Stockholm School of Economics

Master Thesis in Finance

Does the credit market induce an industry effect in Private Equity?

- An empirical study of Private Equity activity on industry level-

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Abstract

Using a sample of 25,682 private equity deals from 1986-2009 we investigate the relationship between Private Equity activity and the credit market as well as the relative valuation of the industry of the target firm. Our results show that buyout activity is negatively related to the credit spread between high yield bonds and LIBOR. We find some evidence for that the credit spread is positively associated with the concentration of buyout activity across industries. Our study does not find evidence that the credit markets and the relative valuation of the target company's industry explain changes in the distribution of private equity activity on industry level. Our results also indicate that the relative valuation of the target company's industry is negatively related to excess returns from multiple expansion over different hypothetical holding periods. Finally, we show that private equity companies invested in industries where the multiple expansion was superior to the benchmark multiple expansion of the economy on average, hence earning excess returns from industry picking.

Keywords: Private Equity, LBO, credit market, industry effect, multiple expansion

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1. Introduction

During the 1980s, a new form of investment technique was developed which has played a very important role in global investment, and is referred to as leveraged buyouts (LBOs) or Private Equity (PE). An investment is generally made by raising a large amount of debt, acquiring the majority of the votes of the target company where after the Private Equity company develops the target company through active ownership. A fund is initially put together to make the acquisition which is normally divested after a holding period of 3-7 years (Kaplan and Strömberg, 2009).

LBO deals started taking place in greater amounts in North America in the mid-1980s since a large market for publicly issued high-yield bonds built up at that time, which enabled and fuelled the growth of LBOs. It was not until late 1990s LBO activity spun off in Europe, but the deal volume in Europe has now equaled the one in the U.S. The LBO volume as a share of M&A activity globally rose from 2% in 2000 to 19% in 2006 (CGFS 2008). During 2004-2007, a value of $535 billion was spent on U.S public-to-private LBOs, which is ten times the value of transactions during the eight precedent years. In the fourth quarter in 2007 however, LBO activity plummeted with 94% from a year earlier (Wang, 2008).

Previous research has suggested that Private Equity is highly cyclical, a pattern that is to a large extent driven by the credit market and availability of debt financing (Bernstein et al., 2010). Fascinated by the Private Equity industry and its role in the global financial markets we set out to investigate how this cyclicality plays out on industry level and what implications potential relationships might have. An intuitive line of reasoning could be that since the stock price normally goes up throughout an industry if PE firms make a (first time) acquisition within this industry, having an idea about what type of firms PE companies will go after judging from ones predictions about the credit market, one could make money from investing in these industries. We use a sample of 25,682 deals matched with industry data on trading valuation multiples and interest rates to examine if credit markets induces an industry effect in the Private Equity market.

1.1 Research question

Given the concept of booms and busts in the Private Equity market and its dependence on the availability of debt financing we want to look at the impact of this cyclicality on the activity across industries. We want to understand if there is cyclicality in how deal activity varies between industries and see if the variations in the credit market drive such an industry effect.

One concept that we examine is if the relative valuation of an industry explains such a shift in deal activity across industries.

Further, to see what the implications for returns would be of the distribution of Private Equity activity across industries, we examine how the returns from shifting valuation levels in industries over time are influenced by the conditions of the credit market at the time of the deal. This analysis could indicate that PE firms time the market to buy in industries where they expect valuations to increase or that the conditions of the credit market are an important determinant of future returns from Private Equity deals.

1.2 Contribution

We hope that this thesis will contribute to the understanding of the cyclicality of the Private Equity market, provide insights to how credit markets influence Private Equity activity and shed light on how much industry wide characteristics influence the investment decisions of Private Equity firms.

1.3 Outline

The thesis is outlined as follows;

In section two we present a brief background on the Private Market and present previous research related to private equity activity, credit markets' role in Private Equity and other areas related to our topic. In section three we present the data, define the variables employed in our analysis and present descriptive statistics. Thereafter, in section four we present our methodology and describe the regressions and tests performed. Section five presents our results and the interpretation of these. In section six we discuss the results, their interpretations and the implications of our results. Lastly, in section seven we conclude and describe some of the limitations and sources of errors as well as give suggestions for future research within this area.

2. Theoretical framework and previous research

2.1 General theory on Private Equity

Private Equity in its most basic sense refers simply to the holding of stock in unlisted companies. Private equity and leveraged buyouts are concepts often used synonymously, which we will also do throughout the thesis (CGFS, 2008). Marais, Schipper and Smith (1989) define a buyout as a transaction in which public common stock ownership gets extinguished and the incumbent/previous management retains control. A LBO is a division of M&A activity that uses a significant amount of debt financing to acquire a target company using the assets of the target as collateral. The leverage ratios can amount up to 90% even though 65-70% was the more common rate before the credit turmoil of 2007 (CGFS, 2008).

The point of using this much debt in comparison to the equity stake is partly since it makes it possible to acquire much larger targets with a limited personal equity investment, and partly since it creates a way of controlling the manager and thereby decreasing agency cost related to free cash flow significantly (Cotter & Peck, 2000). Perhaps the most important aspect however is as the literature states the value created from the interest tax shields. Also, high debt levels force the manager to work efficiently and keep the company away from default (Wang, 2008).

For further readings on private equity we refer to the publication "Leveraged Buyouts and Private Equity" by Kaplan and Strömberg (2009). These authors are prominent within private equity and provide a thorough review on the field.

2.2 Credit market influence on buyout behavior

"Numerous practitioner accounts over the years have suggested that the PE industry is highly cyclical, with periods of easy financing availability (often in response to the successes of earlier transactions) leading to an acceleration of deal volume, greater use of leverage, higher valuations, and ultimately more troubled investments" (Bernstein et al., 2010). Like Ljungqvist, Richardson and Wolfenzon (2007) state, there is no surprise that firms choose to make their acquisitions when debt is cheap and their bargaining power is high, but the fact that the acquisitions differ in deal structure and valuation depending on credit supply could have interesting implications in our search for an industry effect derived from the credit market. There are of course countless factors affecting buyout behavior, like for instance the age of the fund or recent fund performance, but in this thesis we keep our focus on implications from credit market factors (Ljungqvist, Richardson and Wolfenzon, 2007).

When studying implications from the supply side of the credit market, leveraged buyouts give good indications since the high rate of debt make them very sensitive to changes in the credit supply (Wang, 2008). Conversely, the fundamental simultaneity between supply and demand aggravates attempts of stating a clear tie between the supply of capital and corporate conduct (Lemmon and Roberts, 2007). Kaplan and Stein (1993) argue that the reason the deals in the late 1980s were overpriced and financed with more subordinate “junk” bonds simply was the abundance of these fund sources in that period. However, these results can also be questioned due to the causality issue between the short-term financing and “heated” buyout periods. That is, it is hard to say if the abundance of short-term financing lead up to the heated period, or if the heated buyout period generated an increased issuance of short-term financing (Cotter & Peck, 2000). Even though any results can be attributed to multiple factors, empirical analysis indicate that the economy-wide cost of borrowing drives both leverage and pricing as well as affecting booms and busts in PE transactions (Axelson, Strömberg and Weisbach, 2007). This demonstrates the importance of understanding the implications of the credit market on buyout behavior, which is what we hope our thesis will be a contribution to.

2.2.1 Capital structure

Since capital structure plays a central role in the Private Equity industry, due to the fact that transactions are dependent on how much debt PE actors can raise, we will now look at it more closely. An intuitive line of reasoning could be that the credit market drives what type of capital structures are possible for specific firms and scenarios, and to the extent capital structure is an industry characteristic, this could be one link to analyze any industry effect in LBO deals induced by the credit market. In a study by Axelson, Strömberg and Weisbach (2007) results supporting this are identified, stating that partners in LBOs borrow as much as possible for each deal and that the capital market provides discipline by limiting the amount allowed to borrow, deal by deal. Axelson et al. (2009) examined the cyclical use of leverage in LBOs between 1985 and 2008 and came to the conclusion that the leverage rate is driven by the cost of debt rather than more firm- and industry- specific factors which is the case in publicly traded firms.

Kaplan & Stein (1993) showed evidence supporting that the junk bond market which got established in the mid 1980s created a demand push that fundamentally altered the capital structure of subsequent transactions. In the late 1980s leverage rate had grown extremely high and amounted on an average to around 80% of the capital structure. This leverage rate however dropped off in the 1990s and early 2000s but was then steadily rising again until 2007 (Axelson, Strömberg and Weisbach, 2007). Axelson, Strömberg and Weisbach (2007) perform an empirical analysis on leverage and pricing and find several factors linked to firm leverage. For instance, public firms with more variable cash flows, greater profitability or more growth opportunities all have lower leverage. However, Axelson, Strömberg and Weisbach (2007) simultaneously show that the leverage rate in LBO deals is not consistently related to any firm-specific characteristics, which gives us further incentives to keep our study on industry level.

One further aspect Axelson et al. (2009) discusses is the overabundance of diverse capital suppliers constituting the debt load that make up 75% of the transaction price in their data sample. The recent years' vast amount of liquidity in the syndicated loan market, partly fuelled by the eager of hedge funds and investors to hold loans, has made the syndicated debt market the biggest fraction of the debt structures, holding the loans in their original form or as collateralized loan obligations. Since there are so many different types of debt used in LBOs it's evident that type of debt, not just the amount, plays an important role in decisions concerning capital structure (Axelson et al., 2009). Lemmon and Roberts (2007) argue that segmentation of capital markets in the sense that the cost of capital varies across different sources of finance for other reasons than risk, like investor preferences, governmental impediments and from the presence of the same frictions that generate capital rationing. Because of this, the financing and investment behavior of firms can be impacted by shocks to the supply of capital in so far as the segmentation makes it costly to switch sources of capital. However, since they also find that investments go down at just about the same rate as the debt issuance, the corporate leverage ratios remain quite stable leaving the linkage between the supply of capital and firms' capital structure still unclear (Lemmon and Roberts 2007).

The amount and forms of credit that is available is even more important to bear in mind when you as Cotter and Peck (2000) consider that PE investors don't always construct the "base case" optimal capital structure, but to secure credible financing firms may often have to use the kind of debt readily available at the time as they compete with their peers in raising debt. The authors further describe how LBOs' future expected cash flows influence what types of debt can be used. However, even though the usage of junk bonds can drive up the price, it simultaneously means more fragile capital structures. In the late 1980s, "overheating" in the LBO market induced poorly structured deals (Kaplan and Stein, 1993). When the debt ratio rises above the optimal rate, cost of capital increases significantly in normal market conditions (Committee on the Global Financial System 2008). Since it obviously is not only the quantities of credit supplied but types of credit and their composition that determines capital structure and thus generates strong implications on buyout behavior, this theory is important for our research.

2.2.2 The influence of securitization vehicles

In recent years, securitization vehicles have turned into a key factor in LBO transactions. Two years ago, close to half of the demand for leveraged loans originated from securitization vehicles according to private sector estimates. We could all see the importance of a well functioning securitization market in late 2007 as some collateralized loan obligation (CLO) vehicles had to liquidate their holdings (CGFS 2008). Several researchers have identified this collateralized debt obligation (CDO) market as a source of extra credit to LBOs, and Wang (2008) forms three main supporting reasons. One reason is that the CDO market enables a markedly broader spectrum of investors such as banks, hedge funds, pension funds and insurance companies by enabling these investors to hold the right pool of assets with the right seniority to diversify their holdings. Secondly, since banks using these instruments do not have to hold the loans in their own balance sheets but instead sell them onwards, banks have incentives to lend more and can also profit from underwriting CLOs backed by these loans. Lastly, Wang argues that since banks this way can issue assets with much lower ratings by parceling them into investment-grade securities, market segmentation is resolved and investment-grade capital reaches leveraged loans. Wang’s standpoint is also supported by the fact that the CDO issues skyrocketed during the same period as the LBO market last boomed.

The above indicates that securitization vehicles drive capital amount and availability, so we now want to look at what other effects securitization vehicles bring. Shivdasani and Wang (2009) show that the CDO channel had a significant impact on the cost of credit of LBO loans by displaying that banks with greater CDO underwritings offered cheaper credit with looser covenant protection to LBOs. Wang (2008) reports that target firms in CDO-driven deals generate more cash flows, pay more taxes, and are less risky. Although one might think that CDO-driven deals come with greater risk, Shivdasani and Wang (2009) show that management teams and financial sponsors use the increase in credit to lock up incremental financing, lowering the probability of financial distress. CDO-driven deals are also on average four times bigger than other deals. Apart from concluding that the CDOs and other structured credit products did not induce deals of worse quality, the authors are unable to find evidence indicating overpayment in the CDO-driven deals when investigating LBO premiums. Finally, Shivdasani and Wang state that they cannot find a relation with significance between lender CDO funding and transaction multiples.

2.2.3 Private Equity activity

Lemmon and Roberts (2007) express how essential it is to determine any linkage by which the supply of capital, independent of demand, affects corporate behavior through market imperfections. What they find is that net investment decline near to one-for-one with net debt issuance contraction brought on by supply shocks due to the distinctly segmented capital markets. A shock they studied was the abrupt crash of the notorious investment firm Drexel Burnham Lambert Group. Drexel pioneered junk bonds and nurtured them to becoming a $200 billion market which enabled corporate raiders to easily raise all the money needed to go after even the largest firms. As the firm suddenly turned bankrupt, corporate America was saturated with all the debt it dared to take on (*Predators fall: Drexel Burnham Lambert*, 1990). This historic crash created a supply shock that nearly halved the net debt issuance and was followed by close to no substitution at all to alternative sources of finance. One further finding is that the effect from supply contraction differs significantly among below-investment-grade firms depending on their rating (risk). The effects were more persistent with the riskier firms, which creates more expanded capital constraints for the firms more likely to need a restructuring of their debt positions (*Predators fall: Drexel Burnham Lambert*, 1990).

Ljungqvist, Richardson and Wolfenzon (2007) show that, although intuitively, funds increase their investment as credit market loosens. This is however dependant on the age of the company; -young firms normally are less sensitive to market conditions since they for example have the need of building a track record. The authors also argue that funds normally get more conservative after times of good performance.

2.2.4 Industry effect

For an industry effect to exist, factors in common to a firm's industry would be the primary motivation for acquiring it through a LBO. Ambrose and Winters (1992) identify three main industry spanning factors with the potential of inducing an industry effect; the growth rate, the free cash flow and the remaining debt capacity. For an industry to be likely to have higher concentrations of LBO transactions, it should have low rates of asset growth, high free cash flow from operations, excess debt capacity and stable free cash flows. In this test, the authors use industries with greater-than-expected LBO activity. A major weakness important to keep in mind with their study is however that it's based on a relatively small amount of deals (263) over a rather short time period (8 years). Even of greater influence, their study was performed on data from 1980-1987, a time period with very different conditions and an unlike scenario regarding Private Equity than the one of today.

One of the most significant changes between then and now is accordingly to Strömberg (2007) that, as earlier stated, the PE market has grown tremendously in the last ten years, both with regards to transaction value and amount. Other important differences are that the PE business has broadened its industry scope vastly and that an increasingly share of the LBOs are secondary buyouts, i.e. when a buyout transaction is exited to another buyout firm. Two final reasons as to why we have to look at results from the 1980s with a grain of salt are that private equity has become a global phenomenon rather than an U.S one and that, accordingly to how some have argued, the benefits of private ownership have increased significantly as a result from the sometimes burdensome corporate governance regulation imposed in 2001-2002. Strömberg (2007) further shows that out of 21.397 LBOs between 1970-2007 more than 40% took place as from 2004, which clearly imposes the importance of being aware of what time period a study on PE refers to.

What Ambrose and Winters (1992) do find is that when investigating industries with above expected concentration in LBO deals to see if these also have lower growth rates, even though they identify two industries with three times the amount of LBOs, the overall result was that they were unable to find evidence supporting that the industries with "too many" LBOs were low growth industries at that time. Secondly, Ambrose and Winters (1992) conclude that with one exception, no data could be identified to significantly (1%) support the industry effect hypothesis by presenting a greater free cash flow in industries with significantly higher LBO activity than for the population in general. When examining the mean difference in weighted free cash flow for each industry and for each firm year-by-year, they identify a result that usually could support the industry effect hypothesis, but seldom was significant. Lastly, as the authors examine the remaining debt capacity their results show that none of the industries had a mean weighted remaining debt capacity that differed significantly from the mean of the whole population. By using the population proportion test though, the authors identify four industries with significantly lower remaining debt capacity than average, and that the rest of the firms do not differ significantly. Because of this, these results are inconclusively.

As described above, Ambrose and Winters (1992) find none but weak support for the industry effect hypothesis. What their results do show is that industries cannot support LBO activity without the necessary cash flow. Ambrose and Winters (1992) finally arrive at, as they lift the perspective, that industry collective aspects are only secondary explanatory in target selection for LBO actors, whereas the primary explanatory forces are the firm-specific factors. Since, as we have pointed out, Ambrose and Winters (1992) only look at rather few data points from a distant period with conditions momentously different to the ones of today, a valuable research paper to look at is "The new demography of private equity" by Strömberg (2007). In this article, Strömberg performs a substantial research on global LBO activity, exit behavior, and holding periods, in which he builds the most comprehensive (to our knowledge) database, spanning more than 21,000 LBO transactions 1970-2007, at that time (December 2007) on worldwide leveraged buyout transactions. In fact, Strömberg investigates so many issues, with so many different determinants and factors that we cannot give an account for them all. We will give a short walkthrough of the main findings with closest relation to our thesis, and advise anyone who wishes to get a broader background on the subject to read up on "The new demography of private equity" (Strömberg, 2007).

Strömberg (2007) investigates how LBO transactions have changed during 1970-2007 in, among others, the following aspects; 1. Number respective value divided on with or without financial deal sponsor, 2. Number, value and respective composition divided on type of transaction (public-to-private, private-to-private, divisional buyout, financial vendor, distressed), 3. Number respective value divided on region and 4. Composition of industries. In addition the paper contains several high level and interesting matrices, on how different aspects interrelate as LBO activity changes over time, that though are a bit less in line with what we are examining.

Firstly, we can easily see that LBOs without a financial sponsor barely have increased at all in comparison to deals with a financial sponsor. Even more, LBOs without a financial sponsor barely existed before 1994 and the only time there has been a greater increase in LBOs without financial sponsor was in conjunction with the crash around the year 2000. These findings rather straight forwardly strengthens our arguments around how important the credit supply, i.e. the credit market, is for buyout behavior (Strömberg, 2007). Secondly, when dividing the deals over time on type of transaction, Strömberg's (2007) findings show how private-to-private deals quantity wise by far is the main type of LBO transaction, only temporarily being surpassed by divisional deals during 2001-2005. Drawing a conclusion from the composition of deal types based on deal value is obstructed by not having all the information in the private-to-private deals.

When looking at how the number and value of LBOs subdivide over geographic regions, it is clear that the United States has been the by far major market for leveraged buyout transactions over the years, even though its market share has diminished sharply, mostly to the benefit of the United Kingdom. The regions United States, Continental Europe, and United Kingdom have over the whole period combined had 45.1+21.6+18.8=85.5% of the LBO market. By adding the regions Canada and Scandinavia we cover a further 2.2+4.5=6.7% of the transactions. Since we this way know that we cover 92.2% of the worlds leveraged buyout transactions during 1970-2007 by just looking at the geographic regions of North America and Western Europe, we have chosen to put the other regions aside in our thesis since we believe those small regions with diverse circumstances would cause disturbance in our future analysis (Strömberg, 2007).

Lastly, and most in line with the core focus of our thesis, Strömberg (2007) constructs a descriptive table over the composition of LBO transactions in 38 industries, and how this composition has changed between the three intervals 1970-1989, 1990-1999 and 2000-2007. The most prominent change is that the retail industry has decreased in market share by 8.1 percentage points to constitute 6.3% of all LBOs. Apart from this, the biggest changes in market share was in the Software and internet industry as well as the Hotels, Resorts and Cruise Lines industry who both increased by 3.1 percentage points to market shares of 5.9% and 5.2% respectively.

Since Strömberg (2007) generally ties his points of study to a timeline and investigates how certain aspects change over time, there is contributions for us to make by examining similar aspects but investigating how they are linked to the credit spread to see if the changes Strömberg identifies can be partly explained by the transmutable credit market.

2.3 Valuation

An outward shift in the supply curve of credit, whether it's originated by securitization vehicles or other factors, drive up the quantities but lead to lower prices (Shivdasani and Wang, 2009). Kaplan and Stein (1993) show how the fuelling of the credit market by junk bonds in the late 1980s induced higher LBO transaction prices. Also, Bernstein et al. (2010) argue that there is a strong correlation between the use of leverage and higher valuation levels. The LBO activity before 2007 didn't only shock the amount of deals in the Mergers and Acquisitions market, it also drove up the prices and purchase price multiples. A willingness to pay higher prices for target companies could be derived from high levels of Private Equity commitments (CGFS 2008). However, during these inflated prices, strategic buyers are not able to compete with deep-pocketed private investors (Rudnick, 2007).

Accordingly to the industry effect hypothesis we've previously discussed, LBO transactions are more likely to take place in some industries rather than others. If we take it that an industry effect does exist, the market would have recognized the industries in which LBOs have been taking place and embedded this aspect in the share price of each firm in this industry due to the value increasing effect LBO existence has. Now picture such an attractive industry that has not yet contained a leveraged buyout. It is first when a LBO takes place in this industry and provides verification of an expected industry effect that its stock prices will react. Since it is well established that target firms in general earn positive excess returns in takeovers, all companies in this industry are expected to get a positive share price reaction (Ambrose and Winters, 1992). Marais, Schipper and Smith (1989) measured price reactions for public securities at the announcements of buyout proposals, and there was only one class of securities that did not gain on average; nonconvertible debt.

2.4 Performance

One reason for bringing up performance is that if there is an industry effect, the performance could be a way of confirming that it in fact was a successful investment strategy. Bernstein et al. (2010) investigate if the aggregate growth and cyclicality in an industry is affected by PE investments. Utterly, the authors focus on the measures of productivity, employment and capital formation. When it comes to their productivity and employment measures they find that PE investments are associated with faster growth. They also find that industries where PE funds have been active in the past five years grow more rapidly than other sectors for all the measures of total production, value added, total wages and employment. A further finding is that for industries with LBOs taking place within, there is no significant difference in growth depending on the extent of LBO activity. The authors hold the risk of reverse causality, i.e. that it is the growth that drives the LBO activity and not the other way around, as unlikely. One risk with the greater growth though would be if this comes with greater cyclicality, creating a larger risk for investors and stakeholders than the original risk. As they examine this though, little evidence could be found to support this. Kaplan (1989) presents evidence on that in three years after a transaction, operating income, cash flow and market value all increase.

There has long been a hypothesis regarding that Private Equity can improve companies through their operations. The main contributions PE-firms bring to the table are to limit the free cash flow through the debt structure and to closely monitor managers. However, Jensen (1989) proposes a theory about a leveraged buyout not only affecting the specific firm, but also raising the competitive pressure and simultaneously forcing all firms in the industry to improve their operations. John et al. (1992) shows evidence on that the threat of a takeover serves as a spur for the rest of the industry to voluntarily perform company restructurings. Jensen (1989) makes an attempt to explain the fact that firms perform better after a LBO by pointing at the high levels of debt that exist, forcing the firm to respond quicker and more thoroughly to negative periods for their company.

Going through with a transaction at a market peak is seldom a good idea. During 1986-1988, 38% of the 66 largest LBO deals experienced financial distress (Bernstein et al., 2010). Kaplan and Schoar (2005) among others display evidence supporting that performance of funds is negatively correlated with capital inflows into the same funds. A fact that might be opposing one's expectations is that activity in industries with an abundance of LBO transactions is not more volatile when it comes to industry cycles, but on the contrary even sometimes less volatile, especially concerning total wages and employment. To continue on the bright side for PE, the structural differences between other types of financial institutions and PE funds make the ladder less vulnerable to industry shocks. Since PE-funds normally are locked for 5-10 years with their limited partners as only claimants, they escape the hassle of short term holders simultaneously demanding their money back (Bernstein et al., 2010).

2.5 Takings from previous research

As the previous research show, the Private Equity (i.e. leveraged buyout) industry is highly cyclical and sensitive to changes in the credit market through credit availability and the implied possible capital structures. Since the Private Equity market has developed and changed fundamentally over the years, since its growth rate looks close to exponential and since the world at this very moment is experiencing a major turmoil in the credit market, we believe it is a highly current and valuable topic to discuss the credit market's implications on buyout behavior. Given what we have presented above, our predictions going forward are that we will be able to identify some specific industries that host an "overabundance" of LBO activity as the credit spread turns notably small or large. An underlying reason for a correlation like this would be that since the credit spread implies what credit structures are possible, some specific industries are particularly suitable with regards to volatility etc. To be more precise, we intuitively predict the higher valued industries to be more sensitive to changes in the credit market and that these industries would host a relatively high LBO activity during low levels of credit spread.

3. Data

In this section we present the dataset that is analyzed, specify the variables we have chosen and present some descriptive statistics.[1]

3.1 Dataset description

3.1.1 Deal data

The core data consists of all deals in the Capital IQ (CIQ) database that are classified as LBOs, MBOs, going private, recapitalization or similar combinations of deal types indicating a buyout transaction, up to October 2009. We limit the data to deals from January 1986, since there are few deals before that. The date of announcement is used as basis for determining which year a deal occurred. The month of the announcement date is used to allocate each deal to a year-quarter. Deals that according to classification have been cancelled are excluded. We also remove duplicate deals that have been registered twice or more (this can be the case when more than two parties are involved in the transaction).

Using the headquarter country of the target firm in the CIQ we classify all deals into one of 11 regions. We narrow the data down to only including deals in Western Europe and Northern America since they account for over 90% of the number of deals in the sample and the other regions would risk being noise in the analysis.

Based on the CIQ information on the target company's primary industry we create a translation table from CIQ industries to Fama-French (FF) industries and assign a FF industry to each deal. (See appendix for a list of the FF industries)

3.1.2 Industry median data

We construct the variable FF industry-region-year-month and match the deal data with median data on EV/EBITDA trading multiples for traded companies in the same FF industry-region-year-month. Any multiple based on fewer than 5 observations is set as missing. We also use the average EV/EBITDA multiple between the two regions and over the months of a year to construct the average multiples for each combination of FF-industry-year. We use the entry "Net_EV_to_EBITDA_b" where the "_b" means that the average EBITDA of the preceding and of the actual year has been used. The data on multiples are available up until June 2008 (which we base estimates for 2008 on) while 2009 is omitted for regression or

[1] Thanks to Per Strömberg for providing us with the raw data.

analyses including the valuation data. The industry data comes from the databases Compustat North America and Compustat Global.

3.1.3 Interest rate data

By year-month we introduce the US LIBOR rate and the yield of the Merrill Lynch high yield master II interest index and calculate the difference between these rates to get the high yield credit spread (henceforth called the *credit spread*). The data is retrieved from Thomson DataStream and BOFA/Merrill Lynch[2] for the high yields and from British Bankers 'Association for LIBOR.

3.2 Variables

3.2.1 Dependent variables

To perform the analyses on how private equity activity, generally, and across different industries varies with our independent variables we define the following dependent variables.

In the variables the following subscripts are used,

t, is the time either year or year-quarter depending on the regression

N, is the number of industries

i, is the FF industry

s, is an industry's share of the total number/value of deals for the period

me, stands for multiple expansion

n, is the number of years after the deal

region, is either Northern America or Western Europe

For each year 1986-2009 (where 2009 activity is annualized by multiplying number of deals and dollars of deals with 12/10 for comparability) and for each quarter, we compute the % change in number of deals as a measure of how overall PE activity changes.

$$\%\, change\ \#Deals_t = \frac{\#\ Deals_t}{\#\ Deals_{t-1}}$$

[2] http://www.mlindex.ml.com

$$\% \ change \ \$ \ Deals_t = \frac{\$ \ Deals_t}{\$ \ Deals_{t-1}}$$

To measure the concentration of deals across industries we compute a Herfindahl index. The index is calculated both on the basis of an industry's share of the number of deals and on the basis of total transaction value of deals.

$$HI_t^{\$/\#} = \sum_{i=1}^{N} s_i^2$$

where,

$$s_i = \frac{\#/\$ \ deals_{t,i}}{\#/\$ \ deals_t}$$

Next, as a measure of how PE activity in an industry changes we compute the percentage change in number of deals and dollar value of deals between two periods for each industry separately.

$$\% \ change \ \#Deals_{t,i} = \frac{\# \ Deals_{t,i}}{\# \ Deals_{t-1\,,i}}$$

$$\% \ change \ \$ \ Deals_{t,i} = \frac{\sum \$ \ Deals_{t,i}}{\sum \$ \ Deals_{t-1\,,i}}$$

We create a measure for the change in PE activity relative the total PE activity without accounting for the trend in overall PE activity. The variables are defined by the difference between an industry's shares of the total number of deals and dollar value of deals in two consecutive periods.

$$\Delta \ Share \ of \ deals_{t,i} = \frac{\# \ Deals_{t,i}}{\# \ Deals_t} - \frac{\# \ Deals_{t-1,i}}{\# \ Deals_{t-1}}$$

$$\Delta \ \$ \ Share \ of \ deals_{t,i} = \frac{\sum \$ \ Deals_{t,i}}{\sum \$ \ Deals_t} - \frac{\sum \$ \ Deals_{t-1,i}}{\sum \$ \ Deals_{t-1}}$$

To further understand how the timing aspect of choosing targets in different industries when the credit market conditions change we look at how the industries' multiples develop after the deal. We construct a multiple expansion return based on 1, 3 and 5 year horizons defined as per below. The measure is computed for each deal as the year-month-region multiple of the deal's industry 1, 3, or 5 years after the deal divided by the corresponding multiple at the time of the deal.

$$r_{me,n} = \frac{(\frac{EV}{EBITDA})_{t+n,i,region}}{(\frac{EV}{EBITDA})_{t,i,region}} - 1$$

A benchmark return for each year is constructed as the equally-weighted average multiple across all industries in the year 1, 3 and or 5 year after the year of the deal divided by the average multiple the year of the deal.

$$r_{me,benchmark,n} = \frac{(\frac{EV}{EBITDA})_{t+n}}{(\frac{EV}{EBITDA})_{t}} - 1$$

The excess return from multiple expansion of a deal is then computed as the difference between the return from multiple expansion and the benchmark return of average multiple expansion during the period.

$$ER_{me,n} = r_{me,n} - r_{me,benchmark,n}$$

Multiples based on fewer than 5 observations have been set as missing and multiples higher than 20 or less than 1 have been set as missing to exclude extreme values.

3.2.2 Independent variables

As independent variables we want to use measures that capture the state of the credit market as well as the relative valuation of an industry to understand if the deal is a relatively "expensive" of "cheap" industry.

Since LBO transactions typically are highly levered they depend on financing from high yield loans. Therefore we use the high yield spread between the "BOFA Merrill Lynch US high yield master ii index” and the LIBOR rate as an estimate of the credit markets state. The credit spread will of course correlate with other factors that influence buyout activity, e.g. stage in an economic/business cycle. We compute the average credit spread on yearly and quarterly basis.

$$CS_t = BOFA\ ML\ high\ yield\ index_t - Libor_t$$

We compute the change in credit spread between two periods which is used as independent variable in some of the regression.

$$\Delta\, CS_t = Credit\ spread_t - Credit\ spread_{t-1}$$

To measure how the median valuation of companies in an industry compares to the overall valuation in the region during the period of the deal we construct a measure of relative multiple valuation as per below. If multiples were smaller than 1, they have been set equal to one and if they were larger than 20, they have been set equal to 20 to avoid getting extreme values. The multiple has been set as missing if it is based on fewer than 5 companies.

$$RM_{t,i} = \frac{EV/EBITDA_{t,i,region}}{\overline{EV/EBITDA}_{t,region}}$$

3.3 Descriptive statistics

In table 1 below we present summary statistics for the different data categories and variables defined. When performing the analyses by transaction value it should be noted that this data is only available for less than half of the deals.

In the graph 1 and 2 we present the number of deals and aggregated dollar value of deals respectively for Northern America and Western Europe. We see that the distribution in terms of number of deals in close to even while Northern America has a much larger (85% of total transaction value) total transaction value of deals.

In graph 3 and 4 we show the number of deals and transaction value of deals for each year. It is clear that both the number of deals and aggregated value of deals increase over the period. This trend is expected since, as described previously, the PE industry has grown tremendously. A factor that might contribute to and overstate the trend, and hence disturb the results, is if the number of deals actually registered in the CIQ database has increased over time. To try and overcome this potential problem we run several of our regression, not only for the entire sample period, but also for the sub periods with starting years 1997 and 2002

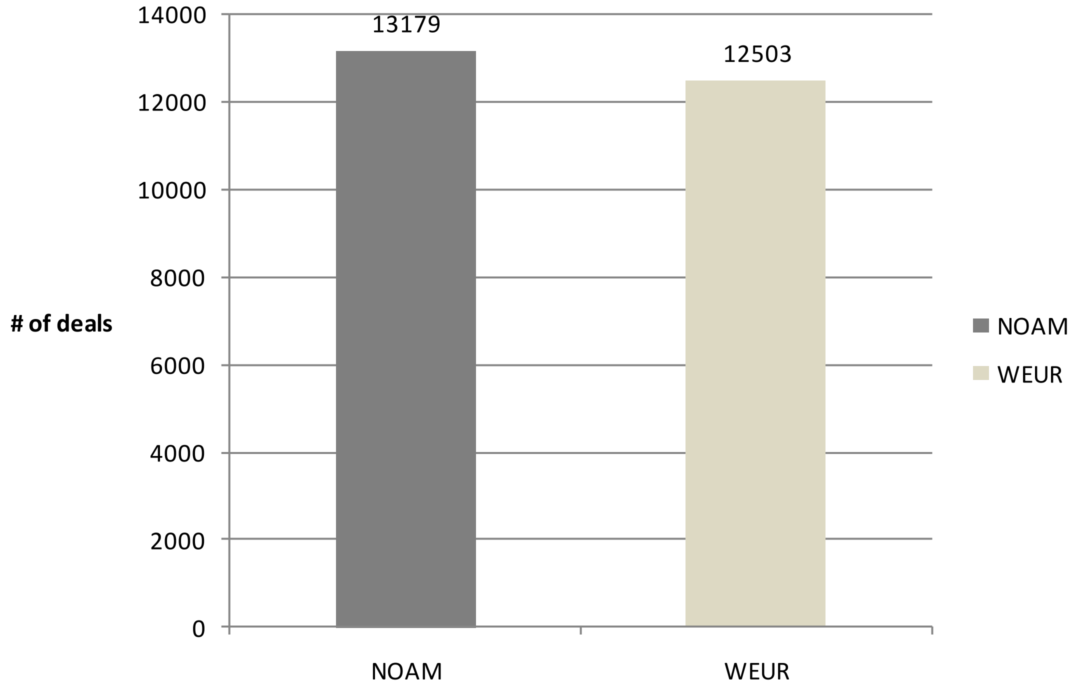
Graph 5 and 6 show the number of deals and transaction value of deals by FF industry. In Graph 6 the number of deals for which transaction value was available can be seen from the secondary axis. We can see that there are large differences between the different industries. A weakness of the distribution across industries might come from a rough industry classification in the CIQ database where 167 unique industries were represented. Additional roughness in the industry distribution might come from the choices we had to make when translating the CIQ industries into one of the 49 FF industries.

Table 1: Summary statistics

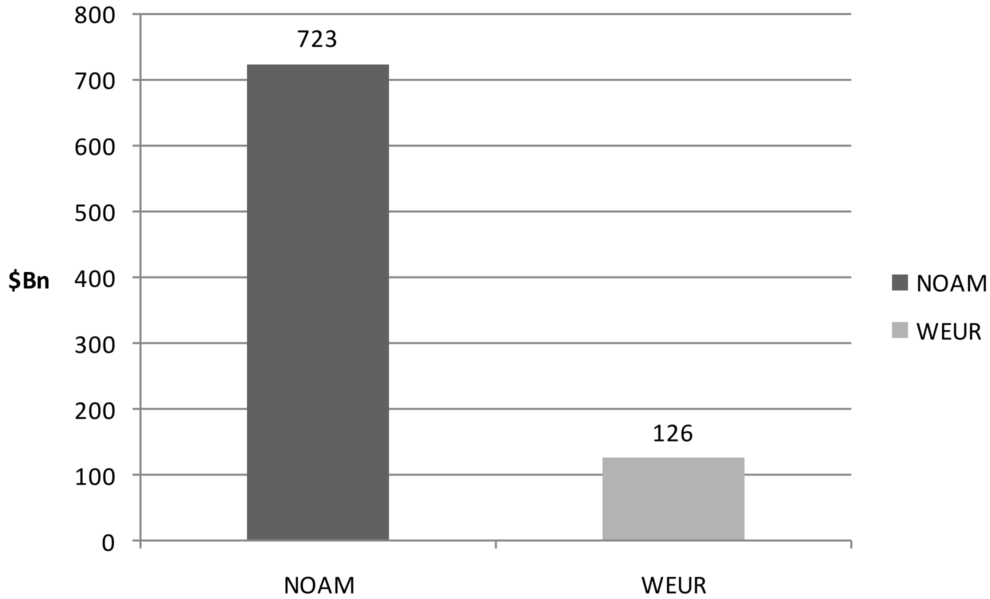
Summary of data								
Data category	Number of oberservations	Missing values	Mean	Min	25th %ile	median	75th %ile	Max
Deals	25682	0	-	-	-	-	-	-
Industry	24182	1500	-	-	-	-	-	-
Transaction value	11857	13825	$257 m	$0,06 m	$8,4 m	$37 m	$150 m	$45237 m
Year	25682	0	-	-	-	-	-	-
Region	25682	0	-	-	-	-	-	-
EV/EBITDA	16907	8775	13,4	5,3	10,5	12,2	14,4	116,9
Credit spread (year-month)	285	1	6,4%	2,2%	4,5%	5,7%	8,0%	20,0%
Reative valuation multiple	1124	2	0,94	0,32	0,77	0,87	1,06	1,98
Herfindahl index (by # deals)	24	0	0,046	0,039	0,041	0,045	0,047	0,072
Herfindahl index (by $ deals)	24	0	0,109	0,051	0,058	0,083	0,130	0,351
% change # dollar (yearly)	23	0	1,154	0,685	1,050	1,111	1,374	1,549
% change $ deals (yearly)	23	0	1,258	0,228	0,683	1,061	1,521	5,673
% change # dollar (yearly by industry)	841	286	1,299	0	0,778	1,130	1,560	9,00
% change $ deals (yearly by industry)	666	461	5,52	0	0,154	0,723	2,385	389,0
% share of # deals (by industry)	1127	0,0%	1,9%	0,0%	0,2%	1,1%	2,7%	17,8%
% share of $ deals (by industry)	1127	0,0%	2,0%	0,0%	0,0%	0,4%	2,4%	57,5%
r(me) 1 year	13887	7591	1,0%	-24,5%	-10,1%	6,0%	7,2%	31,7%
r(me) 3 years	9724	5739	41,1%	-30,3%	-3,1%	7,8%	20,5%	44,3%
r(me) 5 years	6863	4603	6,2%	-21,3%	-7,7%	11,6%	21,7%	46,0%
excess return 1 year	13887	7591	0,5%	-81,1%	-12,3%	-0,6%	12,9%	147,0%
excess return 3 years	9724	5739	3,5%	-91,5%	-13,1%	2,8%	19,8%	166,0%
excess return 5 years	6863	4603	5,9%	-88,7%	-12,7%	4,3%	22,7%	191,0%

Note: The table show summary statistics for the data used throughout the thesis. The % changes are expressed as the multiplication factor of change and not actual percentage change, see the definition in the data section.

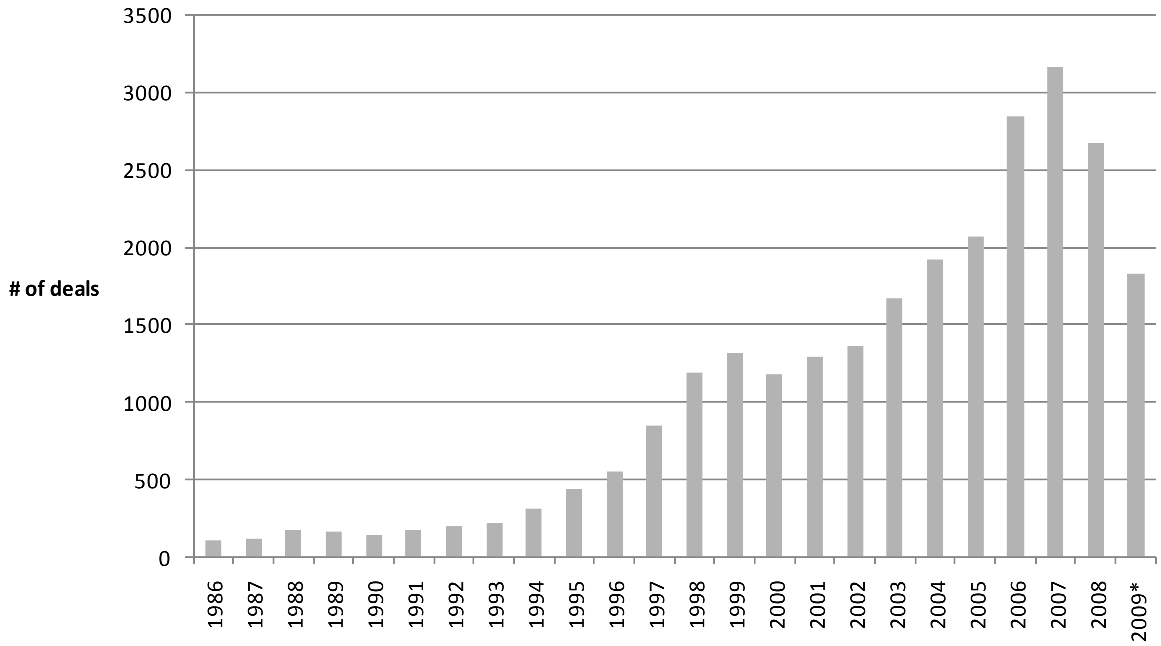
Graph 1: Number of deals by region



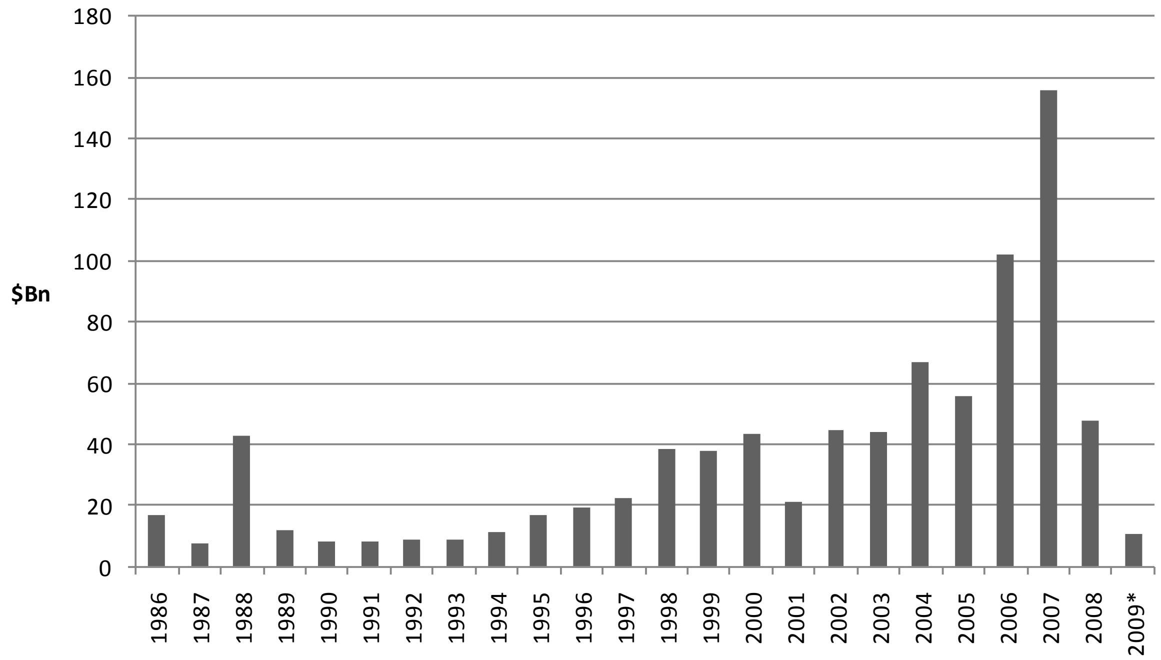
Graph 2: Dollar value of deals by region



Graph 3: Number of deals by year

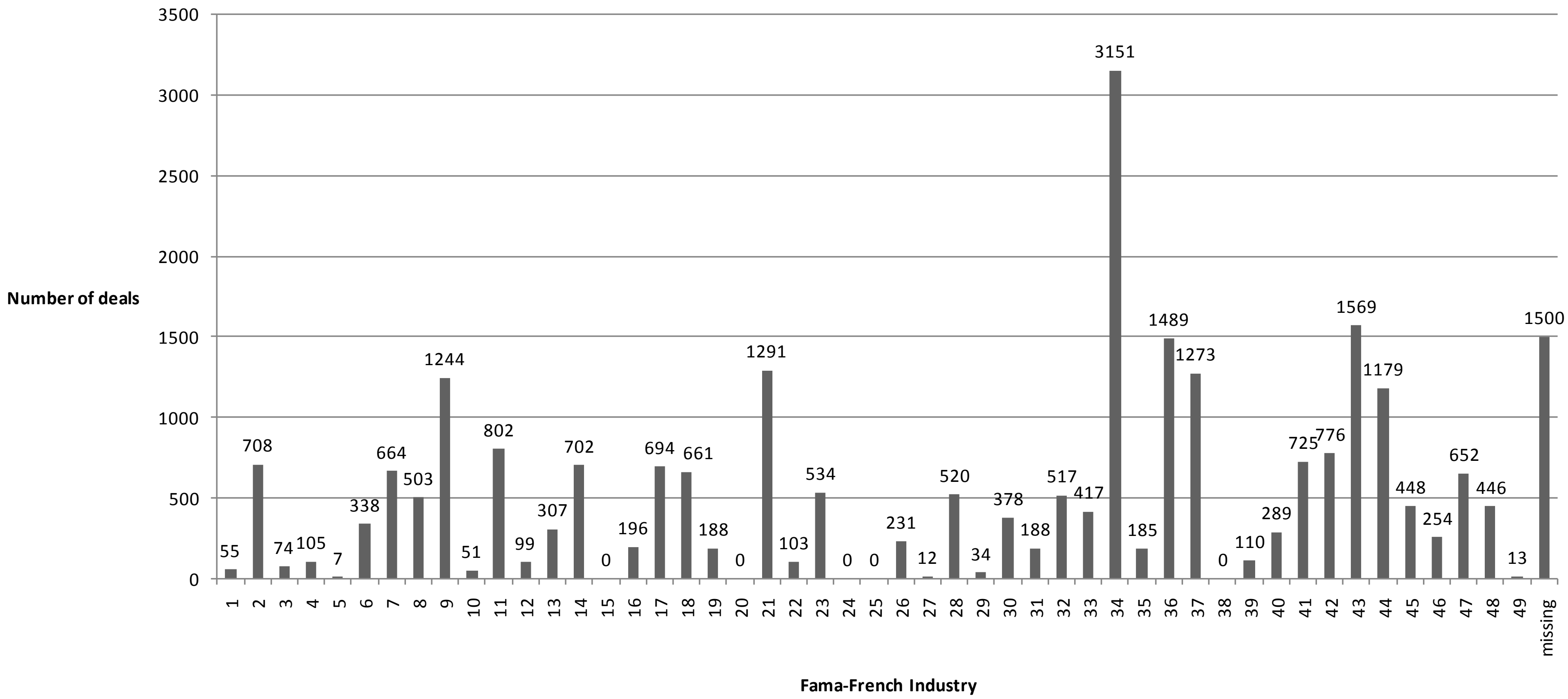


Graph 4: Total value of deals by year

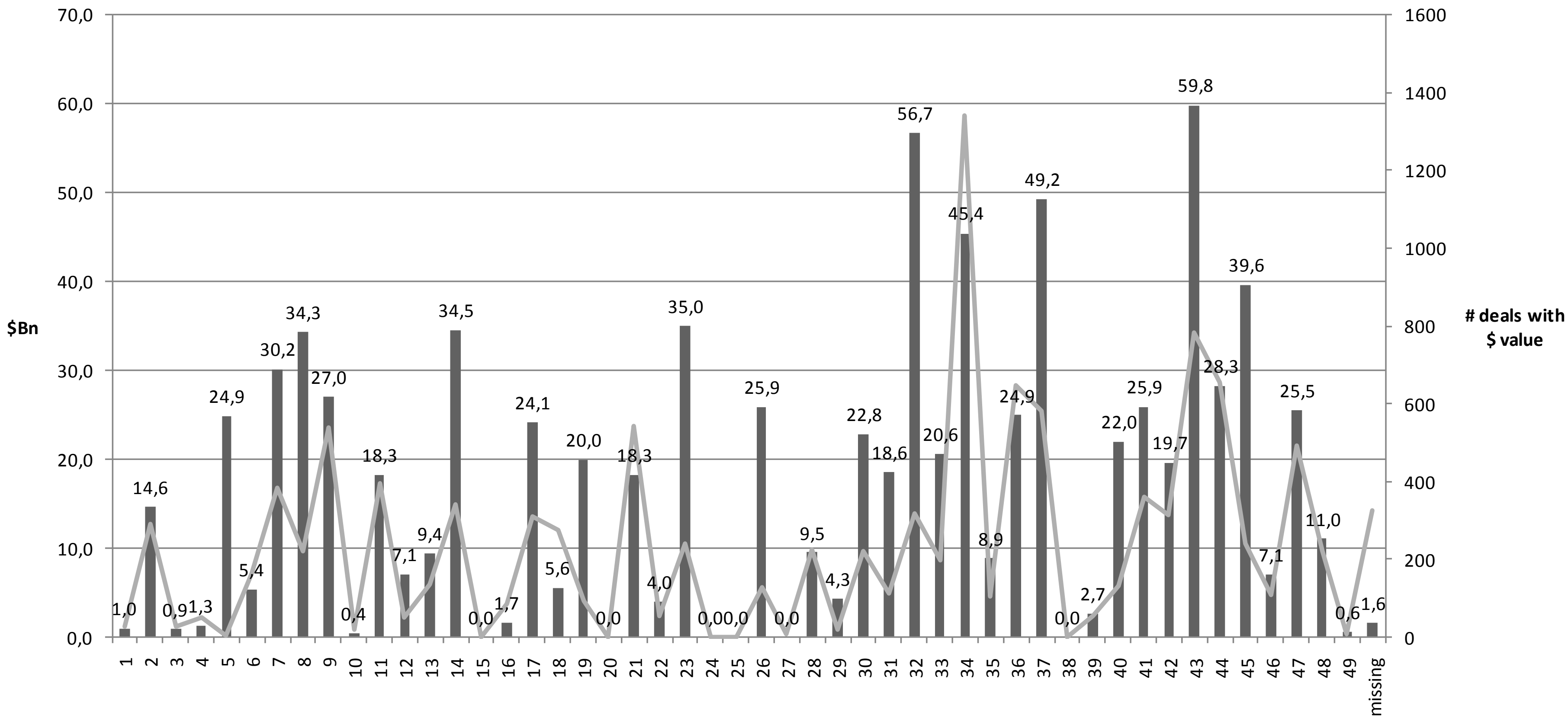


*The value for 2009 have been inflated by 12/10 to annualize the data from January-October

Graph 5: Number of deals by industry



Graph 6: Total value of deals by industry



4. Method

We develop a method to understand how private equity activity, on aggregate, and by industry, is affected by changes in the state of the credit market and which role the relative valuation plays for PE activity. We also investigate if PE firms are able to invest in industries where valuations increase over the coming year(s). The analyses are performed with number of deals and dollar value as basis for evaluating PE activity separately. Below we specify the hypotheses and regressions used to analyze these areas.

4.1 Private Equity activity

Given that prior research on Private Equity has focused on demand side firm characteristics such as taxes and corporate governance while less has been written on the supply side factors determining investment choices (Wang, 2008) we want to look at whether Private Equity activity is affected by changes in the credit markets and how the relative valuation of industries contribute to explain changes in activity. We do this by analyzing the Private Equity deals in our sample on aggregate but also on industry level. One of the central ideas underlying our hypotheses presented below is that of a highly cyclical Private Equity market where the cost of debt (or as we use, the credit spread) plays an important role in driving the market, and determines levels of leverage which in turn affect the valuation of deals. (Axelson et al., 2010)

In our regressions we will test the hypothesis using both number of deals and total dollar transaction value of deals as the basis for measuring PE activity. It should be noted again that out of the 25,682 deals 11,857 have information on transaction value and hence the analyses by transaction value will be based on this, smaller, sample of deals.

4.1.1 Overall activity

The first regressions we run investigates if the change in PE activity in the economy is explained by changes in the credit spread.

Hypothesis 1: Increases (decreases) in the credit spread are associated with decreasing (increasing) PE activity, i.e. $\beta_1 < 0$

$$(1) \quad \%\,change\ \#\,Deals_t = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times T_t + \varepsilon_t$$

$$(2) \quad \%\,change\ \$\,Deals_t = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times T_t + \varepsilon_t$$

We run the regressions on yearly level from 1986-2009, 1997-2009 and from 2002-2009 and on year-quarterly level between 1997-Q3 2009 and 2002- Q3 2009, periods during which there is more data and hence the analysis can be done on quarterly level. For the year 2009 we only have data up until October 2009 so we multiply the number/dollar of deals by 12/10 to be able to compare with other years. T takes the value of the year or the year-quarter in the corresponding regressions to capture trends in the data over time.

4.1.2 Industry concentration

We proceed to measure how the concentration of deals across industries varies with the credit spread.

Based on the idea that when the credit spread increases it is a sign of decreased or stricter lending as well as increasing cost of borrowing, PE firms will have a more difficult time buying some, high multiple, industries - our hypothesis is that if the credit spread increases we would see an increased concentration of the activity across target industries.

Hypothesis 2: Increases (decreases) in the credit spread increases (decreases) the Herfindahl index, i.e. $\beta_1 > 0$

$$(3) \quad HI_t^{\#} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times T_t + \varepsilon_t$$

$$(4) \quad HI_t^{\$} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times T_t + \varepsilon_t$$

We perform this analysis on year level for 1986-2009, 1997-2009 and 2002-2009. As in the previous regression T takes on the value of the year to account for trends over time in the Herfindahl index. The symbols # and $ indicate that the Herfindahl index has been constructed using number of deals and total transaction value of deals by industry respectively.

4.1.3 Activity by industry - change within an industry

We now proceed to perform analyses by industry to see which impact changes in the credit spread and the relative valuation of an industry have on PE activity in that industry. Based on the cyclicality of the Private Equity market and its dependence on debt financing we would expect increases in the credit spread to constrain the PE activity in an industry. If an industry is relatively highly valuated we would expect lower PE activity. Since more debt financing would be needed to buy highly valuated industries, given an average leverage ratio, we expect changes in the product of change in credit spread and the relative valuation multiple to be negatively associated with PE activity in an industry. The presence of a significant pattern would lend support for the idea of a credit driven industry effect.

Hypothesis 3a: Increases (decreases) in credit spread lead to decreases (increases) the PE activity in an industry, i.e. $\beta_1 < 0$

Hypothesis 3b: Increases (decreases) in the valuation of an industry relative to the average valuation decreases (increases) the PE activity in an industry, i.e. $\beta_2 < 0$

Hypothesis 3c: Increases (decreases) in the interaction between the credit spread and an industry's relative valuation decreases (increases) PE activity in that industry, i.e. $\beta_3 < 0$

(5) $$\%\, change\ \#\ Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

(6) $$\%\, change\ \$\ Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

We perform this regressions first for all observations from 1986-2008, 1997-2008, and 2002-2009, and then for each industry separately for the period 1986-2009.

4.1.4 Activity by industry – share of total activity

To look at the difference in PE activity in an industry relative to overall PE activity we perform a regression with a similar set-up as above in equation (3) but where the dependent variable is the difference between an industry's share of the total number of deals over two consecutive periods.

The regression estimates how an industry's share of the total PE activity depends on the credit spread, the relative valuation of the industry, and the interaction between the spread and the relative valuation.

Hypothesis 4a: Increases (decreases) in the credit spread lead to decreases (increases) in relative PE activity in an industry, i.e. $\beta_1 < 0$

Hypothesis 4b: Higher (lower) relative valuation of an industry is associated with decreased (increased) relative PE activity, i.e. $\beta_2 < 0$

Hypothesis 4c: Increases (decreases) in the interaction between the credit spread and an industry's relative valuation decreases (increases) relative PE activity, i.e. $\beta_3 < 0$

$$(7) \quad \Delta\, Share\ of\ deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

$$(8) \quad \Delta\, \$\, Share\ of\ deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

We run these regressions by year for each industry separately for the period 1986-2008.

4.2 Return from multiple expansion

The increased use of leverage, which we assume is negatively correlated with the credit spread, is argued to be associated with lower returns (Axelson, et al. 2009). We want to test if this result holds for returns from multiple expansion on industry level. There is also a possibility that PE companies try to time the market and buy companies that they expect to increase in value. This would then lead to excess returns from multiple expansion. Shein et al. (2009) describe doubts about the causality in a presumption like this; is it Private Equity firms that enter industries with expectations of increased valuation or does the valuation increase as a function of PE activity?

To understand how the timing aspect of choosing targets in different industries when the credit market conditions change we analyze how the industries' median multiples develop after the deal. We construct a multiple expansion return based on 1, 3 and 5 year horizons as defined in the data section.

If PE activity goes through periods of booms and busts that are, in part, driven by the credit market we would expect that during periods of high credit spread, when financing is more difficult to find as well as more expensive, industries with good prospects for increasing valuations would be picked with higher precision and we would see a positive excess return from multiple expansion over the years to come. During periods of low credit spread, booms, we would expect excess returns to be lower.

Hypothesis 5a: Higher (lower) credit spreads is associated with higher (lower) multiple expansion returns, i.e. $\beta_1 < 0$

Hypothesis 5b: Higher (lower) relative valuation is associated with lower (higher) multiple expansion returns, i.e. $\beta_2 < 0$

(9) $$ER_{me,t,n} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times RM_{t,i} + \varepsilon_{t,i}$$

If private equity firms have the ability to time the market and buy industries where they expect the valuation multiples to increase they could get an excess return from multiple expansion larger than zero. We look at the excess returns from multiple expansion over the entire sample by industry to see if the returns are significantly larger or smaller than zero.

Hypothesis 6: Equally weighted excess returns from multiple expansion on industry level are positive

The t-test is performed for 1, 3 and 5 year horizons for the total sample.

5. Results and analysis

In this section we present the results from the regressions and tests described in the methodology and interpret and analyze the results in relation to the hypotheses. In the appendix a table summarizes the results in terms of support or lack of support for the different hypotheses.

5.1 Private Equity activity

5.1.1 Overall activity

When testing how sensitive the Private Equity activity is to changes in the credit spread we find in table 1 that hypothesis 1 is supported by statistically significant negative coefficients for the credit spread over each of the periods analyzed. Hence, changes in credit spread are negatively associated with the development of number of deals.

Table 2: Regression 1, by year

$$\% \text{ change } \# \, Deals_t = \alpha_0 + \beta_1 \times \Delta \, CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period					
	1986-2009		1997-2009		2002-2009	
Variable	**coef**	**se**	**coef**	**se**	**coef**	**se**
Δ CS	-5,297***	1,839	-4,228**	1,845	-4,388**	2,048
Year	-0,005	0,006	-0,027**	0,013	-0,016	0,028
α	11,489	12,331	55,433**	26,132	32,991	56,949
# Observations	23		13		8	
R-squared	0,349		0,570		0,656	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals from which the percentage change in number of deals between years have been calculated. The indepedent variables used is the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate. A variable equal to the year is included to absorb any potential trend in the data.

When performing the analysis on quarterly basis the coefficients are negative and statistically significant on the 10% level for both sub periods. This adds support to hypothesis 1. We also try to perform the regression on monthly level but these results lack statistical significance, which might be explained by a too small number of deals by month to establish a reliable pattern but also from the fact that a month might be a too short period for changes in credit spread to affect the PE market since the investment process of a buyout can be quite lengthy.

Table 3: Regression 1, by quarter

$$\%\ change\ \#\ Deals_t = \alpha_0 + \beta_1 \times \Delta\ CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period			
	1997-2009		2002-2009	
Variable	coef	se	coef	se
Δ CS	-2,037*	1,148	-2,286*	1,210
Year-quarter	0,030*	0,017	0,045**	0,022
α	0,963***	0,046	0,912***	0,059
# Observations	50		31	
R-squared	0,0944		0,182	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals from which the percentage change in number of deals between quarters have been calculated. The inpedent variables used is the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate. A variable equal to the year-quarter is included to absorb any potential trend in the data.

Looking at the regression results on % change in dollars in table 4 we see that changes in the credit spread are negatively related with the change in PE activity, but the negative coefficients for the change in credit spread in the regression is only significant for the sub period 1997-2009.

The same results hold for the regression on quarterly basis, presented in table 5, where the coefficients for the change in credit spread are negative but only significant for the sub period 1997-2009.

Summing up the results from regression on how changes in credit spread affect PE activity we find general support for hypothesis 1, with stronger statistical significance evaluating PE activity by number of deals than by dollar value of deals.

Table 4: Regression 2, by year

$$\%\ change\ \$\ Deals_t = \alpha_0 + \beta_1 \times \Delta\ CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period					
	1986-2009		1997-2009		2002-2009	
Variable	coef	se	coef	se	coef	se
Δ CS	-9,548	10,535	-11,273**	5,730	-4,813	8,195
Year	-0,026	0,035	-0,024	0,041	-0,148	0,114
α	53,440	70,654	48,951	81,146	298,455	227,926
# Observations	23		13		8	
R-squared	0,0817		0,345		0,470	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. Using these deals we compute the percentage change in dollar value of deals between years, which is the dependent variable in the regression. The indepedent variable used is the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate. A variable equal to the year is included to absorb any potential trend in the data.

Table 5: Regression 2, by quarter

$$\%\ change\ \$\ Deals_t = \alpha_0 + \beta_1 \times \Delta\ CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period			
	1997-2009		2002-2009	
Variable	coef	se	coef	se
Δ CS	-12,677**	6,148	-12,745	7,805
Year-quarter	0,001	0,003	0,004	0,007
α	-26,986	55,978	-79,278	141,229
# Observations	50		31	
R-squared	0,0863		0,890	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. Using these deals we compute the percentage change in dollar value of deals between quarters, which is the dependent variable in the regression. The indepedent variable used is the average credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate during the quarter. A variable equal to the year-quarter is included to absorb any potential trend in the data.

5.1.2 Industry concentration

In table 6 we see the results of the regression for the credit spread on the industry concentration based on number of deals, measured by a Herfindahl index. The coefficients for the credit spread are negative, in contradiction to our hypothesis but none of the periods exhibit a coefficient with statistical significance. Hence, we do not find support for hypothesis 2.

Table 6: Regression 3

$$HI_t^{\#} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period					
	1986-2009		1997-2009		2002-2009	
Variable	**coef**	**se**	**coef**	**se**	**coef**	**se**
Δ CS	-0,007	0,060	-0,022	0,026	-0,013	0,015
Year	-0,001**	0,000	0,000*	0,000	0,001***	0,000
α	1,098**	0,461	-0,823*	0,449	-2,037***	0,495
# Observations	24		13		8	
R-squared	0,212		0,273		0,781	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals. The deals are divided into Fama-French industries and the industry's share of total PE activity, based on number of deals, is calculated by year. From these shares a Herfindahlindex is calculated to measure the concentration of deal activity across industries, which is the dependent variable in the regression. As independent variable we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate. A variable equal to the year is included to absorb any potential trend in the data.

Looking at the credit spread's impact on the Herfindahl index by dollar weights of industries we see from table 7 that the coefficients are positive and for the sub periods, 1997-2009 and 2002-2009, statistically significant at the 10% level, which gives some support to hypothesis 2.

Hence, summarizing the results on industry concentration, we can say that they offer at best weak support for the hypothesis that the credit spread is positively associated with the industry concentration.

Table 7: Regression 4

$$HI_t^{\$} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times T_t + \varepsilon_t$$

	Period					
	1986-2009		1997-2009		2002-2009	
Variable	**coef**	**se**	**coef**	**se**	**coef**	**se**
Δ CS	0,761	0,511	0,589*	0,340	0,743*	0,449
Year	-0,004**	0,002	0,005	0,003	0,009	0,007
α	8,880**	3,917	-9,551	5,984	-17,831	14,529
# Observations	24		13		8	
R-squared	0,223		0,473		0,489	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. The deals are divided into Fama-French industries and the industry's share of total PE activity, based on dollar value of deals, is calculated by year. From these shares a Herfindahlindex is calculated to measure the concentration of deal activity across industries, which is the dependent variable in the regression. As independent variable we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate. A variable equal to the year is included to absorb any potential trend in the data.

5.1.3 Activity by industry – change within an industry

In table 8 we see the results for the regression analyzing the change in credit spread's -and relative valuation's effect on the percentage change in deals within an industry between years. The coefficients for the change in credit spread are negative for all periods investigated but only statistically significant for the entire sample period, 1986-2008. This supports H3a. Looking at the coefficients for the other variables the signs are mixed and none are statistically significant. Hence we lack support for H3b and H3c. We try a set up of the regression where the average relative multiple of an industry over all years is used to mitigate the potential problem of changes in relative valuation over time and try to capture if the industry, on average, has been an "expensive" or "cheap" industry relative to average valuation but this regression does not improve the statistical significance of the coefficients on relative valuation multiple or the interaction between valuation and changes in credit spread.

In table 9 we find the results for the regression performed on the data for each industry separately. Generally, the results are not statistically significant and different industries appear the react differently to changes in the credit spread or be affected differently by their relative valuation. FF industry 5, Tobacco products; 22, Electrical equipment; and 45, Banking, have statistically significant negative coefficients for the credit spread, supporting the hypothesis that changes in the credit spread has an effect on the development of Private Equity activity in these industries. The relative valuation of the industry has a statistically significant impact on the development of PE activity in FF-industries 3, Candy and Soda; 5, Tobacco products; 23, Automobiles and Trucks; and 39, Business Supplies. For the interaction between the changes in credit spread and the relative valuation multiple of the industry, two of the industries, 5, Tobacco products; and 22, Electrical equipment, have significant coefficients but in contrast to our hypothesis 3c the coefficients are positive.

The analyses by number of deals give some support to hypothesis 3a when looking at the overall changes within industries but very few individual industries exhibit statistically significant relationship between changes in credit spread and deal activity. The results do not offer support for hypotheses 3b and 3c.

Table 8: regression 5, all industries

$$\%\ change\ \#\ Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\ CS_t + \beta_2 \times\ RM_{t,i} + \beta_3 \times \Delta\ CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

	Period					
	1986-2008		1997-2008		2002-2008	
Variable	**coef**	**se**	**coef**	**se**	**coef**	**se**
Δ CS	-11,403**	5,753	-4,222	4,665	-4,202	4,551
RM	-0,091	0,133	0,102	0,132	-0,109	0,159
Δ CS x RM	5,587	5,750	-1,260	4,684	-0,704	4,521
α	1,396***	0,130	1,168***	0,126	1,337***	0,151
# Observations	840		493		291	
R-squared	0,0199		0,0393		0,0617	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals. The deals are divided into Fama-French industries and the industry's total PE activity, based on number of deals, is calculated by year. We compute the percentage change in number of deals by industry and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

Table 9: Regression 5, by industry

$$\% \, change \, \# \, Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta \, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta \, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

	Period													
	1986-2008													
Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.	Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.
FF1	9,058	0,952	-22,532	0,202	14	0.1509	FF26	-15,051	-0,109	6,986	1,462	21	0.0359
FF2	-52,187	-0,868	55,742	2,040**	22	0.0737	FF27	n/a	n/a	n/a	n/a	n/a	n/a
FF3	10,410	-3,434*	6,851	4,328***	16	0.2741	FF28	19,593	0,362	-32,896	1,082	22	0.0548
FF4	-5,664	3,779	-12,550	-1,836	18	0.1127	FF29	134,621	-1,579	-143,887	2,526	13	0.0876
FF5	-60,005*	1,413***	99,739**	-1,049***	5	0.9728	FF30	-24,169	1,184	8,519	0,364	21	0.1077
FF6	4,858	1,106	-20,576	0,469	22	0.1291	FF31	249,324	-0,820	-259,484	1,832	15	0.2090
FF7	-19,818	0,216	8,824	1,050	21	0.1477	FF32	-8,257	0,265	11,284	1,192	22	0.0046
FF8	-101,238	-0,857	120,573	2,375	22	0.0298	FF33	-48,973	-0,844	43,337	2,374	20	0.0167
FF9	11,111	2,221	-24,582	-0,478	22	0.2504	FF34	43,601	0,019	-54,677	1,155	22	0.1451
FF10	-94,814	3,882	51,541	-1,524	13	0.3241	FF35	-23,178	-1,307	14,869	2,891*	20	0.0733
FF11	-5,111	0,593	-2,835	0,728	21	0.0847	FF36	-53,796	-0,970	39,314	2,569**	22	0.1621
FF12	15,671	-2,151	-23,563	3,416*	19	0.0941	FF37	-3,055	-0,362	-3,024	1,550***	22	0.1321
FF13	53,099	3,578	-53,405	-3,020	18	0.1300	FF38	n/a	n/a	n/a	n/a	n/a	n/a
FF14	9,356	0,783	-17,721	0,672	22	0.0648	FF39	-62,326	-4,766*	72,630	4,907**	18	0.2206
FF15	n/a	n/a	n/a	n/a	n/a	n/a	FF40	77,620	3,195	-103,046	-0,970	19	0.1298
FF16	-44,526	-1,237	51,614	2,369*	22	0.0563	FF41	36,722	-1,350	-39,260	2,768***	22	0.1641
FF17	-17,199	1,030	11,459	0,527	22	0.2026	FF42	-18,721	2,499	18,655	-0,891	22	0.0566
FF18	-1,706	0,344	-3,120	1,009	22	0.0278	FF43	-29,890	1,133	28,402	0,261	22	0.2318
FF19	-36,216	-0,001	33,199	1,428	22	0.0465	FF44	32,352	-0,487	-54,641	1,809	22	0.0668
FF20	n/a	n/a	n/a	n/a	n/a	n/a	FF45	-88,188*	0,102	53,250	1,030	21	0.1421
FF21	-17,202	-0,198	15,850	1,372**	22	0.0573	FF46	-33,838	-0,495	27,354	2,065**	21	0.0877
FF22	-104,601*	-2,099	121,582*	2,670**	19	0.2191	FF47	-41,938	-0,114	44,452	1,387	17	0.1707
FF23	5,198	2,491**	-27,505	-0,627	22	0.2006	FF48	-11,207	-0,083	7,846	1,417**	22	0.0095
FF24	n/a	n/a	n/a	n/a	n/a	n/a	FF49	-10,046	-0,009	21,997	0,142	7	0.4448
FF25	n/a	n/a	n/a	n/a	n/a	n/a							

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients for the regression as well as number of observations and R-squared measure for the regression done on each Fama-French industry individually. The sample used consists of 25,682 Private Equity deals. The deals are divided into Fama-French industries and the industry's total PE activity, based on number of deals, is calculated by year. We compute the percentage change in value of deals by year for each industry and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

From table 10 we can see that the changes in credit spread do not significantly impact the change in dollar volume within industries and in contrast to our expectations the coefficients are positive. The relative valuation multiple coefficient is only statistically significant in the period 1997-2008 during which it is positive in contrast to hypothesis 3b. Looking at the interaction between the changes in credit spread and relative valuation multiple the coefficients are negative, in accordance with hypothesis 3c, for all periods but none are statistically significant even at the 10% level. These results do not support our hypotheses 3a, 3b, and 3c.

Table 10: Regression 6, all industries

$$\%\, change\ \$\ Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

	Period					
	1986-2008		1997-2008		2002-2008	
Variable	coef	se	coef	se	coef	se
Δ CS	16,832	177,734	205,218	188,596	224,864	269,704
RM	1,870	4,016	10,311**	5,118	14,746	9,055
Δ CS x RM	-105,745	175,690	-303,955	186,467	-319,491	263,476
α	3,938	3,948	-3,879	4,943	-6,663	8,754
# Observations	666		422		243	
R-squared	0,0059		0,0197		0,0204	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. The deals are divided into Fama-French industries and the industry's total PE activity, based on dollar value of deals, is calculated by year. We compute the percentage change in value of deals by industry and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

When we run the regression by industry we see from table 11 some of the results are statistically significant and the industries' development of deal volumes in dollars seem to react differently to changes in the credit spread and relative valuation. For example, we see that industries 1, Agriculture and 3, Candy and Soda, exhibit a positive relation between change in credit spread and changes in aggregated transaction value. Five industries show the expected relationship, where increases in credit spread are associated with decreases in aggregated deal value. Among the six industries with statistically significant coefficients for the relative multiple valuation variable, three have a positive coefficient and three a negative one. For the interaction between the change in credit spread and relative valuation multiple six coefficients are statistically significant among which two are negative, while four are positive. The patterns of our results do not support our hypotheses 3a, 3b, and 3c. Even though we do not find support for our hypotheses, these results do not necessarily reject the idea that the PE activity of some industries are closely tied to the state of the credit market and the valuation of an industry. A weaker form of industry effect driven by these factors might exist in some industries.

Summarizing the results on PE activity changes within an industry we interpret the results as offering limited support for hypothesis 3a while the results generally do not support hypothesis 3b and 3c.

Table 11: Regression 6, by industry

$$\%\,change\ \$\ Deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

Period
1986-2008

Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.	Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.
FF1	271,708***	0,080	-257,752***	0,085	6	0,960	**FF26**	796,383	-10,617	-835,675	13,491	19	0,083
FF2	-253,158	-7,727	238,920	10,325	22	0,032	**FF27**	n/a	n/a	n/a	n/a	n/a	n/a
FF3	747,129***	11,042***	-540,064***	-9,657***	6	0,975	**FF28**	-272,620	-5,280	245,657	8,444	19	0,096
FF4	-443,285***	-27,946***	511,267***	22,670***	9	0,957	**FF29**	407,859	-6,002	-598,121	6,620	8	0,237
FF5	n/a	n/a	n/a	n/a	n/a	n/a	**FF30**	7,350	2,646	-37,997	-0,291	15	0,028
FF6	-186,750**	-3,013	224,862**	3,853*	18	0,242	**FF31**	237,897	-2,798	-268,731	5,074	7	0,143
FF7	-561,784	-52,671	655,909	50,067	18	0,146	**FF32**	17,547	-2,343	-54,728	5,492	18	0,013
FF8	-398,880	9,311	517,604	-6,222	18	0,322	**FF33**	-428,052	-26,448	334,518	36,437	18	0,071
FF9	2 011,294	170,140	-2 540,713	-123,407	21	0,112	**FF34**	-658,184	-18,235*	731,545	18,567**	22	0,220
FF10	n/a	n/a	n/a	n/a	n/a	n/a	**FF35**	-5,041	2,148	-32,738	-1,360	13	0,165
FF11	456,406	-12,390	-334,265	16,163	19	0,111	**FF36**	328,720	9,799*	-316,914	-9,069	18	0,208
FF12	-1 228,345**	-8,193	1 187,947**	11,103	11	0,403	**FF37**	77,708	-2,077	-109,619	4,063	21	0,099
FF13	264,392	12,182	-284,167	-9,283	15	0,029	**FF38**	n/a	n/a	n/a	n/a	n/a	n/a
FF14	1 956,927	310,386	-3 381,706	-224,676	21	0,081	**FF39**	-4 696,366**	-78,511***	6 748,614**	57,612***	9	0,604
FF15	n/a	n/a	n/a	n/a	n/a	n/a	**FF40**	1 535,249	54,594*	-2 375,583	-32,865	15	0,266
FF16	113,301	5,250	-214,845	-2,249	13	0,290	**FF41**	89,010	1,638	-98,327	-0,092	20	0,080
FF17	1 023,002	70,215	-1 583,355	-37,584	21	0,037	**FF42**	-156,067	4,835	161,788	-1,747	19	0,015
FF18	1,042	-4,180	-6,174	8,038	18	0,013	**FF43**	351,361	-13,350	-384,271	13,617	22	0,043
FF19	-6 720,106	-105,586	8 306,858	101,414	16	0,169	**FF44**	-39,918	9,385	-57,696	-2,679	20	0,022
FF20	n/a	n/a	n/a	n/a	n/a	n/a	**FF45**	-2 790,366	-47,331	1 316,893	98,773	20	0,047
FF21	-37,284	-2,365	30,777	3,556	22	0,096	**FF46**	-984,782*	-13,187	787,584*	24,948	18	0,225
FF22	5,851	-6,833	129,533	8,354	11	0,333	**FF47**	-1 363,988	-7,828	1 180,563	16,672	14	0,040
FF23	-6,226	-33,294	156,003	35,300	20	0,026	**FF48**	-253,133	9,765	-438,744	2,261	18	0,103
FF24	n/a	n/a	n/a	n/a	n/a	n/a	**FF49**	n/a	n/a	n/a	n/a	n/a	n/a
FF25	n/a	n/a	n/a	n/a	n/a	n/a							

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients for the regression as well as number of observations and R-squared measure for the regression done on each Fama-French industry individually. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. The deals are divided into Fama-French industries and the industry's total PE activity, based on dollar value of deals, is calculated by year. We compute the percentage change in value of deals by year for each industry and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

5.1.4 Activity by industry – share of total activity

We now turn to the results of the regression with the change in an industry's share of total PE activity, based on number of deals, as dependent variable. Looking at table 12, we find that there is little of statistical significance. FF industry 2, Food products is the only one where the coefficient for changes in credit spread is statistically significant. The results generally do not support any of the hypotheses 4a, 4b and 4c.

Moving on to table 13, where the transaction value of deals is the basis of computing an industry's share of total activity, we find that three industries have positive and statistically significant coefficients for the change in credit spread while four are negative. Three industries have statistically significant coefficients for the relative multiple variables, all three coefficients being negative. The product of change in credit spread and relative multiple have seven industries with statistically significant coefficients of which three are negative and four positive. These mixed results, and the general lack of statistical significance does not support our hypotheses 4a, 4b and 4c.

Table 12: Regression 7, by industry

$$\Delta\, Share\ of\ deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\, CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\, CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

	Period												
	1986-2008												
Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.	Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.
FF1	-0,005	0,000	0,001	-0,000	22	0.0015	FF26	-0,678	0,006	0,695	-0,005	22	0.0786
FF2	-1,537**	-0,023	1,780**	0,019	22	0.2503	FF27	n/a	n/a	n/a	n/a		n/a
FF3	-0,073	0,001	0,010	-0,001	22	0.0658	FF28	0,021	0,003	-0,003	-0,002	22	0.0029
FF4	0,200	0,007	-0,204	-0,006	22	0.0149	FF29	0,376	-0,002	-0,412	0,001	21	0.0586
FF5	-0,138	-0,006	0,217	0,005	22	0.0542	FF30	0,139	0,002	-0,149	-0,002	22	0.0057
FF6	-0,264	0,004	0,295	-0,004	22	0.0421	FF31	0,331	-0,002	-0,392	0,002	22	0.0768
FF7	0,107	-0,007	-0,113	0,007	22	0.0345	FF32	-0,286	-0,000	0,403	0,000	22	0.0279
FF8	-1,042	-0,007	1,333	0,007	22	0.0592	FF33	0,202	0,004	-0,132	-0,004	22	0.0364
FF9	0,904	0,104	-1,317	-0,082	22	0.1446	FF34	3,536	-0,084	-4,102	0,074	22	0.1348
FF10	0,274	0,006	-0,327*	-0,004	22	0.1394	FF35	0,225	-0,002	-0,205	0,002	22	0.0148
FF11	-0,152	0,003	0,101	-0,002	22	0.0189	FF36	-1,492	-0,007	1,191	0,009	22	0.0917
FF12	0,361	-0,013**	-0,356	0,013**	22	0.2011	FF37	0,851	-0,011	-0,982	0,008	22	0.0606
FF13	0,771	0,020	-0,617	-0,024	22	0.1166	FF38	n/a	n/a	n/a	n/a	n/a	n/a
FF14	-0,186	-0,035	0,314	0,028	22	0.0167	FF39	-0,312	-0,013	0,319	0,009	22	0.0696
FF15	n/a	n/a	n/a	n/a	n/a	n/a	FF40	0,803	0,018	-1,119	-0,015	21	0.0967
FF16	-0,435	-0,011	0,650	0,008	22	0.1391	FF41	0,603	-0,004	-0,629	0,004	22	0.0498
FF17	-0,459	0,029	0,420	-0,021	22	0.1606	FF42	0,621	0,013	-0,564	-0,012	22	0.0437
FF18	-0,215	-0,001	0,223	0,002	22	0.0307	FF43	-3,808	0,006	4,409	-0,008	22	0.1212
FF19	-0,570	0,001	0,700	-0,001	22	0.0756	FF44	3,348	-0,007	-4,411	0,005	22	0.1585
FF20	n/a	n/a	n/a	n/a	n/a	n/a	FF45	-0,702	0,000	0,435	0,000	22	0.0333
FF21	0,304	-0,007	-0,254	0,004	22	0.0209	FF46	-0,364	-0,008	0,338	0,012	22	0.0949
FF22	-0,276	-0,004	0,306	0,003	22	0.0157	FF47	-0,518	-0,006	0,669	0,008	22	0.3541
FF23	-0,116	0,004	-0,025	-0,004	22	0.0530	FF48	0,002	0,002	0,045	-0,003	22	0.0224
FF24	n/a	n/a	n/a	n/a	n/a	n/a	FF49	-0,291	-0,007*	0,331	0,007*	22	0.2229
FF25	n/a	n/a	n/a	n/a	n/a	n/a							

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients for the regression as well as number of observations and R-squared measure for the regression done on each Fama-French industry individually. The sample used consists of 25,682 Private Equity deals. The deals are divided into Fama-French industries and the industry's share of total PE activity, based onnumber of deals, is calculated by year. We compute the change in share of Private Equity activity by year for each of the industries and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

Table 13: Regression 8, by industry

$$\Delta\,\$\,Share\ of\ deals_{t,i} = \alpha_0 + \beta_1 \times \Delta\,CS_t + \beta_2 \times RM_{t,i} + \beta_3 \times \Delta\,CS_t \times RM_{t,i} + \varepsilon_{t,i}$$

Period

1986-2008

Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.	Industry	Δ CS	RM	Δ CS x RM	α	#obs	R-sq.
FF1	0,263	0,014	-0,269	-0,014	22	0.0425	**FF26**	3,079	-0,014	-3,638	0,004	22	0.0503
FF2	5,155*	-0,042	-5,526*	0,043	22	0.2414	**FF27**	n/a	n/a	n/a	n/a	n/a	n/a
FF3	0,077	0,005	-0,083	-0,005	22	0.0314	**FF28**	-0,516	-0,004	0,566	0,004	22	0.0004
FF4	0,697	0,038	-0,786	-0,031	22	0.0222	**FF29**	3,506**	-0,061***	-4,296**	0,051***	21	0.3347
FF5	-3,744	-0,192	5,900	0,160	22	0.0222	**FF30**	0,340	0,027	-0,473	-0,021	22	0.0336
FF6	-1,167	-0,010	1,480	0,008	22	0.0754	**FF31**	0,249	-0,007	-0,364	0,008	22	0.0052
FF7	-1,890	-0,051	2,136	0,042	22	0.0317	**FF32**	-5,733*	0,036	5,160	-0,034	22	0.2883
FF8	-8,486	0,252	12,100*	-0,223	22	0.3675	**FF33**	-2,318	-0,001	2,033	0,001	22	0.1025
FF9	-2,490	0,172	2,553	-0,131	22	0.1330	**FF34**	-3,256	-0,050	4,130	0,047	22	0.0465
FF10	-0,026	-0,000	0,024	0,000	22	0.0102	**FF35**	4,636	-0,012	-3,456	0,014	22	0.0305
FF11	0,072	-0,058	0,135	0,055	22	0.0623	**FF36**	1,838	0,023	-1,696	-0,025	22	0.0653
FF12	-3,506***	0,015	4,051***	-0,011	22	0.6789	**FF37**	0,336	-0,052	-1,317	0,054	22	0.1810
FF13	1,700	0,008	-1,273	-0,008	22	0.0807	**FF38**	n/a	n/a	n/a	n/a	n/a	n/a
FF14	-3,166	0,056	2,415	-0,045	22	0.1086	**FF39**	-0,458	-0,002	0,459	0,001	22	0.0978
FF15	n/a	n/a	n/a	n/a	n/a	n/a	**FF40**	7,538	0,119	-12,735	-0,114	21	0.2022
FF16	0,051	0,012	-0,158	-0,010	22	0.0243	**FF41**	1,557	0,023	-1,347	-0,025	22	0.0438
FF17	-0,291	-0,038	-0,039	0,028	22	0.0383	**FF42**	1,352	-0,051	-1,839	0,047	22	0.0442
FF18	-0,071	-0,002	0,028	0,002	22	0.0118	**FF43**	4,343	-0,653**	-5,330	0,522**	22	0.3144
FF19	-2,838	-0,089	3,580	0,067	22	0.0693	**FF44**	-15,336**	-0,043	18,892**	0,051	22	0.2621
FF20	n/a	n/a	n/a	n/a	n/a	n/a	**FF45**	9,603	-0,102	-3,950	0,185	22	0.5131
FF21	2,933	-0,026	-3,199	0,020	22	0.0553	**FF46**	-0,155	0,023	0,220	-0,033	22	0.0122
FF22	0,236	-0,011	0,007	0,005	22	0.0550	**FF47**	-3,834	-0,076	3,059	0,091	22	0.1807
FF23	5,123***	0,006	-4,256***	0,009	22	0.3672	**FF48**	0,743	0,003	-0,528	-0,003	22	0.0162
FF24	n/a	n/a	n/a	n/a	n/a	n/a	**FF49**	-0,345**	-0,013***	0,393**	0,013***	22	0.5223
FF25	n/a	n/a	n/a	n/a	n/a	n/a							

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients as well as number of observations and R-squared measure for the regression done on each Fama-French industry individually. The sample used consists of 25,682 Private Equity deals of which data on transaction value exists for 11,857 deals. The deals are divided into Fama-French industries and the industry's share of total PE activity, based on dollar value of deals, is calculated by year. We compute the change in share of Private Equity activity by year for each of the industries and use this measure as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries, and the product of these two variables.

5.2 Returns from multiple expansion

In this part we look how the returns from changes in valuation multiples on industry level are affected by the credit spread and the relative valuation of an industry.

In table 14 we find that changes in the credit spread are positively related to the excess return from multiple expansion, on 1 a year horizon in accordance with hypothesis 3a, while they are negatively relation on 3 and 5 year(s), which does not support hypothesis 3a. All of the coefficients are statistically significant at the 1% level. We also find that the relative multiple is negatively associated with returns from multiple expansion, also for 1, 3, and 5 year(s) horizon and statistically significant on the 1% level. These results give clear support for hypothesis 5b.

Graphs 7 and 8 show the returns and excess returns from multiple expansion by year respectively. In graphs 9 and 10 the average return and excess return from multiple expansion by year are plotted against the credit spread. In graphs 11, 12 and 13 the excess return from multiple expansion for each deal are plotted against the credit spread for horizons of 1, 3 and 5 years respectively.

We proceed to look at the excess results from the t-tests where the mean returns from the multiple expansion, equally weighted by deal, are evaluated, on 1, 3 and 5 year(s) horizon. In table 15 we see that average return from multiple expansion are positive over all periods and given the low p-values we can reject the null hypothesis that they are equal to or less than zero on the 1% level. These results give support to hypothesis 6.

Table 14: Regression 9, by year

$$ER_{me,t,n} = \alpha_0 + \beta_1 \times CS_t + \beta_2 \times RM_{t,i} + \varepsilon_{t,i}$$

	Horizon					
	1 year		3 years		5 years	
Variable	**coef**	**se**	**coef**	**se**	**coef**	**se**
CS	0,006***	0,001	-0,008***	0,001	-0,009***	0,001
RM	-0,428***	0,009	-0,638***	0,015	-0,689***	0,017
α	0,342***	0,009	0,636***	0,015	0,712***	0,017
# Observations	13885		9722		6861	
R-squared	0,135		0,166		0,197	

note: *** p<0.01, ** p<0.05, * p<0.1

The table shows the coefficients and standard error for the regression as well as number of observations and R-squared measure for the regression. Using the median EV/EBITDA multiple of the industry that a deal is classified in and dividing by the corresponding multiple 1, 3 and 5 years later we compute the return from multiple expansion. From this return we subtract the average multiple expansion return across all industries for the horizon to arrive at the excess return which is used as our dependent variable. As independent variables we use the credit spread between the yield of BOFA Merrill Lynch High Yield Index and the LIBOR rate, the relative EV/EBITDA multiple of an industry during a year compared to the average multiple across all industries.

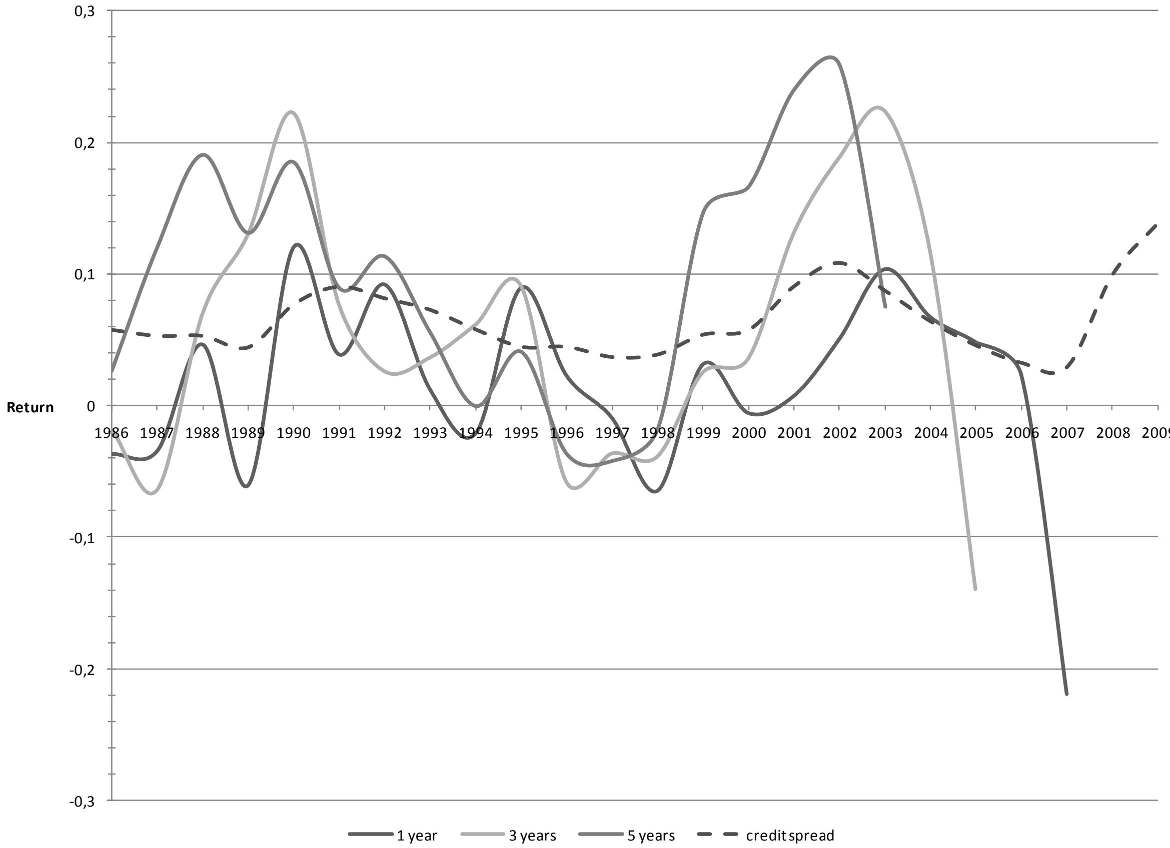
Table 15: T-tests for excess returns from multiple expansion, all deals

T-test by year if mean return is larger or less than 0 depending on sign of mean

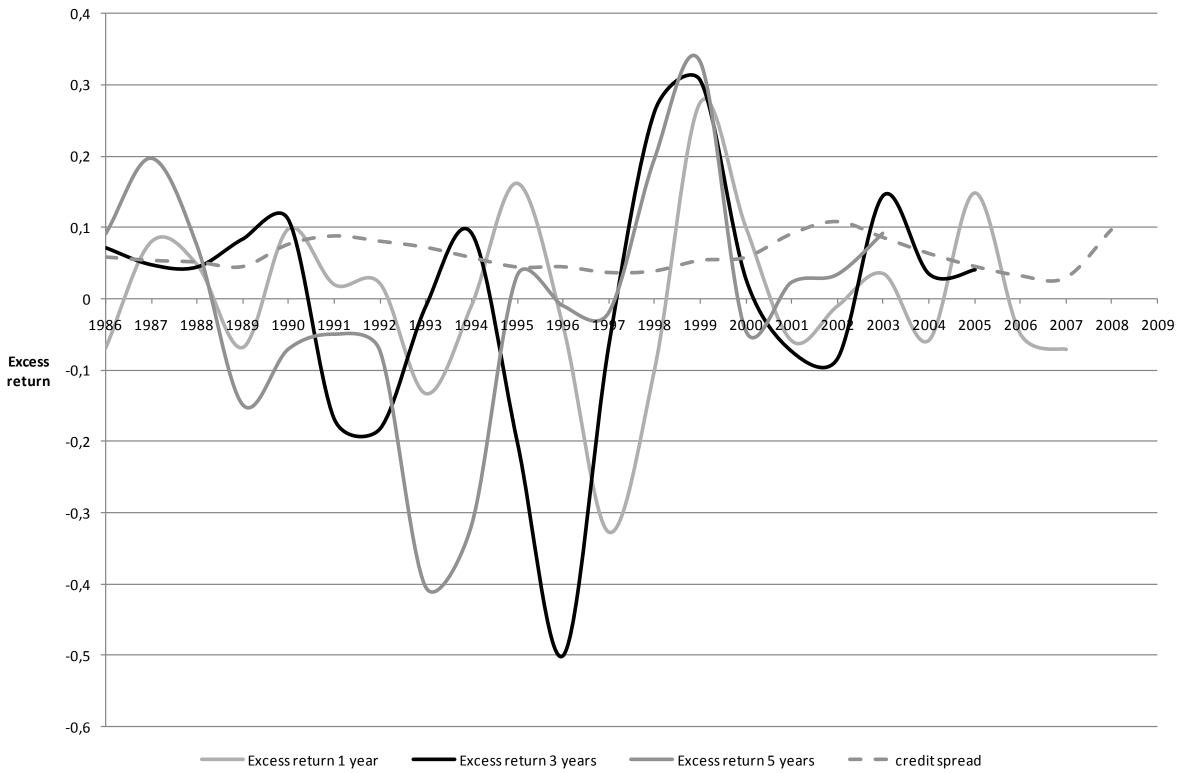
	Horizon											
	1 year				3 years				5 year			
	mean	**P(T<0)**	**P(T>0)**	**# obs**	**mean**	**P(T<0)**	**P(T>0)**	**# obs**	**mean**	**P(T<0)**	**P(T>0)**	**# obs**
Excess return	0,0053		0,002	13866	0,0352		0,000	9723	0,059		0,000	6862

The table shows the mean value and P-value from t-tests on the excess returns from multiple expansion on the Private Equity deals for 1, 3, and 5 year horizons.

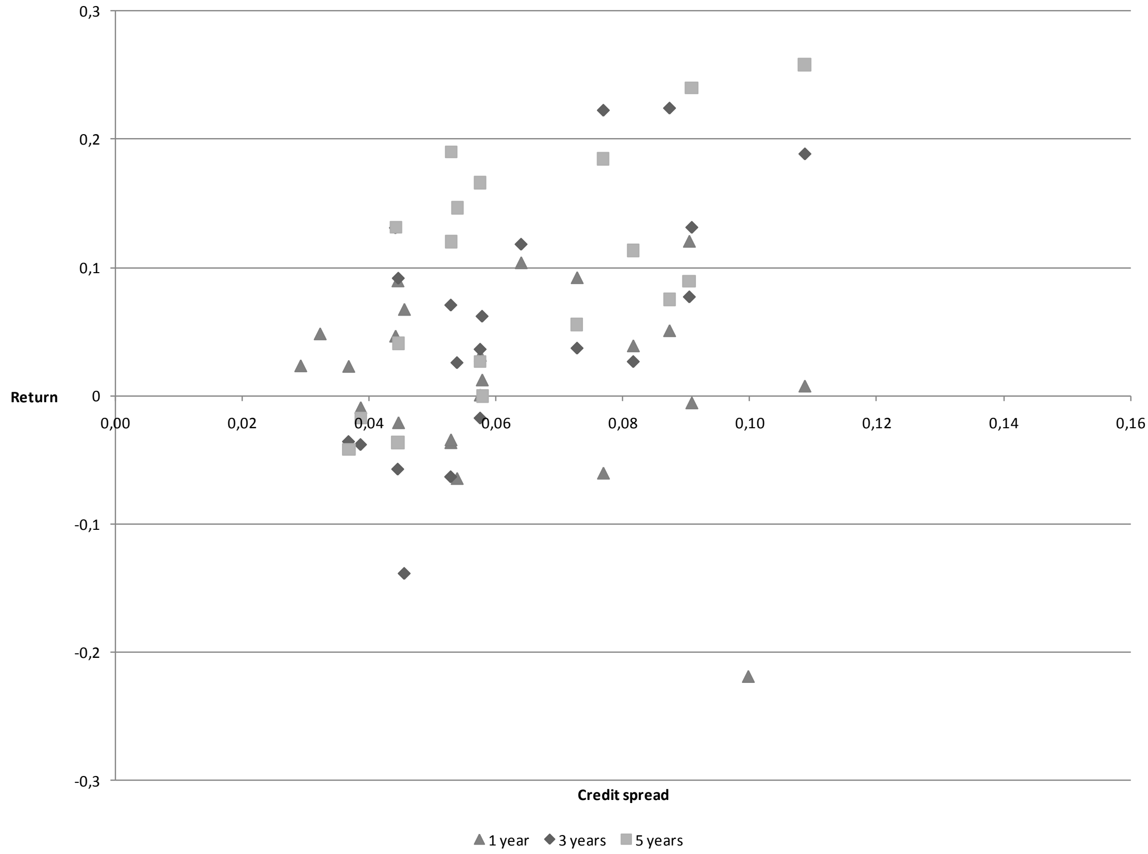
Graph7: Returns from multiple expansion and credit spread by year



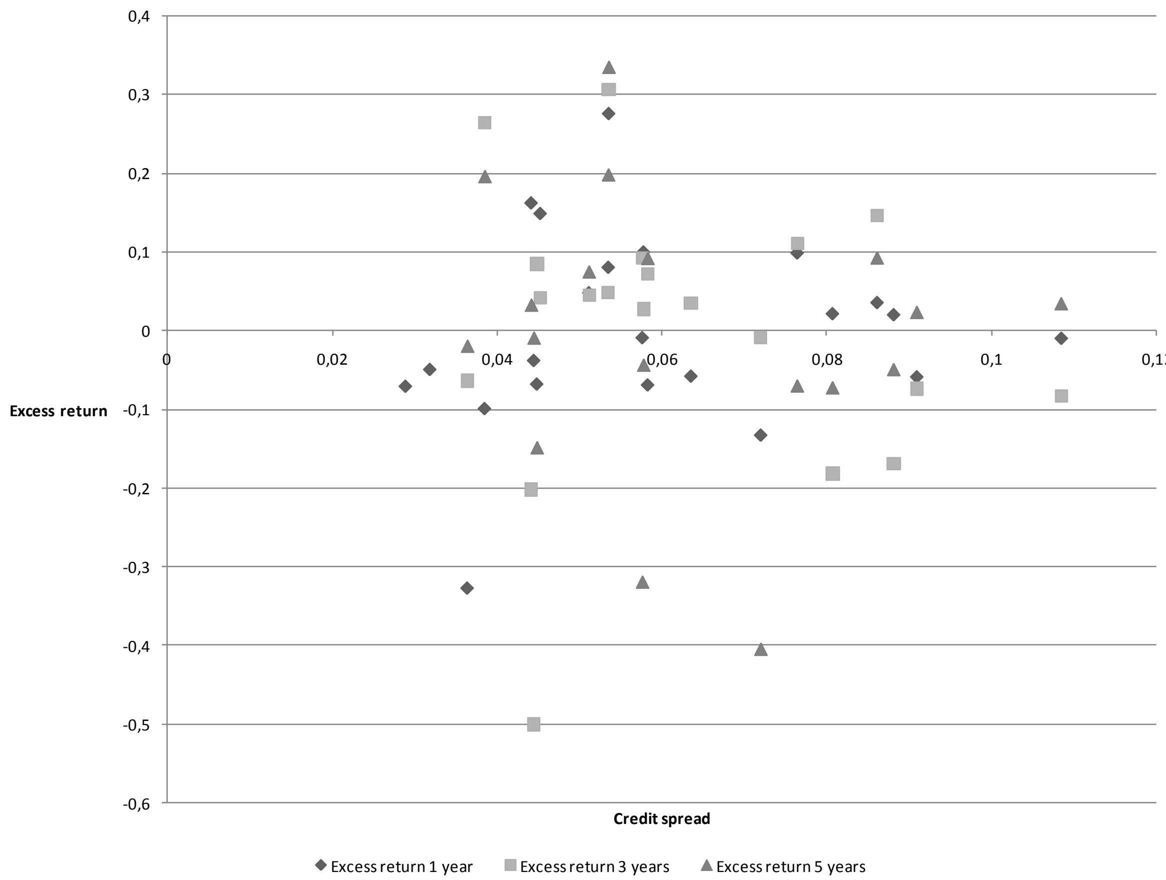
Graph 8: Excess returns from multiple expansion and credit spreads by year



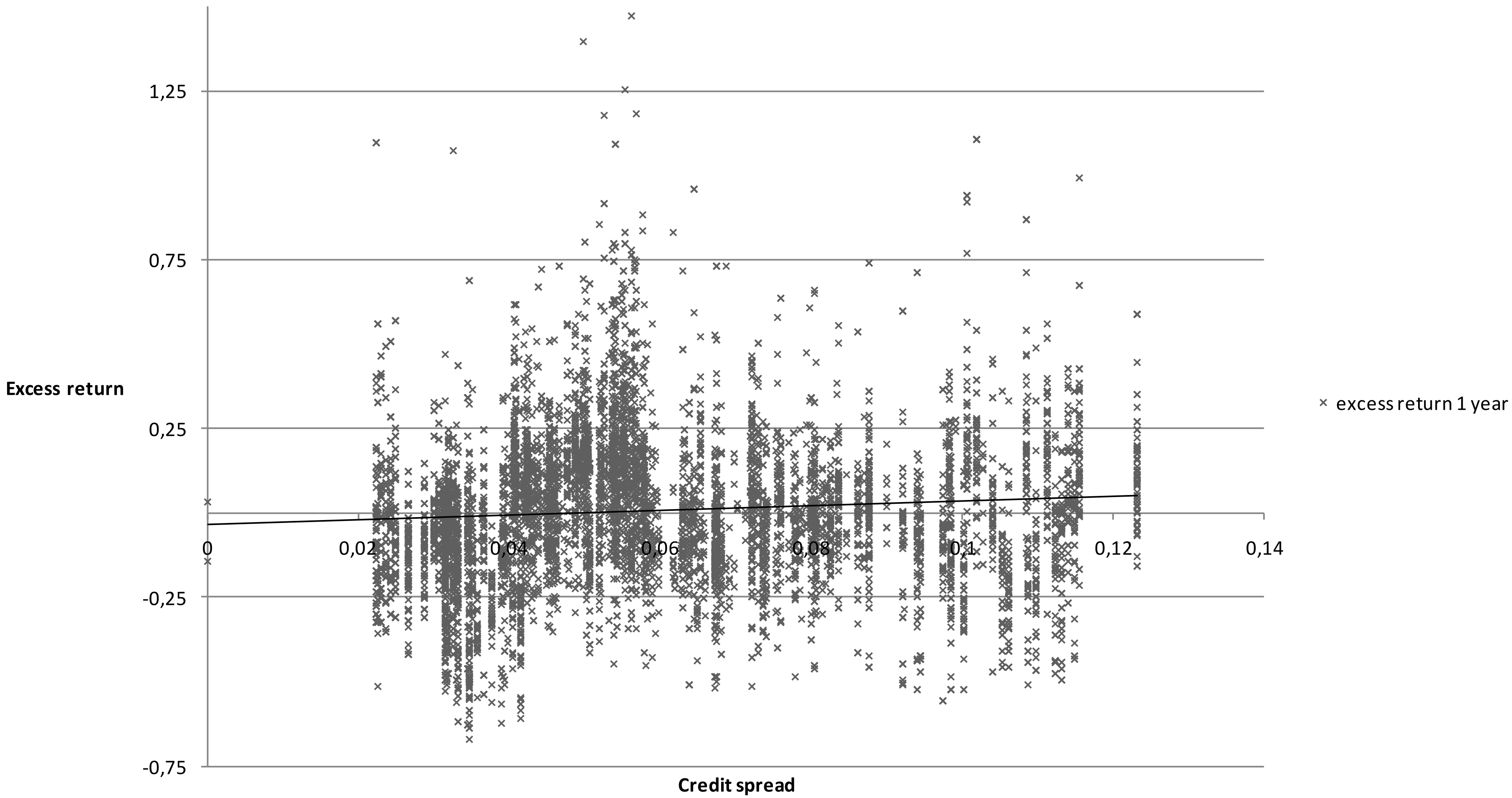
Graph 9: Returns from multiple expansion and credit spreads plotted



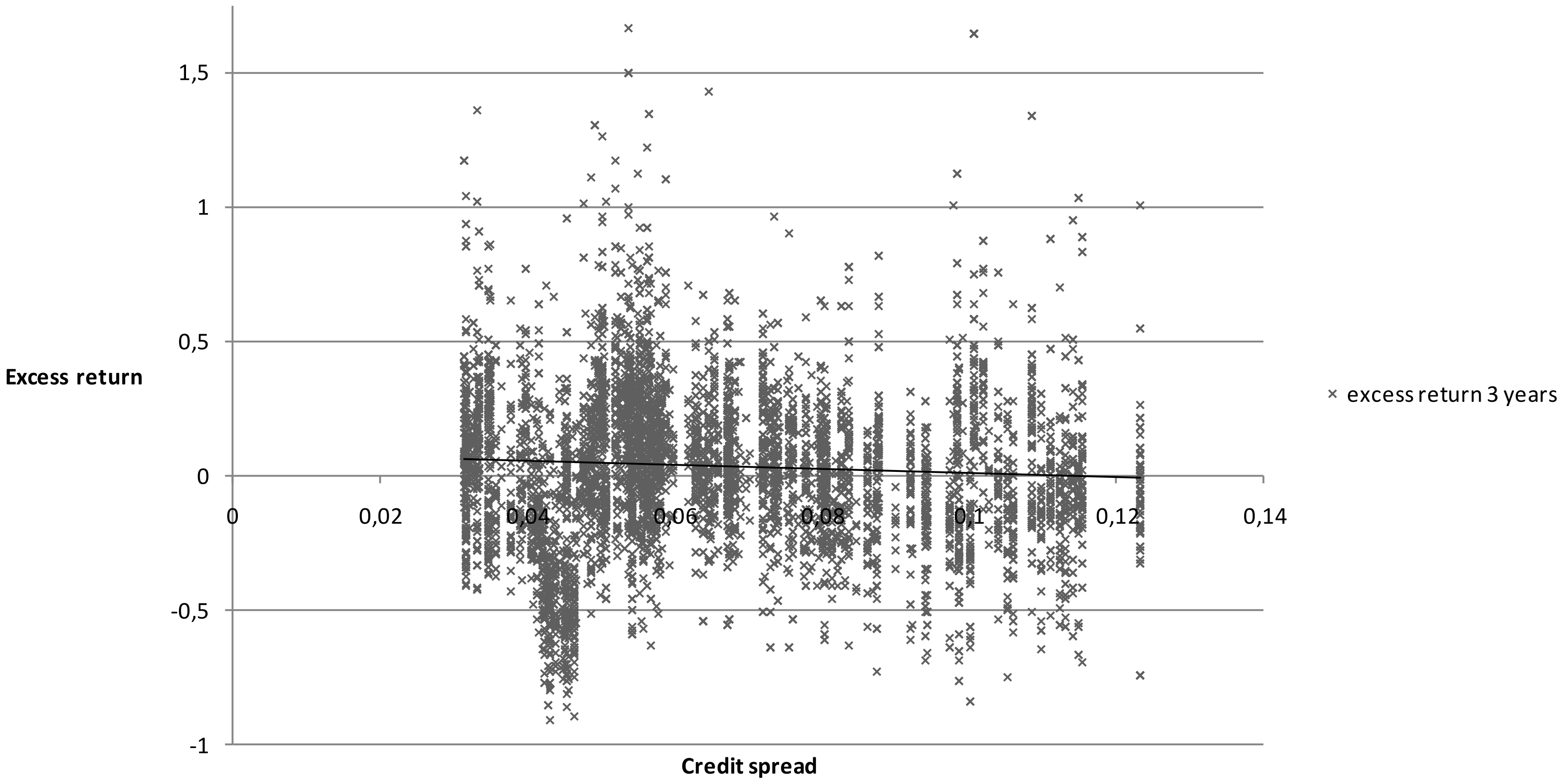
Graph 10: Excess returns from multiple expansion and credit spreads plotted



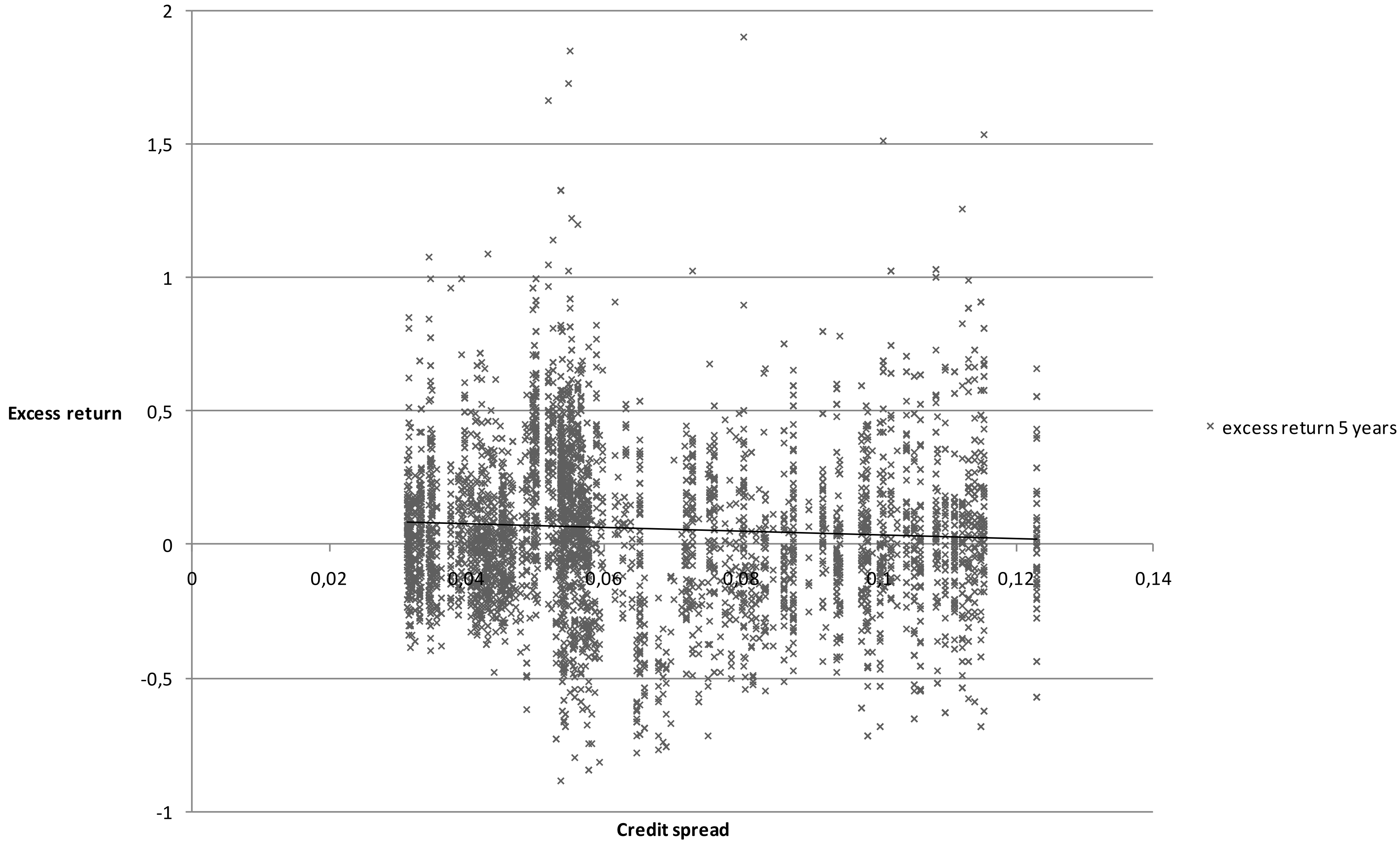
Graph 11: Excess returns on 1 year horizon against the credit spread



Graph 12: Excess returns on 3 year horizon against the credit spread



Graph 13: Excess returns on 5 year horizon against the credit spread



6. Discussion

Summarizing the analysis of our results we can conclude that our study finds support for that general PE activity is affected by changes in the credit market. This confirms the results from previous research that changes in PE activity are driven by the conditions of the credit market. The change in credit spread is negatively related to the development of overall PE activity and the same tendency is demonstrated when looking at the change both by number of deals and by transaction value.

When performing the analysis on industry level our study does not give support for the general idea that credit market conditions and relative valuation affect which industries PE firms target.

The concentration of PE activity across industries does not change significantly with the credit spread when considering number of deals but the concentration of transaction value across industries is positively associated to changes in the credit spread. The latter result supports the idea that when credit spreads are low different kinds of industries, e.g. highly valued industries, can become available thanks to increased lending, while the variety of industries invested in decreases when credit spreads are higher.

When the change in PE activity is analyzed by industry the aggregated data exhibits the expected negative relationship between changes in credit spread and development of deal activity when the number of deals is used as basis, but we do not find this relationship using transaction value. The relative valuation multiple of an industry and the interaction between changes in credit spread and relative valuation multiple does not explain changes in deal activity neither by number of deals nor by transaction value. Looking at the changes in activity for each industry individually, very few industries show a significant relationship between its activity, the change in credit spread, relative valuation multiple or the interaction between the two variables. The results that are significant have mixed signs and we are not able to draw any conclusions from that pattern.

The independent variables, change in credit spread, relative multiple and their products, do not seems to explain the changes in an industry's share of total deal activity by year, neither by number of deals nor by transaction value.

The results regarding the excess returns from multiple expansion on industry level show mixed results with regards to the relation to the credit spread, but there is a negative relationship to relative valuation. Hence, Private Equity companies that bought companies in relatively high valued industries found the relative valuation of their industries decline during 1, 3 and 5 year periods after the deal on average. This indicates that relative valuation of an industry should be of interest for PE companies and have a significant effect on the returns they earn.

When looking at the average excess returns from multiple expansion we find that they are positive for all three time horizons, 1, 3 and 5 years, indicating that PE firms are able to time the market or exhibit an “industry picking ability” and invest in industries where valuations, on average, outperform the average development. The risk is of course that the causality is reversed and that increased PE presence in an industry leads to an inflation in valuation.

7. Conclusions, limitations and further research

7.1 Conclusions

Using a set of regressions on a sample of 25,682 deals combined with credit spread and median valuation data for traded companies on industry level we investigate the relationship between Private Equity activity and the credit spread and relative valuation of industry targets.

Our study confirms that changes in credit spread affect overall PE activity in the economy. When searching for patterns on industry level to see if changes in the state of the credit market and the relative valuation of industries drive an industry effect in PE activity the results of our study generally does not support the existence of an industry effect even though some parts of our analysis give weak support to the concept.

Looking at the returns from multiple expansion we conclude that our study supports the existence of a variance in returns driven by the relative valuation of an industry. We further show that the excess returns from multiple expansion are positive on average indicating that PE firms are able to time the market and invest in industries with increasing valuations, even though there is some doubt about the causality of this result.

7.2 Sources of error and limitations

There are several factors that impact the results that we haven't taken into account, for example the size of industries, the relationship between number of firms and the size of the firms.

An important factor that our analysis does not take into account is that as the economy changes and different industries change over time the general composition of industries is also expected to change and this will of course influence the deal activity distribution across industries.

Another source of error is of course that when we look at valuation multiples we base the analysis on median data of the entire industry, when the individual deal can be priced significantly different. This is especially true since trading multiples and transaction multiples can differ systematically.

The classification of data from the CIQ database led to a quite rough classification of FF industries leading to some limitations on the validity of the data.

When performing our regressions based on the dollar value of deals we have used a sample half of the size of our total sample of deals which limits the power of those results.

7.3 Further research

Given the findings of our study and the limitations of our way of analyzing the questions we would be interested in seeing results from research on the following topics:

- Since our study show that multiple expansion returns are negatively related to the relative valuation it would be interesting to deepen the understanding for this relationship by looking at a sample where actual entry and exit multiples are available and not just looking at industry medians, to confirm and develop a deeper understanding for these results.
- Another interesting area would be to do a more in depth analysis of certain industries and repeat some of our regression using the relative valuation of the deal and not just the industry.
- A more comprehensive measure of PE activity with a comparison to the size of the economy. The relative PE activity could be measured as the number of deals compared to the number of firms or the dollar value of deals is compared to the market capitalization of an industry which would be an interesting way to test if the there is an industry cyclicality that depends on credit markets and relative valuation.
- For the industries with significant coefficients for credit spread, relative valuation and their interaction, more detailed analyses with data on deal, financing, valuation etc. could reveal if PE activity is driven by changes in the independent variables in these specific industries.
- Other measures such as growth, margins, cash flows, etc might be able to explain the distribution and changes in PE activity on industry level.

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9. Appendix

Table A1. List of Fama-French industries

	Fama French industries		
FF	Name	FF	Name
1	Agriculture	26	Defense
2	Food Products	27	Precious Metals
3	Candy & Soda	28	Non-Metallic and Industrial Metal Mining
4	Beer & Liquor	29	Coal
5	Tobacco Products	30	Petroleum and Natural Gas
6	Recreation	31	Utilities
7	Entertainment	32	Communication
8	Printing and Publishing	33	Personal Services
9	Consumer Goods	34	Business Services
10	Apparel	35	Computers
11	Healthcare	36	Computer Software
12	Medical Equipment	37	Electronic Equipment
13	Pharmaceutical Products	38	Measuring and Control Equipment
14	Chemicals	39	Business Supplies
15	Rubber and Plastic Products	40	Shipping Containers
16	Textiles	41	Transportation
17	Construction Materials	42	Wholesale
18	Construction	43	Retail
19	Steel Works Etc	44	Restaraunts, Hotels, Motels
20	Fabricated Products	45	Banking
21	Machinery	46	Insurance
22	Electrical Equipment	47	Real Estate
23	Automobiles and Trucks	48	Trading
24	Aircraft	49	Almost Nothing
25	Shipbuilding, Railroad Equipment		

Source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Siccodes49.zip

Table A2. Summary of hypotheses

Summary of hypotheses											
Part	Weights	H	regression	Interval		1986-	1997-	2002-	1 year	3 years	5 years
4.1.1	# Deals	H1	1	By year	All data	•	•	•			
4.1.1	# Deals	H1	1	By quarter	All data		•	•			
4.1.1	$ Deals	H1	2	By year	All data	•	•	•			
4.1.1	$ Deals	H1	2	By quarter	All data		•	•			
4.1.2	# Deals	H2	3	By year	All data	•	•	•			
4.1.2	$ Deals	H2	4	By year	All data	•	•	•			
4.1.3	# Deals	H3a	5	By year	All data	•	•	•			
4.1.3	# Deals	H3a	5	By year	By industry	•					
4.1.3	$ Deals	H3a	6	By year	All data	•	•	•			
4.1.3	$ Deals	H3a	6	By year	By industry	•					
4.1.3	# Deals	H3b	5	By year	All data	•	•	•			
4.1.3	# Deals	H3b	5	By year	By industry	•					
4.1.3	$ Deals	H3b	6	By year	All data	•	•	•			
4.1.3	$ Deals	H3b	6	By year	By industry	•					
4.1.3	# Deals	H3c	5	By year	All data	•	•	•			
4.1.3	# Deals	H3c	5	By year	By industry	•					
4.1.3	$ Deals	H3c	6	By year	All data	•	•	•			
4.1.3	$ Deals	H3c	6	By year	By industry	•					
4.1.4	# Deals	H4a	7	By year	By industry	•					
4.1.4	$ Deals	H4a	8	By year	By industry	•					
4.1.4	# Deals	H4b	7	By year	By industry	•					
4.1.4	$ Deals	H4b	8	By year	By industry	•					
4.1.4	# Deals	H4c	7	By year	By industry	•					
4.1.4	$ Deals	H4c	8	By year	By industry	•					
4.2	# Deals	H5a	9	By year	All data				•	•	•
4.2	# Deals	H5b	9	By year	All data				•	•	•
4.2	# Deals	H6	n/a	n/a	All data				•	•	•

• Indicates that the hypothesis is tested for this combination of parameters

Table A3. Summary of results

Summary of results											
Part	Weights	H	regression	Interval		1986-	1997-	2002-	1 year	3 years	5 years
4.1.1	# Deals	H1	1	By year	All data	√	√	√			
4.1.1	# Deals	H1	1	By quarter	All data		√	√			
4.1.1	$ Deals	H1	2	By year	All data	√	√	√			
4.1.1	$ Deals	H1	2	By quarter	All data		√	√			
4.1.2	# Deals	H2	3	By year	All data	√	√	√			
4.1.2	$ Deals	H2	4	By year	All data	√	√	√			
4.1.3	# Deals	H3a	5	By year	All data	√	√	√			
4.1.3	# Deals	H3a	5	By year	By industry	√					
4.1.3	$ Deals	H3a	6	By year	All data	√	√	√			
4.1.3	$ Deals	H3a	6	By year	By industry	√					
4.1.3	# Deals	H3b	5	By year	All data	√	√	√			
4.1.3	# Deals	H3b	5	By year	By industry	√					
4.1.3	$ Deals	H3b	6	By year	All data	√	√	√			
4.1.3	$ Deals	H3b	6	By year	By industry	√					
4.1.3	# Deals	H3c	5	By year	All data	√	√	√			
4.1.3	# Deals	H3c	5	By year	By industry	√					
4.1.3	$ Deals	H3c	6	By year	All data	√	√	√			
4.1.3	$ Deals	H3c	6	By year	By industry	√					
4.1.4	# Deals	H4a	7	By year	By industry	√					
4.1.4	$ Deals	H4a	8	By year	By industry	√					
4.1.4	# Deals	H4b	7	By year	By industry	√					
4.1.4	$ Deals	H4b	8	By year	By industry	√					
4.1.4	# Deals	H4c	7	By year	By industry	√					
4.1.4	$ Deals	H4c	8	By year	By industry	√					
4.2	# Deals	H5b	9	By year	All data				√	√	√
4.2	# Deals	H5b	9	By year	All data				√	√	√
4.2	# Deals	H6	n/a	n/a	All data				√	√	√

√ Indicates that the results support the hypothesis

√ Indicates that the results does not support the hypothesis