company is listed. An empirical assessment of this possibility has not been undertaken within this thesis.

Within the bankruptcy probability analysis, an examination is undertaken whether the bankruptcy frequency is higher for companies which experienced a buyout in years

characterized by favorable market conditions. Following Axelson et al. (2013) and Tykvová and Borell (2012), the difference of the Merrill Lynch High-Yield index and Libor is used as a proxy for the European high-yield spread. The yearly credit spread is the arithmetic average of the difference between the weekly offered rates of the Merrill Lynch High-Yield index and Libor. Weekly values are used to account for differing market conditions within the year, instead of using an end-of-year value. The analysis segments buyouts undertaken in favorable conditions with a below the sample median high-yield spread and unfavorable conditions with high-yield spreads being above the sample median (i.e. 7.82%). Thus, conditions in the debt market were favorable in 1999 and in the time span of 2003 and 2007.

Furthermore, the impact of experience is analyzed. The private equity firm's experience is measured within the sample as a binary variable being equal to one if the particular transaction is not the first transaction carried out by the general partner within the sample and zero otherwise. The variable experience is included in the model specification 4 and 6.

Table XI depicts the results of the differing regressions performed. Factors that influence the bankruptcy likelihood such as company-specific characteristics, i.e. firm size and age, as well as the general economic environment are controlled for in the regression results. As economic environment indicators the HHL, domestic credit to private sector, real economic growth, inflation measured by the GDP deflator and the oil price are controlled for.

The first four regressions are based on the sample, including all buyouts and control firms occurring before 2009, whereas the last two regressions consider only buyout companies. The first column displays the result from a logit regression with the depend variable bankruptcy being equal to one if the company has received buyout funding and zero otherwise. The effect of receiving private equity funding is positive, but insignificant, implying that the bankruptcy likelihood is statistically not higher for buyout companies than their comparables. Column (2) adds as an additional control variable the ZM-score to the first model specification. The effect is not statistically significant, which indicates that higher distress risk is not associated with a higher bankruptcy probability. The results of column (3) indicate that even for portfolio companies involved in buyout transactions in years with favorable market conditions, i.e. cheap financing possibilities, the bankruptcy risk is not higher than for their comparable companies. Model specification (4) differentiates buyouts based on the private equity firm's experience at the time of the particular transaction. Results indicate that experience increases bankruptcy likelihood and thus contradicts prior academic evidence obtained e.g. by Tykvová and Borell (2012). However, as seen in Section III.B, the sample is driven by the high activity of few private equity firms, thus may bias the obtained result. Both, column (5) and (6) focus on the buyout sample, but do not provide additional insights.

Table XI
Bankruptcy Probability

This table reports the results from logit regression estimations with the dependent variable bankruptcy being equal to one if the firm enters into liquidation proceedings before June 2014 and zero otherwise. An overview on the variables used with detailed descriptions is provided in Appendix B. A random-effects model specification is assumed. Significance at the 1%, 5%, and 10% level are denoted by the asterisks ***, **, and *, respectively.

Bankruptcy probability						
	All buyouts and control firms				Only buyouts	
	(1)	(2)	(3)	(4)	(5)	(6)
Buyout characteristics						
Buyout	0.668	0.718				
	(0.935)	(0.852)				
Favorable			0.129		0.107	
			(0.843)		(1.513)	
Experience				1.444*		-
				(0.811)		
Firm characteristics						
Size	-0.257	-0.295*	-0.188	-0.261*	-0.0459	-0.419
	(0.169)	(0.169)	(0.164)	(0.151)	(0.316)	(0.664)
Age	-0.710*	-0.719**	-0.776*	-0.638*	-0.462	1.689
	(0.381)	(0.355)	(0.449)	(0.336)	(0.701)	(1.785)
ZM-Score		-0.000564				
		(0.0122)				
Economic characteristics						
HHI	0.355	0.296	0.772	0.318	-0.208	-2.385
	(2.133)	(1.978)	(1.933)	(1.894)	(4.570)	(20.82)
Credit	2.99e-07	2.57e-07	7.41e-07	1.95e-07	-2.15e-07	-3.17e-06
	(3.00e-06)	(2.87e-06)	(3.22e-06)	(2.73e-06)	(5.75e-06)	(7.86e-06)
GDP growth	-4.911	-5.567	-4.339	-4.785	1.430	6.484
	(37.04)	(35.68)	(35.61)	(33.88)	(62.86)	(94.67)
Inflation	2.227	2.371	1.521	2.055	-0.161	-0.167
	(7.789)	(7.558)	(7.913)	(7.195)	(14.53)	(21.88)
Oil price	0.00150	0.00175	-0.00118	0.00129	0.00274	-0.0138
	(0.0240)	(0.0230)	(0.0277)	(0.0216)	(0.0482)	(0.0584)
Constant	-11.33***	-10.80***	-11.70***	-10.73***	-13.25***	-25.21***
	(2.690)	(2.737)	(2.567)	(2.468)	(4.820)	(9.233)
Observations	8,936	8,838	8,936	8,645	1,254	963

B.4. Employment

For exploring the impact of private equity's funding on employment and wages, two variables are used. The variable 'Wages' comprises any form of a company's remuneration to its employees and executive personnel as well as board of directors, contribution to the National insurance and pension expenses in a fiscal year (measured in thousand NOK). In addition to this, employment is measured by the number of full-time equivalents of the company (denoted as 'Employees'). This information is based on the underlying accounting database, supplemented with data from the Register of Employers and Employees (AA Register) from the Norwegian Labour and Welfare Service (NAV) covering the period of 1995 to 2012 (but lacks consolidated figures) (Berner et al., 2014).

Results on the impact on employment and wages are shown in table XII. While there is a significant positive change in number of employees at the 10% significance level after the first year, the median firm neither increases nor decreases its employment in the following periods compared to the buyout year. Especially when looking at the differential effect, it can be observed that private equity-backed companies create more jobs compared to their peers. These findings are in line with the vast majority of the literature, reporting modest increases in employment contradicting the notion that private equity investments lead to cuts in employment due to restructuring measures. The reported increase in employment can be linked to the findings regarding the operating performance measures. An increased employment can be interpreted in a way that sales increases driven by full potential strategies outweigh the organizational efficiency measures.

Additionally, wages increase significantly from NOK 39,891k in the buyout year to NOK 115,369k in third year after the buyout. The median change over the respective period is 80.41% and statistically different form zero at the 1% significance level. The results based on the mean support the positive effect on wages with a positive average treatment effect on the treated in period one of NOK 56,048k, period two of NOK 81,861k and period three of NOK 77,805k. However, by comparing the mean values to the median values, outliers dominate the mean results of employees and wages.

Table XII
Impact on Employment and Wages after the Buyout

This table reports the median values and changes for employment, measured in full-time equivalents, and wages in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Employees (FTE)							
Differential effect	-12.2	-1.2	-9.1	-16.5	6.68%**	21.29%**	19.28%*
Buyouts	18.0	17.0	10.5	8.0	4.92%*	0.00%	0.00%
# of observations	81	91	96	101	63	59	57
# of pos. observations	64	68	71	71	36	29	28
Control firms	6.0	4.0	3.0	2.0	0.00%	0.00%	0.00%
# of observations	489	496	496	490	308	292	285
# of pos. observations	322	307	300	285	129	126	129
Rank-sum test	0.027**	0.028**	0.034**	0.075*	0.058*	0.348	0.313
Wages (in thousand NOK)							
Differential effect	3,424	25,202	35,090	36,518	33.17%***	85.78%***	80.64%***
Buyouts	39,891	79,795	95,799	115,369	37.78%***	78.48%***	80.41%***
# of observations	113	108	105	103	107	104	102
# of pos. observations	112	106	102	94	88	88	73
Control firms	8,884	8,271	6,482	6,236	6.18%***	11.43%***	14.92%***
# of observations	565	547	524	510	420	401	391
# of pos. observations	435	413	389	375	275	257	262
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

B.5. Innovation

In order to extract the effect of a buyout transaction on the underlying firm's innovative activities, several measures are used. To begin with, following Lichtenberg and Siegel (1990) and Long and Ravenscraft (1993) R&D intensity is analyzed. The R&D intensity measures the R&D expenditures of a company in proportion to its sales level and thus provides a comparable ratio across entities. As the accounting database does not provide the specific income statement item 'R&D expenses' and instead includes development costs within 'other operating expenses', it is proxied by the change in the balance sheet position 'Research and development'. This accounting item represents the capitalized parts of any research and development activities undertaken by the company, that aim to e.g. procure new knowledge, make such effort results commercially viable or design new supply chain processes. Being introduced in 1999 and previously part of the item 'capitalized costs' which also comprises other items such as goodwill, it is only possible to measure R&D intensity from 1999 onwards (Berner et al., 2014). Furthermore, the variable contains two particular shortcomings. Firstly, the capitalization rules have changed

during the period, which implies a bias in measure for the estimated treatment effect. Secondly, the capitalization of research expenses is not permitted under IFRS due to its uncertainty in providing financial benefits and thus is not reliable on a holding basis if the international accounting standard is applied.

Table XIII
Changes in Innovative Performance after the Buyout

This table reports the median values for the innovation performance ratios in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
R&D-intensity							
Differential effect	0.00%	0.00%	0.00%	0.00%	-92.65%	-100.00%	-100.00%*
Buyouts	0.00%	0.00%	0.00%	0.00%	-100.89%*	-100.00%	-100.00%
# of observations	46	94	92	90	12	11	8
# of pos. observations	7	18	13	19	4	4	3
Control firms	0.00%	0.00%	0.00%	0.00%	99.40%*	100.00%**	100.00%**
# of observations	308	339	331	327	19	17	15
# of pos. observations	7	13	9	15	14	15	12
Rank-sum test	0.174	0.348	0.604	0.238	0.006***	0.216	0.182
Patents (balance sheet item)							
Differential effect	0.000	0.000	0.000	0.000	-5.48%	-0.33%	-11.32%
Buyouts	0.000	0.000	219.000	0.000	-14.63%**	-8.73%	-31.77%*
# of observations	103	102	103	103	43	41	40
# of pos. observations	45	49	54	51	13	17	13
Control firms	0.000	0.000	0.000	0.000	-5.42%	-12.51%	-32.77%
# of observations	515	518	516	510	76	73	75
# of pos. observations	82	83	79	84	25	28	24
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.205	0.573	0.834

Results on R&D-intensity are depicted in table XIII. The median end-of-year value is 0.00% for buyouts and their control firms in all periods indicating negligible R&D expenditures. The proxy to capture the R&D expenditures is obviously inappropriate as it seems that most R&D expenses are not capitalized.

In addition to the aforementioned general shortcomings, it has been acknowledged that higher R&D expenditures are not necessarily equivalent to higher innovation. Hence, more recent studies have used different measures to investigate innovative performance focusing directly on patent activity (Lerner et al. (2011), Ughetto (2010)). The accounting item 'Patents' comprises permits, patents, licenses, trademarks, copyrights and contract rights representing the value in its usage right or contract exploitation. However, this item was also part of 'capitalized costs' prior to 1999 and thus can only be analyzed afterwards (Berner et al., 2014). Furthermore, its measurable impact on innovation is

biased due to the inclusion of other items such as permits and licenses.

Similar to R&D-intensity, results on the balance sheet position 'Patents' illustrate that for the vast majority of analyzed companies no patents are capitalized and thus report a value of zero.

Considering the shortcomings of these accounting items and following recent academic methodology, acknowledging patenting activity as a true indicator for innovative performance, the variable patents applications is used, representing the patenting frequency of the individual firm covered in the Orbis database. It measures the number of applied patents by a firm in a certain year. Additionally, the patent stock is assessed. Following Ughetto (2010), the patent stock is calculated as the depreciated sum of past patents with a yearly depreciation of 15%.

Results on patenting activity lack meaningful insights as only few companies within the sample file patents. Thus, results are reported in the Appendix D for completeness.

Overall, the analysis highlights the empirical challenges involved when assessing the innovative performance of companies within a country, especially a small country like Norway. Most importantly, the lack in reported R&D expenditures within the profit and loss statement of a Norwegian company eliminates even the most basic analysis. The more sophisticated and recent methodologies used in the academic literature, are not applicable due to the size of the economy and the lack of available information, e.g. citation count.

B.6. Immediate effect and long-term effect analysis

Considering only the immediate year after a buyout deal, the sample can be extended covering transactions up to 2011. Thus, the sample includes 140 portfolio buyout companies. The results are depicted in table XIV. Evidence shows a beneficial impact of private equity funding on short-term financial performance. A significant positive development is captured in the ratios EBITDA over total assets as well as equity, implying a significant improvement in EBITDA (median increase of 12.76% in EBITDA/total assets for buyout companies). Especially, the percentage change in the differential effect in EBITDA ratios are positive, e.g. 51.27% for EBITDA/total assets, and significantly different from zero based on a Wilcoxon signed-rank test. Also, the net cash flow ratios drop in the first period after the buyout for portfolio companies, indicating an immediate capital investment. Both findings are coherent to the results obtained in the main analysis. In contrast to the main analysis, the median differential effect in the net cash flow/total asset ratio does not increase in the first period, indicating larger capital expenditures undertaken by the control firms compared to the portfolio companies.

In terms of profitability, buyouts have a strong significant impact on inflation-adjusted sales and asset turnover of their portfolio companies, i.e. median increase of 34.61% and 9.99%, respectively. Other profitability ratios, such as return on sales and the EBITDA-margin, also increase, although there is a significant difference between buyout and control firms, with the latter providing higher profit margins. Furthermore, private equity funding has a significant negative impact on the current ratio, i.e. decreasing by -8.97%, indicating an immediate change in working capital management. Despite an increase in RoS for portfolio companies, findings are coherent to the main analysis.

Within the short-term analysis, a median increase in leverage by 1.56% is observed for buyout companies. Results on the metrics measuring insolvency risk remains inconclusive for the first year after the buyout. However, a strong and significant improvement of 38.63% in wages is observed for buyout-backed companies, whereas control firms improve wages only by 6.36%. The performance difference increases by 6.01% in terms of full-time employees and by 32.76% in wages, thus providing similar results to the main analysis.

The results on innovative performance highlight again the problem of missing information for all individual companies. The median percentage change in the balance sheet position 'Patents' declines for buyout firms and their comparables by -10.04% and -10.99%, respectively. Thus, no valid inferences on innovative performance can be made.

Considering an extended analyzed period of up to five years after the buyout deal, the sample coverage has to be restricted up to the year 2007. Consequently, the sample includes only 87 portfolio buyout companies. Results are depicted in table XV. Evidence on financial performance indicates a further improvement in EBITDA up to the fifth year. The return on asset metric using EBITDA in the nominator reaches its all-time high in

the fifth year after the buyout with a median value of 10.20% for portfolio companies. Moreover, the median increase of the differential effect from the buyout year to the third year afterwards is 21.55%, whereas 46.23% to the fifth year. Furthermore, the net cash flow ratio continues its positive development for buyout companies with a percentage change of 71.86% between the buyout year and the fifth year. The differential effect has a median increase of 49.03% up to the third period and 64.91% up to the fifth year. The increasing differential effect indicates less capital expenditures in private equity funded companies compared to their matched peers.

Even though, the development of inflation-adjusted sales flattens in the fifth year for both buyout and control firms, asset turnover increases for buyouts more significantly than for the peer companies as the increasing percentage change in the differential effect indicates (49.88% up to the third period and 63.40% up to the fifth year). Furthermore, profitability increases in the fifth year compared to the immediate following three years, i.e. the EBITDA-margin increases from a median of 7.54% in the third period to 8.41% in the fifth period for buyout companies. Moreover, the median current ratio further decreases for buyout firms.

Since long-term leverage has been further reduced and thus leverage (median percentage change in leverage to the fifth period is -2.83%), all scores on financial distress risk indicate a lower risk for buyout firms. Furthermore, a strong and significant improvement of 121.91% in wages is observed for buyout-backed companies, whereas control firms improve wages only by 20.90%. The performance difference increases by 30.51% in terms of full-time employees and by 123.60% in wages.

Overall, long-term results suggest no deterioration of performance results over time. The main results obtained in the previous main analysis are consistent to the long-term analysis. However, there exists a large dependency between both analysis as the long-term sample is included in the main sample and thus may be driving these results. Similar dependency holds for the immediate effect analysis. To gain a more detailed assessment on the economic impact buyouts have on company performance in the long-term, this analysis should be repeated in a few years using the same buyout firms.

Table XIV
Immediate Effect Analysis (before 2011)

This table report the median values per year and percentage change in performance ratios from year i to year j (# observations; # positive observations) for the extended sample covering all buyout transactions up to 2011. The variable differential effect (abbreviated as 'DE') depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

	0						+1						0 to +1					
	DE	Buyout		Control		Rank-sum	DE	Buyout		Control		Rank-sum	DE	Buyout		Control		Rank-sum
A. Financial performance																		
Net income/total assets	-3.32%	0.60%	(140; 75)	2.30%	(700; 525)	0.000***	-1.10%	0.79%	(135; 72)	2.01%	(677; 492)	0.001***	13.15%	-1.17%	(135; 66)	-5.78%	(677; 323)	0.410
EBITDA/total assets	-3.57%	5.75%	(140; 107)	7.30%	(700; 603)	0.026**	1.74%	8.27%	(135; 103)	6.60%	(677; 558)	0.508	51.27%***	12.76%**	(135; 81)	-1.97%	(677; 321)	0.004***
Net cash flow/total assets	-2.56%	0.35%	(72; 36)	3.64%	(655; 409)	0.130	-5.52%	-2.03%	(135; 60)	3.78%	(677; 440)	0.000***	-11.62%	0.13%	(71; 36)	3.35%	(634; 328)	0.405
Net income/equity	-11.51%	5.86%	(140; 82)	10.44%	(698; 536)	0.001***	-11.25%	5.36%	(135; 76)	8.85%	(675; 513)	0.002***	11.43%	-7.1%	(135; 64)	-8.33%	(675; 305)	0.590
EBITDA/equity	-16.54%	21.16%	(140; 110)	27.81%	(698; 591)	0.051**	-2.82%	27.42%	(135; 103)	24.50%	(675; 558)	0.798	38.40%**	20.19%***	(135; 79)	-8.43%*	(675; 293)	0.001***
Net cash flow/equity	0.58%	3.98%	(72; 37)	12.44%	(654; 409)	0.191	-29.63%	-5.04%	(135; 64)	12.36%	(675; 441)	0.000***	-57.17%	-5.45%	(71; 35)	-7.36%	(633; 291)	0.405
B. Operating performance																		
Inflation-adjusted sales	n/a	1.000	(135; 135)	1.000	(489; 489)	n/a	0.340	1.346	(130; 124)	0.995	(469; 438)	0.000***	n/a	34.61%***	(130; 96)	-0.51%	(469; 225)	0.000***
Return on sales	-6.28%	0.52%	(135; 71)	4.74%	(489; 360)	0.000***	-5.73%	0.77%	(128; 69)	4.86%	(458; 333)	0.000***	5.17%	5.10%	(124; 65)	0.97%	(439; 223)	0.938
EBITDA-margin	-20.66%	7.15%	(140; 107)	21.43%	(700; 606)	0.000***	-19.36%	8.34%	(134; 103)	18.18%	(667; 562)	0.000***	10.26%*	8.68%	(134; 74)	-1.37%	(667; 307)	0.122
Asset turnover	0.106	0.759	(140; 135)	0.155	(700; 489)	0.000***	0.358	0.936	(135; 128)	0.150	(677; 456)	0.000***	13.55%***	9.99%***	(130; 79)	0.45%	(469; 238)	0.000***
Current ratio	-0.780	1.471	(140; 140)	1.384	(695; 692)	0.995	-0.778	1.368	(135; 135)	1.407	(675; 672)	0.133	-14.95%**	-8.97%***	(135; 54)	0.95%*	(669; 345)	0.005***
Coverage ratio	-4.904	1.372	(93; 59)	2.023	(498; 396)	0.018**	-2.533	0.846	(97; 62)	1.833	(482; 361)	0.009***	-2.30%	23.44%	(81; 44)	-4.78%	(437; 210)	0.212
C. Insolvency risk																		
Leverage	5.45%	73.01%	(140; 140)	73.30%	(700; 698)	0.993	3.43%	74.16%	(135; 135)	71.96%	(677; 676)	0.200	17.16%*	1.56%**	(135; 77)	-0.45%	(675; 312)	0.023**
Long-term leverage	0.42%	30.72%	(140; 122)	26.78%	(700; 535)	0.458	-0.51%	29.86%	(135; 121)	25.04%	(677; 516)	0.252	2.89%	-5.58%	(117; 50)	-2.44%***	(517; 210)	0.795
ZM-score	0.441	-0.357	(140; 56)	-0.344	(695; 281)	0.396	0.283	-0.345	(135; 55)	-0.391	(675; 264)	0.100	5.20%	3.10%	(135; 72)	-0.43%	(672; 331)	0.647
O-score	-0.397	-1.369	(48; 11)	-0.922	(512; 167)	0.256	0.289	-0.789	(100; 30)	-0.848	(516; 165)	0.192	18.58%	6.50%	(42; 21)	0.25%	(412; 207)	0.760
Z'-score	-0.461	1.082	(130; 121)	1.042	(649; 612)	0.867	-0.340	1.313	(129; 117)	1.029	(647; 605)	0.551	30.66%	12.25%**	(125; 75)	0.84%	(627; 324)	0.040**
D. Employment and wages																		
Employees (FTE)	-10.60	19.00	(90; 72)	4.00	(622; 396)	0.006***	-8.70	12.00	(110; 78)	4.00	(623; 380)	0.090*	6.01%*	4.92%*	(71; 39)	0.00%	(380; 165)	0.119
Wages (in thousand NOK)	3,679.9	40,987.0	(140; 139)	8,309.5	(700; 531)	0.000***	22,965.6	80,369.0	(135; 132)	7,970.0	(677; 507)	0.000***	32.76%***	38.63%***	(134; 112)	6.36%***	(513; 336)	0.000***
E. Innovation Performance																		
R&D-intensity	0.00	0.00%	(55; 7)	0.00%	(383; 12)	0.917	0.00	0.00%	(118; 22)	0.00%	(413; 19)	0.227	-92.15%	-65.76%	(14; 6)	56.94%	(26; 16)	0.051*
Patents (balance sheet item)	0.00	110.00	(130; 65)	0.000	(650; 115)	0.000***	0.00	382.00	(129; 67)	0.000	(648; 113)	0.000***	0.00%	-10.03%*	(63; 23)	-10.99%*	(107; 35)	0.680

Table XV
Long-term Effect Analysis (before 2007)

This table reports the median values for the performance ratios in relation to the fiscal year ending of the buyout (year $t = 0$), i.e. implying that the first full fiscal year following the year of buyout completion is indicated as year +1. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Panel A provides the financial performance estimates. Panel B contains the operating performance ratios. Panel C covers the insolvency risk metrics. Panel D depicts the employment measures, whereas Panel E shows the innovative performance estimates. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

Panel A: Financial Performance							
	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Net income/total assets							
Differential effect	-3.32%	-0.33%	-1.10%	-2.04%	-1.95%	-3.67%	-10.75%
Buyouts	1.50%	1.98%	0.74%	1.14%	0.86%	-41.75%	-47.91%
# of observations	87	82	81	80	76	80	76
# of pos, observations	52	50	44	0	41	34	33
Control firms	2.77%	2.45%	2.58%	2.37%	2.51%	-7.35%	-3.47%
# of observations	435	419	400	390	370	390	370
# of pos, observations	333	307	304	278	279	188	183
Rank-sum test	0.009***	0.102	0.004***	0.009***	0.029**	0.189	0.136
EBITDA/total assets							
Differential effect	-3.40%	1.10%	-0.18%	-1.11%	2.33%	21.55%	46.23%**
Buyouts	7.13%	9.00%	7.68%	7.51%	10.20%	3.12%	28.66%**
# of observations	87	82	81	80	76	80	76
# of pos, observations	69	65	61	62	56	42	44
Control firms	7.64%	7.35%	7.62%	7.11%	6.46%	-10.15%	-9.00%
# of observations	435	419	400	390	370	390	370
# of pos, observations	379	352	339	318	288	171	171
Rank-sum test	0.353	0.241	0.945	0.892	0.122	0.211	0.022**
Net cash flow/total assets							
Differential effect	-2.85%	-5.98%	-5.24%	-3.28%	-0.85%	49.03%	64.91%
Buyouts	-0.77%	0.02%	1.85%	2.38%	5.82%	24.23%	71.86%
# of observations	50	82	79	78	76	44	44
# of pos, observations	24	41	44	46	49	24	29
Control firms	3.67%	4.07%	4.27%	3.71%	3.87%	-0.33%	9.19%
# of observations	397	419	398	384	366	354	335
# of pos, observations	244	274	260	244	248	176	178
Rank-sum test	0.122	0.004***	0.004***	0.294	0.788	0.899	0.472

Table XV (continued)

	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Net income/equity							
Differential effect	-9.78%	-6.72%	1.92%	-8.68%	-5.11%	-21.48%	-62.76%
Buyouts	7.64%	7.44%	11.85%	6.06%	7.55%	-36.55%	-32.10%
# of observations	87	82	81	80	76	80	76
# of pos, observations	57	52	53	53	47	35	36
Control firms	11.76%	9.21%	9.33%	9.05%	10.07%	-11.34%	-12.13%
# of observations	433	417	398	388	369	388	369
# of pos. observations	337	317	308	284	290	178	164
Rank-sum test	0.788	0.233	0.879	0.330	0.209	0.567	0.274
EBITDA/equity							
Differential effect	-7.59%	-1.90%	4.01%	1.00%	2.47%	12.09%	35.14%
Buyouts	27.63%	33.72%	29.51%	26.01%	34.03%	-3.01%	5.35%
# of observations	87	82	81	80	76	80	76
# of pos. observations	72	65	64	64	54	39	38
Control firms	27.60%	24.60%	22.89%	20.57%	20.03%	-16.84%	-24.52%
# of observations	433	417	398	388	369	388	369
# of pos. observations	372	353	337	317	292	164	156
Rank-sum test	0.641	0.200	0.270	0.780	0.235	0.333	0.450
Net cash flow/equity							
Differential effect	4.57%	-31.59%	-6.38%	-1.71%	6.51%	11.32%	-22.14%
Buyouts	2.30%	3.56%	10.83%	15.47%	18.97%	75.92%	36.13%
# of observations	50	82	79	78	76	44	44
# of pos. observations	25	43	46	51	51	25	26
Control firms	12.59%	12.15%	13.22%	9.65%	11.47%	-16.91%	-6.26%
# of observations	396	417	396	382	365	353	334
# of pos. observations	247	270	258	238	244	162	162
Rank-sum test	0.225	0.010***	0.271	0.875	0.347	0.213	0.405

Panel B: Operating Performance

	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Inflation-adjusted sales							
Differential effect	n/a	0.323	0.645	0.677	0.605	n/a	n/a
Buyouts	1.000	1.408	1.604	1.620	1.378	62.00%***	37.77%***
# of observations	83	78	76	74	72	74	72
# of pos. observations	83	77	73	67	65	51	47
Control firms	1.000	0.995	0.964	0.976	0.892	-2.43%	-10.83%***
# of observations	326	311	293	281	264	281	264
# of pos. observations	326	293	264	244	229	134	102
Rank-sum test	n/a	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Table XV (continued)

	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Return on sales							
Differential effect	-9.34%	-5.32%	-8.60%	-7.02%	-4.61%	31.23%	46.97%
Buyouts	2.07%	1.56%	0.78%	1.03%	1.10%	26.55%	-2.13%
# of observations	83	80	76	73	70	70	67
# of pos. observations	49	49	42	39	37	36	33
Control firms	5.27%	5.45%	4.75%	4.75%	4.51%	12.76%*	-6.97%
# of observations	326	304	281	266	238	249	219
# of pos. observations	244	223	215	191	176	134	106
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.001***	0.382	0.672
EBITDA-margin							
Differential effect	-15.72%	-18.38%	-20.32%	-18.08%	-16.94%	16.83%	38.09%**
Buyouts	7.27%	9.10%	7.59%	7.54%	8.41%	0.63%	17.15%
# of observations	87	82	78	76	72	76	72
# of pos. observations	69	65	61	61	56	39	40
Control firms	19.24%	16.51%	17.65%	16.23%	16.27%	-6.83%	-9.25%**
# of observations	435	414	383	372	348	372	348
# of pos. observations	380	353	340	318	288	156	146
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.000***	0.582	0.125
Asset turnover							
Differential effect	0.123	0.353	0.363	0.362	0.538	49.88%***	63.40%***
Buyouts	0.773	1.018	0.970	0.891	1.135	14.88%***	16.97%***
# of observations	87	82	81	80	76	77	73
# of pos. observations	83	80	76	72	70	45	41
Control firms	0.238	0.206	0.192	0.191	0.163	-3.59%	-10.34%**
# of observations	435	419	400	390	370	289	275
# of pos. observations	326	303	279	265	237	128	111
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.000***	0.003***	0.000***
Current ratio							
Differential effect	-0.622	-0.482	-1.319	-1.088	-0.860	-67.45%***	-53.84%**
Buyouts	1.526	1.487	1.460	1.365	1.221	-14.00%**	-21.43%***
# of observations	87	82	80	78	74	78	74
# of pos. observations	87	82	80	78	74	26	25
Control firms	1.350	1.371	1.422	1.478	1.355	0.46%**	-3.57%
# of observations	431	417	394	385	366	384	363
# of pos. observations	428	415	392	385	366	195	169
Rank-sum test	0.218	0.813	0.260	0.129	0.111	0.027**	0.056*
Coverage ratio							
Differential effect	-5.151	-3.024	-7.402	-6.428	-0.744	-56.19%	-37.61%
Buyouts	2.552	1.335	0.727	0.904	0.999	-61.15%	-82.68%
# of observations	60	59	62	59	60	46	44
# of pos. observations	42	41	39	40	35	20	14
Control firms	2.145	1.942	2.074	1.747	1.835	-5.77%	-8.25%
# of observations	311	295	281	269	242	229	204
# of pos. observations	252	232	221	199	174	113	101
Rank-sum test	0.337	0.084*	0.002***	0.046**	0.081*	0.525	0.070*

Table XV (continued)

Panel C: Leverage and Insolvency Risk							
	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Leverage							
Differential effect	5.75%	3.43%	7.61%	4.68%	6.29%	3.17%	25.65%
Buyouts	72.59%	74.26%	73.40%	68.59%	72.03%	-3.61%	-2.83%
# of observations	87	82	81	80	76	80	76
# of pos. observations	87	82	81	79	75	35	35
Control firms	72.40%	71.96%	69.72%	69.91%	68.53%	-0.51%	-2.92%
# of observations	435	419	400	390	370	389	369
# of pos. observations	433	418	398	389	368	182	163
Rank-sum test	0.468	0.202	0.110	0.554	0.107	0.505	0.551
Long-term leverage							
Differential effect	4.28%	1.45%	-0.81%	-1.04%	-3.28%	-21.73%*	-10.41%
Buyouts	33.07%	30.53%	30.30%	28.03%	26.15%	-13.20%*	-16.98%**
# of observations	87	82	81	80	76	71	68
# of pos. observations	77	73	71	66	66	25	22
Control firms	22.15%	23.09%	22.78%	23.47%	20.03%	-5.79%***	-13.96%***
# of observations	435	419	400	390	370	303	290
# of pos. observations	334	324	303	297	275	121	106
Rank-sum test	0.044**	0.097*	0.149	0.579	0.258	0.368	0.809
ZM-score							
Differential effect	0.455	0.088	0.569	0.208	0.531	-2.08%	26.82%
Buyouts	-0.449	-0.473	-0.372	-0.579	-0.320	-41.06%	-4.55%
# of observations	87	82	80	78	74	78	74
# of pos. observations	34	32	32	29	29	30	36
Control firms	-0.391	-0.514	-0.576	-0.592	-0.735	-0.32%	-5.74%**
# of observations	431	417	394	385	366	385	365
# of pos. observations	167	157	145	145	126	192	166
Rank-sum test	0.214	0.193	0.040**	0.187	0.015**	0.136	0.501
O-score							
Differential effect	-0.786	0.040	0.978	0.467	0.702	-22.17%	62.57%
Buyouts	-1.675	-0.902	-0.829	-0.763	-0.552	-7.20%	-2.25%
# of observations	34	60	58	52	57	23	23
# of pos. observations	8	17	19	20	23	11	10
Control firms	-1.038	-1.093	-0.919	-0.891	-1.192	-7.54%*	-7.19%**
# of observations	319	320	309	296	288	227	221
# of pos. observations	103	95	98	97	97	103	101
Rank-sum test	0.291	0.335	0.381	0.072*	0.057	0.770	0.861
Z'-score							
Differential effect	-0.466	-0.183	-0.311	-0.282	-0.186	30.23%	13.19%
Buyouts	1.089	1.474	1.473	1.469	1.572	29.34%**	10.92%**
# of observations	77	76	79	79	75	69	67
# of pos. observations	72	71	74	70	67	44	40
Control firms	1.178	1.229	1.317	1.288	1.296	0.47%	-0.79%
# of observations	384	389	390	389	368	345	326
# of pos. observations	366	367	368	366	345	173	161
Rank-sum test	0.573	0.356	0.451	0.955	0.349	0.043**	0.221

Table XV (continued)

Panel D: Employment and Wages							
	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Employees (FTE)							
Differential effect	-12.2	-0.2	-4.9	-17.9	-7.5	28.29%**	30.51%**
Buyouts	23.0	19.0	10.5	7.5	7.0	0.71%	11.11%
# of observations	57	67	74	78	76	45	43
# of pos. observations	50	53	55	54	55	23	23
Control firms	11.0	6.0	5.5	5.0	3.0	0.00%	-2.34%
# of observations	360	369	374	370	360	231	220
# of pos. observations	262	246	241	226	209	104	97
Rank-sum test	0.047**	0.067*	0.156	0.353	0.077*	0.268	0.201
Wages (in thousand NOK)							
Differential effect	2,663.4	22,125.9	35,810.0	34,673.4	38,292.4	101.42%***	123.60%***
Buyouts	39,801.0	82,489.5	99,231.0	126,649.0	130,084.0	109.19%***	121.91%***
# of observations	87	82	81	80	76	80	76
# of pos. observations	87	81	78	73	71	60	59
Control firms	10,318.0	9,731.0	8,000.0	7,096.0	6,638.5	14.57%***	20.90%***
# of observations	435	419	401	390	370	306	290
# of pos. observations	342	323	302	295	274	209	185
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Panel E: Innovation Performance							
	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
R&D-intensity							
Differential effect	0.00%	0.00%	0.00%	0.00%	0.00%	-123.23%*	-65.52%
Buyouts	0.00%	0.00%	0.00%	0.00%	0.00%	-100.00%	-31.03%
# of observations	33	70	69	69	70	5	7
# of pos. observations	5	8	7	11	10	2	3
Control firms	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%*	100.00%
# of observations	227	259	257	256	237	10	9
# of pos. observations	5	12	7	11	11	8	7
Rank-sum test	0.152	0.091*	0.701	0.750	0.725	0.240	0.394
Patents (balance sheet item)							
Differential effect	0.0	0.0	0.0	0.0	0.0	-24.81%	-35.93%
Buyouts	0.000	0.000	0.000	61.000	541.500	-31.77%	-39.16%**
# of observations	77	76	79	80	76	30	28
# of pos. observations	33	37	39	41	45	11	8
Control firms	0.000	0.000	0.000	0.000	0.000	-32.77%	-52.17%
# of observations	385	390	393	390	370	59	56
# of pos. observations	66	66	63	68	59	20	20
Rank-sum test	0.000***	0.000***	0.000***	0.000***	0.000***	0.920	0.836

V. Conclusions and suggestions for further research

This thesis examines the effect buyouts have on their Norwegian portfolio companies. While most existing academic literature focuses almost entirely on buyouts in the U.S. or at least Europe as a whole, research lacks for individual countries, especially smaller economies such as Norway. For a base sample of 203 buyouts undertaking between 1992 and 2012, this thesis provides a solid overview on buyout activity in Norway. Since performance assessment is restricted to available accounting data up to the year 2012, the returns are analyzed at first for up to three years of the buyout event, implying a restriction of the sample to 113 buyouts occurring before 2009. The analysis is further supplemented, providing a long-term performance as well as immediate effect assessment. The former includes 87 buyouts up to 2007, whereas the latter includes 140 buyouts up to the year 2011. Performance is assessed by benchmarking the considered metrics to comparable companies, identified using propensity score matching among all Norwegian companies regardless of being public or private.

To begin with, results indicate an improvement in operating income and net cash flow, i.e. EBITDA minus capital expenditures, of private equity-backed companies. In this regard, evidence implies decreasing capital expenditures for private equity-backed companies. Secondly, substantial increases in inflation-adjusted sales and asset turnover are observed for portfolio companies, providing evidence that private equity firms aim to enhance the overall potential of the firm in addition to efficiency measures. Within the profitability ratio analysis, a decreasing current ratio is observed for buyout firms over time, suggesting a valuation of tighter working capital at the cost of increased liquidity risk by the private equity investors. Moreover, an efficiency improvement is observed using a Cobb-Douglas production function. Finally, results demonstrate significant improvements in wages for private equity firms.

By capturing the development along five dimensions and thus not only analyzing one aspect of corporate performance, this thesis contributes to the existing academic research as it provides a holistic overview on the economic impact. Furthermore, this thesis is based on a profound attempt to capture all buyout market activity and thus aimed to diminish the sample selection bias existent in previous research. Hence it follows, this thesis provides an unadorned view on the Norwegian buyout market, on which the Argentum Centre for Private Equity at the NHH is able to take appropriate actions to enhance their existing database by gathering essential data and eliminating distortions, not only in the underlying private equity data, but also in the accounting database provided by the SNF.

Due to the more recent development of the Norwegian private equity market, research suffers in particular from data insufficiency. As buyout activity increased over the last years and seems to maintain recent growth rates, sample sizes and thus reliability will be larger in the near future. Furthermore, through the Public Limited Liability Companies

Act (ASA Act) and Limited Liability Companies Act (AS Act) in 2013 (described in Section I.B), the rules on business incorporation, firm capital and organizational matters were eased as well as the strict prohibition of credit granting or security were modified. These business-friendly amendments may not only impact the number of M&A activities, in particular buyout deals, but also the financing structure owing to the higher flexibility. Hence, private equity activity is likely to further increase. Moreover, data will become more accessible due to the AIFMD implementation in 2014 (for details see Section I.B).

In spite of data insufficiency, the analysis has been challenged by general private equity practices applied within buyout transactions. The implementation of new holding companies, consolidation of portfolio companies as well as changes in organizational numbers, through e.g. renaming of firms, introduce significant problems within the research design. This thesis adopted the approach to match at the end of the buyout year and thus considered the resulting information at the end of the transaction. However, with gathered information on implemented changes by the private equity fund, an analysis of pre-buyout data is possible, which might yield additional understanding on the economic impact of private equity.

Furthermore, the analysis of cash flow data obtained by Norwegian private equity funds might yield fundamental insights. Firstly, it would allow to benchmark investor performance with alternative investment forms and thus provide a more detailed insight on financial performance. Secondly, the fund behavior in charging fees could be analyzed in detail and contrasted against European practices, determining the level of competition. Thirdly, by using cash flow data, realized capital gains through the investments' exits may yield fundamental insights on the success of Norwegian buyouts. However, an attempt to analyze such data will encounter difficulties. To exemplify, as seen in the performance benchmark analysis in Section III.B, only six funds of the total 87 funds in the sample are covered by the Preqin database. Thus, it seems questionable whether such a research attempt would yield sufficient data.

Additionally, the observed productivity effects might depend on a certain type of buyout transaction or the involved private equity house. Furthermore, it has been acknowledged that private equity houses build up their expertise in operations and product development. Performance might differ substantially between different levels of operational expertise.

Future research on these areas might prevail interesting relationships and further enhances the existing understanding on fundamental characteristics of private equity. At this stage, it certainly remains an interesting and promising research area, despite the myriad empirical challenges faced in each endeavor.

Appendix A. Funds Performance - Preqin

Table XVI

The table illustrates private equity fund returns according to the vintage year. Information on IRRs, TVPI (Total Value to Paid-in-Capital) and percentage called are obtained from Preqin. The median IRR, size-weighted and equal-weighted IRR are reported for each vintage year differentiated to the fund stage, i.e. buyout and venture capital funds. Panel A reports values for all funds worldwide, whereas Panel B only considers European funds.

Panel A: Global

	Buyout Funds						Venture Capital Funds			
Vintage Year	Obs	Called (Median)	TVPI (Median)	IRR-Median	IRR-Size Weighted	IRR-Equal Weighted	Obs	IRR-Median	IRR-Size Weighted	IRR-Equal Weighted
1980	4	1.00	3.7	0.20	0.25	0.21	6	0.14	0.26	0.16
1981	-	-	-	-	-	-	9	0.12	0.21	0.19
1982	-	-	-	-	-	-	14	0.09	0.16	0.13
1983	-	-	-	-	-	-	15	0.10	0.16	0.13
1984	6	1.00	3.33	0.24	0.30	0.33	23	0.12	0.15	0.12
1985	4	1.00	2.08	0.11	0.10	0.13	28	0.13	0.10	0.14
1986	12	1.00	2.47	0.19	0.40	0.46	22	0.10	0.13	0.11
1987	8	1.00	3.87	0.22	0.11	0.22	28	0.15	0.13	0.13
1988	13	1.00	2.1	0.14	0.15	0.20	26	0.23	0.29	0.22
1989	17	1.00	3.07	0.27	0.28	0.30	47	0.15	0.34	0.20
1990	22	1.00	2.38	0.19	0.19	0.22	29	0.17	0.20	0.15
1991	9	1.00	2.24	0.25	0.27	0.25	16	0.26	0.04	0.45
1992	23	1.00	2.03	0.21	0.34	0.20	30	0.18	0.10	0.21
1993	19	1.00	2.25	0.21	0.26	0.25	38	0.30	0.40	0.30
1994	41	1.00	1.83	0.19	0.31	0.23	26	0.27	0.60	0.30
1995	35	1.00	1.67	0.16	0.15	0.18	28	0.18	0.17	0.55
1996	30	0.99	1.74	0.11	0.13	0.15	32	0.19	0.30	0.38
1997	46	1.00	1.64	0.12	0.10	0.13	47	0.33	0.37	0.51
1998	55	0.99	1.57	0.10	0.04	0.07	35	0.03	0.31	0.18
1999	35	0.97	1.65	0.12	0.06	0.12	31	-0.05	-0.07	0.00
2000	44	0.98	2.02	0.24	0.21	0.23	38	-0.02	-0.07	-0.01
2001	19	1.00	2.75	0.31	0.29	0.31	16	0.00	0.03	0.03
2002	10	0.98	1.64	0.21	0.26	0.24	13	0.08	0.08	0.07
2003	12	0.99	1.76	0.17	0.15	0.16	11	0.05	0.34	0.08
2004	10	0.98	2.24	0.28	0.27	0.28	8	0.03	0.00	0.06
2005	17	0.99	1.58	0.13	0.19	0.20	13	-0.03	0.16	0.06
2006	19	0.96	1.53	0.09	0.11	0.11	9	-0.02	0.07	-0.04
2007	16	0.96	1.57	0.11	0.14	0.14	8	0.05	0.09	0.07
2008	7	0.88	1.62	0.13	0.13	0.16	15	0.11	0.08	0.08
2009	9	0.92	1.55	0.23	0.22	0.26	-	-	-	-
2010	4	0.81	1.44	0.16	0.11	0.13	-	-	-	-
2011	13	0.63	1.12	0.11	0.14	0.14	9	0.12	0.29	0.22
2012	8	0.50	1.07	n/a	n/a	n/a	12	n/a	n/a	n/a

Table XVI (continued)

Panel B: Europe

Vintage Year	Buyout Funds						Venture Capital Funds			
	Obs	Called (Median)	TVPI (Median)	IRR-Median	IRR-Size Weighted	IRR-Equal Weighted	Obs	IRR-Median	IRR-Size Weighted	IRR-Equal Weighted
1989	6	1.00	1.92	0.19	0.18	0.19	-	-	-	-
1990	7	1.00	1.61	0.21	0.23	0.26	-	-	-	-
1991	4	1.00	2.22	0.25	0.25	0.25	-	-	-	-
1992	5	1.00	2.06	0.22	0.27	0.24	-	-	-	-
1993	-	-	-	-	-	-	-	-	-	-
1994	10	1.00	2.1	0.22	0.39	0.30	-	-	-	-
1995	10	1.00	1.73	0.17	0.29	0.16	-	-	-	-
1996	8	0.98	1.74	0.15	0.13	0.13	-	-	-	-
1997	17	1.00	1.67	0.12	0.27	0.20	10	0.32	0.46	0.37
1998	14	0.98	1.84	0.16	0.16	0.18	4	0.06	0.05	0.09
1999	16	0.95	1.64	0.13	0.10	0.13	4	n/a	0.22	0.12
2000	19	0.98	2.02	0.25	0.20	0.23	7	n/a	0.04	0.11
2001	10	1.00	2.25	0.29	0.24	0.28	6	0.05	0.15	0.05
2002	7	0.96	1.67	0.25	0.33	0.30	-	-	-	-
2003	6	0.95	2.3	0.28	0.24	0.28	5	0.02	0.06	0.05
2004	5	0.98	2.15	0.20	0.17	0.29	-	-	-	-
2005	8	0.99	1.61	0.14	0.33	0.32	5	n/a	0.00	-0.05
2006	11	0.95	1.24	0.05	0.04	0.07	-	-	-	-
2007	9	0.92	1.55	0.10	0.09	0.13	-	-	-	-
2008	4	0.91	1.51	0.11	0.10	0.13	6	0.00	0.03	0.01
2009	-	-	-	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-	-	-
2011	9	0.66	1.16	0.14	0.15	0.15	-	-	-	-
2012	4	0.54	0.84	n/a	n/a	n/a	4	n/a	n/a	n/a

Appendix B. Variables descriptions

Table XVII

This table provides an overview of the variables used in the empirical analysis with detailed descriptions. Panel A depicts the covariates used in the propensity score specification. Panel B displays the performance metrics used to track company performance. Panel C provides an overview of additional variables used in panel regressions within the empirical section. Accounting items are measured in 1,000 NOK.

Panel A: Covariates used in the propensity score model specification	
Variables used in the specification	
Size	The logarithm of the balance sheet item total assets. Source: SNF
Sales	The balance sheet item total revenues. Source: SNF
EBITDA-margin	Operating profitability measured by EBITDA divided with total revenues. Source: SNF
Fixed asset ratio	The fraction of total fixed assets divided by total assets. Source: SNF
Industrycode	Nat. log. of one plus the industry class (based on the 5-digits NACE-code). Source: SNF
Panel B: Performance metrics of the empirical analysis	
Financial Performance	
Net income/total assets	Return on assets metric measured as net income divided by total assets. Source: SNF
EBITDA/total assets	Return on assets metric measured as EBITDA divided by total assets. Source: SNF
Net cash flow/total assets	Net cash flow, measured as EBITDA minus Capex, divided by total assets. Source: SNF
Net income/equity	Net income divided by total equity. Source: SNF
EBITDA/equity	EBITDA divided by total equity. Source: SNF
Net cash flow/equity	Net cash flow, measured as EBITDA minus Capex, divided by equity. Source: SNF
Operational Performance	
Inflation-adjusted sales	Inflat.-adj. sales in k NOK, normalized to unity in the buyout year (t=0). Source: SNF
Return on sales	Net income divided by total sales volume. Source: SNF
EBITDA-margin	Operating profitability measured by EBITDA divided by total revenues. Source: SNF
Asset turnover	Sales divided by total assets. Source: SNF
Current ratio	The current ratio measured as current assets divided by total liabilities. Source: SNF
Coverage ratio	EBIT divided by interest payments. Source: SNF
Insolvency risk	
Leverage	The total book value of debt divided by total assets. Source: SNF
Long-term leverage	Book value of long-term interest-bearing liabilities divided by total assets. Source: SNF
ZM-, O-, Z'-score	Financial distress measures (see Section IV.B). Source: SNF, Datastream
Employment and wages	
Employees	Variable measuring the number of full-time equivalents of the company. Source: AA Register from the NAV (SNF)
Wages	Comprises any form of a company's remuneration to its employees and executive personnel as well as board of directors, contribution to the national insurance and pension expenses (in thousand NOK). Source: AA Register - NAV (SNF)
Innovative Performance	
R&D-intensity	The variable measures R&D expenditures of a company, proxied by the change in the balance sheet position 'Research and development' comprising all capitalized parts of any such activities, in proportion to its sales level. Source: SNF
Patents (balance sheet)	Accounting item comprising permits, patents, licenses, trademarks, copyrights and contract rights, representing the value in its usage right or contract exploitation (in thousand NOK). Source: SNF

Table XVII (continued)

Further considered, but not displayed ratios	
Sales efficiency	Sales divided by total FTE of employees. Source: SNF
QR-ratio	It measures current assets less inventories divided by current liabilities. Source: SNF
Z-score	Financial distress measure presented in Section IV.B. Source: SNF, stock data NHH
Patents applications	It measures the number of applied patents, which are later granted and published, by a firm in a certain year (see Appendix D). Source: Orbis
Patents stock	The patent stock is calculated as the depreciated sum of past applied patents with a yearly depreciation of 15% (see Appendix D). Source: Orbis

Panel C: Variables used in the panel regressions of the empirical analysis	
Dependent variable	
Bankruptcy	Binary variable indicating whether the considered firm entered liquidation proceedings between September 1993 and June 2014 by taking the value one and zero otherwise. Source: register of bankruptcies from the Brønnøysund Register Centre (SNF)
Productivity	Productivity is measured by the logarithm of value added (i.e. gross profit). Source: SNF
Independent variables	
Buyout and buyout characteristics	
Buyout	Binary variable being equal to one for buyout firms and zero otherwise. Source: ACPE-sample
Pre BO	Binary variable being equal to one for buyout firms before the buyout event and zero otherwise (including control firms). Source: ACPE-sample
Post BO	Binary variable being equal to one for buyout firms after the buyout event and zero otherwise (including control firms). Source: ACPE-sample
Favorable	Binary variable being equal to one for portfolio companies, for which the buyout occurred in years with favorable conditions in the debt market, and zero for other buyout companies and control firms. Market conditions are considered favorable when the high-yield credit spread is below the sample period median. The high-yield spread is measured as the difference between the Merrill Lynch High-Yield index and Libor rate. Source: Datastream
Experience	Binary variable being equal to one for buyout transactions in which the private equity investors experience is larger than one, and zero otherwise (also for matched control firms). The investor's experience is proxied by the number of all deals carried out by the GP prior to the particular transaction. Source: ACPE-sample
General firm characteristics	
Ln(L)	Log. of labor (full-time equivalents of employees). Source: AA Register - NAV (SNF)
Ln(K)	Log. of capital, which is measured by the deflated amount of fixed assets (inflation adjusted with the GDP-deflator). Source: SNF, Datastream
Age	Natural log. of one plus the difference between the fiscal year and the year of the company's incorporation. Source: SNF
Economic environment	
HHI	The Herfindahl-Hirschman-Index of industry concentration is obtained by adding the squared market shares of each individual firm in each sector year based on the industry classification. High values indicate pricing power and low competition. Source: SNF
Credit	Credit indicator (C2), i.e. credit from domestic sources in both local and foreign currency to non-financial companies (mill. NOK). Source: Datastream (Norway Statistics)
GDP growth	Percent. change in real-GDP (at market price of 2012). Source: Datastream (Norway Statistics)
Inflation	Inflation is derived from the GDP-deflator of Norway. Source: Datastream (Norway Statistics)
Oil price	End-of-year oil price in USD per barrel (Crude Oil-Brent). Source: Datastream (ICIS Pricing)
Further considered, but not displayed variables	
Bankruptcy, under or enforced liquidation	Binary variable and equivalent in meaning to 'Bankruptcy'. However, the data has been separately obtained from the register of bankruptcy (Brønnøysund Register Centre), because it distinguishes on the type of insolvency, i.e. going bankrupt, being under liquidation or being under enforced liquidation. Source: Brønnøysund Register Centre.

Appendix C. Thin common support problem

Table XVIII

This table provides the distribution of portfolio companies backed by private equity (buyouts) differentiated among the industry code. Following the Standard industrial classification (NACE) with five digits, the companies are segmented up to and including 2007 according to the standard SN2002 and afterwards to the audited version of SN2007. Accordingly, prior to 2008 industries are segmented into 12 different categories, whereas the SN2007 differentiates among 14 industries. The legend is provided below.

Panel A: Distribution among industry code up to 2007

Entry year	1	2	3	4	5	6	7	8	9	10	11	12	n/a
1996	-	-	2	-	-	-	-	-	-	-	-	-	-
1997	-	-	2	-	1	-	-	-	-	-	-	1	-
1998	-	-	1	-	2	-	-	-	-	-	1	-	-
1999	-	-	2	-	1	1	-	-	1	-	-	-	1
2000	-	-	3	-	-	-	-	-	-	-	-	-	2
2001	-	-	-	-	3	-	-	-	1	-	-	-	-
2002	-	-	1	-	-	-	-	-	-	-	1	-	1
2003	-	2	1	-	1	-	-	-	2	-	-	4	-
2004	2	-	2	-	2	-	-	-	3	-	-	-	-
2005	1	-	2	-	1	-	-	1	5	-	-	-	-
2006	-	2	4	-	2	-	-	3	3	-	1	2	1
2007	1	-	3	-	3	-	1	-	10	4	-	-	-

Panel B: Distribution among industry code from 2008

Entry year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2008	-	1	2	1	-	2	-	1	3	-	-	5	1	3
2009	-	-	3	-	-	-	-	-	3	3	-	-	-	-
2010	-	1	2	-	1	2	-	-	2	4	1	4	-	1
2011	-	2	1	-	1	2	-	-	1	1	-	6	-	-
2012	-	1	3	1	-	3	-	-	-	-	-	5	-	-

SN2002: Primary industries (1), Oil/Gas (2), Manufacturing industries (3), Constructions/Energy (4), Trade (5), Shipping (6), Transport/Tourism (7), Finance/Insurance (8), Services/Real Estate/Advisors (9), Health/Care (10), Culture/Media (11), IT/Telecom (12)

SN2007: Primary industries (1), Oil/Gas/Mining (2), Manufacturing industries (3), Energy/Water/Sewage/Util. (4), Constructions (5), Trade (6), Shipping (7), Transport/Tourism (8), Telecom/IT/Media (9), Finance/Insurance (10), Real Estate/Services (11), General Service (12), R&D (13), Public Sector/Culture (14)

Appendix D. Patenting activity

Table XIX

This table reports median values for the variables measuring patenting activity. The variable differential effect depicts the median performance difference between the single buyout firm and the mean of its corresponding control group. Values are calculated on an end-of-year basis. Based on a Wilcoxon-Mann-Whitney rank-sum test, the equality of distributions between the two respective groups is tested, whereas the Wilcoxon signed-rank test is used to test whether the changes in ratios are significantly different from zero. Significance at the 1%, 5%, and 10% level are denoted by asterisks ***, **, and *, respectively.

Panel A: Main empirical analysis (sample up to 2009)							
	Year after buyout ($t = 0$)				Percentage Changes		
	0	+1	+2	+3	0 to +1	0 to +2	0 to +3
Patents applications							
Differential effect	1.000	0.000	0.000	0.000	-100.00%	-100.00%	-100.00%
Buyouts	1.000	1.000	0.000	0.000	-66.67%	-100.00%	-100.00%
# of observations	11	13	14	15	8	8	7
# of pos. observations	8	9	5	6	1	2	1
Control firms	0.000	0.000	0.000	0.000	-16.67%	-45.83%	25.00%
# of observations	19	21	20	23	6	6	6
# of pos. observations	6	6	5	9	1	2	3
Rank-sum test	0.049**	0.062*	0.460	0.879	0.507	0.490	0.054*
Patents stock							
Differential effect	2.268	1.928	1.639	1.393	-15.00%	-27.75%	-38.59%
Buyouts	3.000	2.700	2.148	1.658	11.86%	8.41%	-8.48%
# of observations	11	13	14	15	11	11	10
# of pos. observations	11	13	14	15	6	7	4
Control firms	0.870	1.000	0.953	0.898	-15.00%***	-27.75%**	-38.59%*
# of observations	19	21	20	23	19	18	19
# of pos. observations	19	21	20	23	3	4	5
Rank-sum test	0.085*	0.043**	0.074*	0.110	0.080*	0.041**	0.126

Panel B: Long-term performance (sample up to 2007)							
	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Patents applications							
Differential effect	-	-	-	-	-	-	-
Buyouts	2.000	1.000	0.000	0.000	0.000	-100.00%**	-100.00%
# of observations	9	10	10	11	12	5	6
# of pos. observations	6	7	3	4	3	0	1
Control firms	0.000	0.000	0.000	0.000	0.000	25.00%	-87.50%
# of observations	17	19	18	21	22	6	6
# of pos. observations	6	6	5	9	5	3	1
Rank-sum test	0.126	0.144	0.857	0.704	0.680	0.014**	0.858

Table XIX (continued)

	Year after buyout ($t = 0$)					Percentage Changes	
	0	+1	+2	+3	+5	0 to +3	0 to +5
Patents stock							
Differential effect	-	-	-	-	-	-	-
Buyouts	3.000	3.125	2.656	1.658	1.491	-8.48%	-29.53%
# of observations	9	10	10	11	12	8	9
# of pos. observations	9	10	10	11	12	3	4
Control firms	1.462	1.000	1.289	1.000	0.895	-38.59%	-35.95%
# of observations	17	19	18	21	22	17	17
# of pos. observations	17	19	18	21	22	5	6
Rank-sum test	0.258	0.113	0.195	0.292	0.264	0.304	0.309

Panel C: Immediate effect analysis (sample up to 2011)

	Year after buyout ($t = 0$)		Percentage Changes
	0	+1	0 to +1
Patents applications			
Differential effect	1.000	0.000	-100.00%
Buyouts	1.000	1.000	-66.67%
# of observations	11	14	8
# of pos. observations	8	10	1
Control firms	0.000	0.000	-16.67%
# of observations	25	28	8
# of pos. observations	8	10	1
Rank-sum test	0.023**	0.087*	0.587
Patents stock			
Differential effect	2.268	1.928	-15.00%
Buyouts	3.000	2.498	11.86%
# of observations	11	14	11
# of pos. observations	11	14	6
Control firms	0.874	1.000	-15.00%**
# of observations	25	28	25
# of pos. observations	25	28	6
Rank-sum test	0.092*	0.069*	0.157

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Notes

[1]Preqin is a data provider, founded in 2003 as 'Private Equity Intelligence', which has become increasingly popular among researchers and practitioners. According to the company's website, the independent company collects its data not only through direct contacting and establishing relationships with industry professionals, but also through monitoring regulatory fillings, making FOIA requests and tracking news sources (Phalippou, 2010).

[2]Between 1989 and 2006, the collected data set is compiled from EVCA, Thomson Reuters and PricewaterhouseCoopers. From 2007 onwards, the EVCA yearbooks are based on data provided by PEREP_ Analytics and third party information. PEREP_ Analytics is the pan-European statistics platform on which the regional and national private equity associations collect their activity data (among others the NVCA) and thus represents the most comprehensive European private equity database.

[3]For a detailed description of Norwegian taxation rules regarding different company vehicles, general partners and investors see e.g. Wiese-Hansen and Nordal (2014)

[4]Unfortunately, the data, provided by the EVCA does not report the investment count after and including 2007. Therefore, the number of companies is reported as a proxy (before 1997 no report on companies).

[5]Press release of Argentum as of February 1, 2012 (http://www.argentum.no/en/Market-Database/News/).

[6]The Argentum market database can be accessed at http://www.argentum.no/en/Market-Database/.