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Does Firm Size Matter?

A study of the relationship between relative valuation and firm size

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Abstract

Buy-and-build strategies have recently become a common way for private equity firms to create value from their portfolio companies by i.a. increasing their size. Finance theory, on the other hand, gives no support that there should be a relationship between relative firm valuation and mere size. This paper provides an empirical study of 5,790 transactions that occurred during 1994 and 2007. We found that, on average, there is no significant relationship between a firm's valuation multiple and its size, in terms of sales. However and interestingly, for subsamples, we found that such a positive relationship exists and is especially strong for small-sized firm, stagnates for larger firms and eventually turns negative for the largest firms. Roughly, the relationship is positive for firms with revenues between USD 20-50m and negative for firms with revenues between USD 300-600m. This has implications for when this relationship may be true and when buy-and-build strategies may result in multiple expansion.

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Table of Contents

1 Introduction

Among many professionals, such as investors and private equity firms, there is a firm belief that so called buy-and-build strategies earn abnormal returns and that larger firms, on average, should be valued at a higher multiple[1] than smaller firms. As Figure 1, 2 and 3 in the appendix show, the number of follow-on acquisitions, and hence the prevalence of buy-and-build strategies, have soared at the same time as this strategy has outperformed other corporate strategies in terms of profit and value growth (MacDougall and Whiley 2008, and Nicholson et al 2008). In today's mergers and acquisitions environment, multiples are frequently used as a valuation tool and measurement, and according to Hoffmann (2008) it was more frequently used than the discounted cash flow model. However, finance theory has contradicting implications regarding these beliefs. Valuation theory tells us that the most common valuation measures, multiples, are driven by return, discount rate and growth (Koller et al 2005). Since firm size, in terms of revenue, has no place in that equation, it is a puzzle that such beliefs exist.

In this paper, we aim at investigating whether a relationship between multiple valuation levels and firm size exists. We will use a data sample of 5,790 merger and acquisition transactions from the period between 1994 and 2007. While controlling for a number of transaction characteristics, we study if there is a general relationship and if this relationship changes regarding the size of the firms. The latter is motivated since buy-and-build strategies only are applied to small to mid-sized firms, but there can obviously be other explanations as well why the relationship may change depending on firm size, which we will investigate.

Previous thinking on this subject has some implications for this problem, even though there is a lack of research on this very specific issue. The research can be divided into theories that have implications for the different drivers of valuation multiples; discount rate, growth rate and return.

Numerous researchers of stock market returns have also concluded that small firms are undervalued (Banz 1981, and Fama and French 1992 and 1993). This implies clearly that buy-and-build strategies would earn abnormal returns. This might be one reason why this strategy is currently implemented more than ever. There are a number of possible explanations to this phenomenon. One is that small firms are considered more risky and hence get a higher risk premium and a higher discount rate. Another reason could be that there is an information asymmetry and investors prefer larger firms that are well-known.

[1] In this paper, we will use EV/EBITDA as the transaction multiple and will refer to it only as "multiple". See chapter 6.1. for a motivation and discussion.

Furthermore, institutional investors may have restrictions for which firms they can invest in, which would result in a higher liquidity for larger firms compared to smaller firms.

A contradicting theory is however the recognized theory that small firms consistently show a higher growth rate than large firms (Koller et al 2005). This would mean that smaller firms, ceteris paribus, should be valued at a higher multiple than larger firms.

Extensive research has been done within the field of mergers and acquisitions (M&A), which is the alternative growth strategy to organic growth. The results are however that acquiring firms, on average, earn zero or negative abnormal returns (Andrade, Mitchell and Stafford 2001). This is in line with corporate valuation theory and implies that there should be no, or potentially a slightly negative, relationship between relative valuation and size.

In contrast to the existing research, our approach and scope is different and investigates this relationship between firm size and transaction multiples and how it varies depending on the size of the target company in terms of revenue. This approach is also differentiating since it looks at both private and public firms and at transactions. The link between the exit multiple and firm size is of large interest to private equity firms and corporate managers in setting their strategies for creating shareholder value.

Our ambition with this paper is to contribute to current research with a new perspective on value creation from firm sizes and to come up with insights to the question if bigger firms tend to be more valuable, in relative terms, than smaller ones.

More in detail, we perform both general OLS regressions and Quandt likelihood ratio (QLR) tests in our study to test our hypotheses. The OLS regressions are used to test if there is an overall value-size relationship. The QLR tests for the hypothesis that an overall regression may not be representative for all different subsamples with different firm sizes. The test investigates whether there is a structural break in the size coefficient, i.e. if it is significantly different in a certain subsample compared to the rest of the data sample. A number of deal characteristics are controlled for such as industry, deal year, region, type of target, buyer and seller, type of acquisition and consideration, and the average market valuation levels sorted by industry, region and year.

We found that there is no significant overall relationship between the valuation multiple and firm size. Furthermore and interestingly, we also found that, for small firms with revenues ranging between USD 20m and 50m, there is a significantly strong relationship between the firms' transaction multiple and their firm size, in terms of revenues. Thereafter the relationship becomes less clear, but for larger firms, with

revenues ranging between USD 300m and 600m, we found that there is actually a significantly negative relationship between a firm's multiple and its size.

These findings have a number of implications. The theories implying i.a. that smaller firms have higher discount rates seem to have bearing. While observing these results one should bear in mind that the firm size of companies may be a proxy for other influential variables, such as information asymmetries and liquidity. The results may also explain why buy-and build transactions chiefly focus on small and mid-sized firms and recommend professionals to focus on and grow firms with revenues between USD 20m and 50m.

For further research, we recommend studies on buy-and-build strategies from the private equity funds' point of view. It would be interesting to study whether these strategies really render abnormal returns, which is occasionally claimed. This is especially so since this paper mainly studies the general relationship between multiple valuation and firm size, and not the strategy per se. Another interesting topic could be the study of how firms' valuation changes depending on their size throughout time as they grow.

In the following chapter, the theoretical framework will be further described followed by a qualitative background chapter. Thereafter the hypotheses are presented in chapter 4. The sample and data used will be further described in chapter 5. Chapter 6 will discuss the methodology of the analysis, while chapter 7 presents and analyses the results. References and Appendix, with exhibits, can be found in chapter 8 and 9, respectively.

2 Theoretical Framework

2.1 Academic Theories

In this chapter, theories with implications for why firm size should affect relative valuation are discussed. All of these theories, directly or indirectly, serve as a basis for our hypotheses. As a starting point of this chapter, the drivers of valuation multiples are being considered, to which the theories are linked.

$$\frac{Enterprise\ value}{EBITDA} = \frac{(1 - T_{ROIC})(1 - \frac{g}{ROIC})}{WACC - g}$$

As can be seen above, the main drivers are the discount rate, growth rate, and return, but not firm size. It is therefore a puzzle in the light of valuation theory that some investors assume such a relationship between multiples and firm size since it should not have any significant effects. Effective tax rates could

potentially be a value driver, but since tax rates are usually assumed to be constant, they will not be an area of further studies in this paper. Multiples are often used as a complementary valuation tool besides discounted cash flow models by practitioners. At the same time as discounted cash flow models often are seen as more accurate and flexible, multiples are often used to benchmark companies against each other and to create insight into what drives value for certain industries. A common flaw though in multiples analyses is that analysts often disregard differences in companies' characteristics and value drivers, when comparing companies within industries (Koller et al 2005).

Discount rates

A theory that has implications regarding the discount rate for small vis-à-vis large firms is the so-called size effect. Whether small firms are undervalued or not compared to larger firms have been a field of extensive research throughout the last decades. This research has focused on stock return for publicly traded firms but nevertheless has implications for the scope of this paper. Throughout the debate of the relevance and formation of the capital asset pricing model, developed by Sharpe (1964), Lintner (1965), and Black (1972), a heavy focus has been on the customary explanatory variable, beta. In 1981 however, Banz (1981) criticized the beta variable for being over-simplistic. He recalled other researchers and argued that beta is hard to measure, not significant in tests and possibly a proxy for additional factors. In his paper, he examined the relationship between the return and the total market value of NYSE common stocks during the period 1936-1975. He found that small firms had, on average, higher risk-adjusted returns than large firms independent of beta. This result was called the 'size effect' and shows that small firms were consistently undervalued. Banz discusses that one explanation for this phenomenon may be that the lack of information about small firms leads large institutional investors to neglect these stocks and to pursue a limited diversification.

Fama and French (1992 and 1993) incorporated these findings in their research and developed the well-known three-factor model that explains cross-sectional stock returns. Its explanatory variables were market beta, size and book-to-market equity ratio.

Black (1993), on the other hand, rejected the findings done by Banz, Fama and French and disregarded them as data mining. He argued that the size effect disappeared after the discovery and that the book-to-market equity ratio is not relevant in efficient markets, stressing that beta may be more relevant than ever.

However, Berk (1995 and 1997) claims that the size effect discovered first by Banz is not significant since the measure of size, market value, is also a proxy for other variables. That is because this measure is not only a measure of the size but it is also inversely related to a firm's discount rate. Hence, the market

value will be inversely related to return. Berk also tests for other measures of firm size but none of them show any signs of significance. Francis, LaFond, Olsson and Schipper (2003) also found that small firms are associated with information uncertainty and are hence viewed with a higher discount rate. Such an additional risk premium may undervalue small firms. However, a theoretical counterargument might be that there should not be such a premium since investors should always be able to diversify away from idiosyncratic risk.

Even though the debate involves different opinions, the size effect still has interesting implications for the valuation of companies and the discount rate. Since small firms tend to be undervalued, they would carry a lower transaction multiple than larger firms, according to the 'size effect' theories.

Growth

It is usually said that firms can grow either organically or by acquisitions. For organic growth, it is easy to see that as long as a firms produces returns over its cost of capital, higher growth means more value creation and a higher valuation multiple. This is especially the case for start-ups with currently low or negative profits that are expected to show a high growth rate in the future. According to Koller (2005), larger firms have less growth opportunities than smaller firms and show a lower growth rate empirically. This might imply that large firms should have lower multiples. For acquisitive growth on the other hand, whether value creation takes place or not is a more debated question, which has been subject for substantial research.

When investigating whether the size of a firm corresponds to higher exit multiples, mergers is an interesting area of study since it is used to expand firm size and hopefully create value. Buy-and-build strategies make up of several mergers, at least two, which together become the new entity. Therefore, M&A's impact on value creation is important when studying buy-and-build strategies. Mergers are one of the most studied fields of finance. Even though plenty of research has been done on the subject, the outcome, whether M&As create value or not, is unclear. For example, Andrade & Stafford (2004) find that mergers on average increase value and lead to improved profitability in the following years. The study included combined acquired and target stock returns and measure of post-merger operating performance. On the other hand, a number of studies report that acquirers underperform after a merger. Dyer, Kale, and Singh (2004) and Marks and Mirvis (2001) found that 60 to 80 percent of all mergers fail to create value to their shareholders.

In order to sort all these studies out and make some general conclusions, Bruner (2002 and 2004) gathered data from, in total, 14 informal studies and 120 scientific studies carried out since 1971 relating to the

value creation of mergers. His conclusions were somewhat mixed and the data supported a number of views. One view is that M&As do create value, especially for the shareholders of the target firm, and some joint value for both the acquirer and target shareholders. But for bidders alone, there was no clear sign of value creation. Second, another view that could be supported is that M&A do not create value if the focus was on the bidder and success is defined by significant abnormal returns. Naturally, it would be surprising if M&As created large economic rents in an efficient and competitive economy. Third, the value creation is an ambiguous process since it is neither M&As in general nor the pricing in particular that makes a deal successful. Instead value is created more by strategic, integration and focused processes, which varies from deal to deal. Fourth, the results are uncertain since many of the studies only reject the null hypothesis but never confirm any of the alternative hypotheses, which in themselves are stronger proofs. Fifth, there is some truth in each position, which however makes its hard to draw any hard conclusions. Finally, similarly to the fifth point, since many of the positions are at loggerheads with each other, the only real conclusion may be that none of the views may be true.

Despite the fact that the conclusion of some economic returns from M&A-based growth is under some criticism, this is where a balanced conclusion ends up.

Return

The effect of return on the valuation multiple is somewhat dubious. This is so since an increase in ROIC in the formula will simultaneously increase EBITDA on the left handed side. So even if the profit increases, this has no implications for the valuation multiple of the company. An increase in profits may only lead to an increase in the total valuation if the multiple is constant. Whether or not multiple expansion will take place is unclear. However, a few theories regarding return and size are here described.

One reason large firms might be higher valued than small firms is economies of scale. Larger firms can use their size in strategic purposes and manage their assets in a more efficient way than smaller firms. Economies of scale can be divided into internal and external factors. Examples of internal factors are production, marketing and distribution efficiencies. External factors can take the form of greater market power in terms of lower purchasing and financing costs and probably a larger market share (Perloff 2007 and Comanor and Wilson 1969). In contrary, there is a point in where economies of scale no longer exist and average unit cost would be unrelated to firm size. If this was not the case, in theory, the largest firm would get a natural monopoly (Becker-Blease, Kaen & Baumann 2003). It should also be mentioned that, for obvious reasons, economies of scale is more important in certain industries than in others. In the academic world, the expression *optimal size* is commonly used, but few studies trying to observe the optimal size have been done (Jensen 1986).

Agency theory is one possible explanation to managers' preferences of growth over shareholder value. This would imply that large firms might prioritize size over shareholder value and thus tend to be undervalued compared to smaller firms. Since managers are the agents of shareholders, they may often have conflicting interests compared to the shareholders. A central agency issue in this relationship is the payout of cash. With a payout to the shareholders, the resources under the managers' control will decrease, and hence their power. Furthermore, by keeping the cash and fund projects internally, a firm is more likely to avoid the monitoring of the capital market and the possibility of funds being unavailable or charged a high price, which could occur with share issues (Easterbrook 1984, and Rozeff 1982). Managers, on the other hand, have incentives to grow the company beyond its optimal size using this cash. Growth will increase managers' power through the increased base of resources and their compensation, which is partly linked to the size of the firm (Murphy 1985). However, the occurrence of this particular link is likely to have decreased over time.

Two problems usually arise due to this tendency. First, overinvestment is the name of the phenomenon when managers invest in even negative NPV projects in order to grow the firm's size. A way to control managers not to pursue this strategy is to finance the company with more debt. Then however, underinvestment or debt-overhang may occur, which is when the debt repayments restrict managers to invest in some positive NPV projects (Jensen 1986, Hart and Moore 1994, and Myers 1977).

According to this theory, takeovers and diversification programs generally destroy value since these are two ways managers spend cash to grow the firm instead of paying it out to shareholders. Thus, the more equity-financed a firm is and the larger its free cash flows are, the larger the probability is that it will undertake inefficient mergers (Jensen 1986). This behaviour tends to be more frequent in consolidated mature industries than in new high-growth industries, which would imply that these large firms trade at a lower multiple compared to peers in other industries.

As is the case with economies of scale, the occurrence of agency costs would most probably directly lead to higher costs and a lower profit margin. Hence, this profit increase would only affect the valuation of the company but not its valuation multiple, which may be constant. However, this effect cannot be completely tested.

A third theory is the theory of management compensation discussed by Gabaix and Landier (2008). Since there is a competition of employing the most talented managers and CEOs, large firms with their advantageous access to the management labour market may be able to run their operations better and more efficient. This would result in a higher profit and valuation, but the effect on multiple expansion is again dubious.

Liquidity

In additional to the three drivers discussed above, there may be exogenous factors that can affect valuation multiples levels. Liquidity and visibility are such factors. These two are closed related due to the fact that an increase visibility of a firm usually increases its liquidity. Since many small firms, by their nature, are not as well-known and visible as their larger firms, they may be harder for buyers to find. This may result in that when a potential buyer approaches a small, and often private, firm, the buyer gets a proprietary dealflow, since other competing buyers may have difficulties to find and approach the same target company. The sole bidder may now be able to negotiate about a low transaction multiple due to the lack of competing bidders. But as firms grow larger, and especially when they list on a stock exchange, they tend to be more covered by analysts and enter the "radar" of potential buyers. This increased competition among the buyers would naturally push up the valuation multiple levels, even though the underlying business may be unchanged. Another factor that increases the liquidity for larger firms has been discussed in the chapter about discount rates. Since many institutional investors have restrictions to only stick to large and "familiar" firms, smaller firms get a lower liquidity, which has been observed frequently in empirical studies (Liu 2006, Audretsch and Elston 2000, and Banz 1981).

2.2 Previous Research

All in all, there has been very little research similar with our hypothesis. Albeit, we will give a brief discussion concerning prior studies.

Buy-and-build strategies

There is a lack of research done on buy-and-build strategies even though this is not a new phenomenon; buy-and build strategies have been around for almost a couple of decades, but in recent years, the amount of buy-and-build strategies that have been undertaken has increased significantly (Nicholson et al 2008).

Hoffmann (2008) analyzed German buy-and-build strategies with 21 cases of platform companies. The research is quantitative as well as qualitative since the data input is from interviews and questionnaires with private equity firms. Hoffman concludes that buy-and-build strategies were successful in creating value, especially by capturing synergy potential. 75 percent of the buy-and-build transactions resulted in an internal rate of return (IRR) exceeding 25 percent. Cost synergies, especially due to economies of scale, had the greatest impact on value creation. Thereafter, most value was created from revenue, management and financial synergies. With respect to the latter one, synergies were mostly expected to result from a higher exit valuation due to the larger size of the combined entity. However, in order to

value the target company, firms preferred using multiples-based valuation (75 percent) and second most common was DCF valuation (55 percent).

Of the other few studies in the field, most have been performed by private equity firms and large accounting firms, etc. Smit (2004) has published a couple of articles on buy-and-build strategies, but has been focusing more on the rationale behind investments rather than on the return to the investors and multiple expansion. Despite that the amount of research is small, previous research still implies that these strategies should be profitable and earn abnormal returns, which might imply a positive value-size relationship.

Size effect

In contrast to previous research, Moeller, Schlingemann and Stulz (2004) found that small firms' returns are significantly higher than large firm's when they make an acquisition announcement. This would imply that large firms tend to overpay for acquisitions. This might indicate that small firms make acquisitions at lower multiples than larger firms. The authors' explanation to this is that larger firms offer higher bid premiums than smaller firms and enter acquisitions with negative dollar synergy gains. This could imply that acquisitions made by smaller firms create more value than acquisitions made by acquirers, which are larger firm. In the research, Moeller et al used transaction value over total assets as a measure of relative size. However, whether multiple expansion takes place or not is not investigated.

In previous research on size effects, none of the studies have been done on exit multiples and multiple expansion. Since exit multiples are commonly used in private equity and M&A in general, it would be interesting to do the same study but focusing on relative valuation in terms of multiples.

3 Background on Buy-and-Build Strategies

Since there is somewhat of a lack of research on buy-and-build strategies and the relationship between multiple valuation levels and firm size, this chapter serves as a background on the subject. Buy-and-build strategies are also often called "leveraged build-up" (Allen 1999), "strategic roll-up" or "consolidation play" (Fordyce and Stewart 1994) in academia. This strategy is often defined as an initial buyout-type purchase of a company, usually called "platform", after which the private equity firm completes one or more add-on acquisitions (Baker and Montgomery 1994). These buy-and-build transactions are normally structured as horizontal acquisition strategies. The strategy usually target small and mid-sized firms where clear economies of scale and organizational improvements can be undertaken, and/or fragmented industries. The goal is then to consolidate the specific industry and to create a larger player in the relevant

market with a critical size. According to O'Donnell (2001), there are four different buy-and-build strategies.

Consolidation: This strategy is often motivated by rationalisation through vertical or more usually horizontal mergers particularly within mature and/or cyclical industries.

Build-up: This alternative consists of a large number of small acquisitions in a fragmented industry that together creates a new scale and scope of the business.

Missing link: This is a complementary acquisition in order to complete the product range or the geographic focus.

Roll-up: This strategy tries to impose the acquirer's successful business model on the add-on acquired companies.

3.1 Examples

This chapter illustrates how buy-and-build strategies can be applied in reality and how firms, by levering economies of scale from its growth, can be sold at a higher multiple than the entry multiple. This chapter gives a more practical understanding of how these strategies can be undertaken and will serve as support for the reasoning of this paper. However, since the buyout and exit multiples are some of the most well-preserved secrets of private equity firms, they are often not available, even from firm representatives. Despite that, this chapter works as an illustration of three cases where multiple expansions are most likely to have occurred according to our sources due to a clear and focused buy-and-build strategy which has grown the companies' sizes. One should however bear in mind that there are a number of drivers affecting the value creation, such as sales growth, expanding margins, business cycle valuation levels, debt pay downs, as well as multiple expansion, which makes the exact determinant of a higher multiple sometimes ambiguous.

Callenberg

Callenberg is an engineering group with a focus on electrical automation and heating, ventilation and air conditioning. Its main customers are found in the marine and offshore industry. Segulah, a Swedish private equity group, bought Callenberg in 2001 and 2002. In May 2001, 80 percent was acquired from the previous owner Expanda Design Group, a holding company focused on design companies. The remaining 20 percent was acquired in April 2002. The combined entry EV/EBIT multiple was 1.3x. Callenberg has historically been known for its good know-how and reputation but was showed signs of stagnation at the time of the acquisition. At this time, Callenberg had revenues of SEK 232m and an

operating profit of 18.6m. Segulah set up a board of directors with industry knowledge and together with Callenberg's management began reviewing expansion opportunities. This ended in a number of acquisitions. In 2003, Callenberg acquired the Marine Service and Switchboard division of Semco Maritime, a subsidiary of W. Obel A/S, a Danish maritime company. This was followed by the acquisition of AC Marine AS during the same year. In 2005, the Gothenburg-based Marine Ventilation service division of ABB Automation Technologies was acquired. During the fall of 2007, Segulah was approached by the listed Norwegian maritime service company Wilhelmsen ASA to sell Callenberg, which was being realized in February 2008. At this time, Callenberg had revenues of SEK 930m and an operating profit of SEK 68m. The exit EV/EBIT multiple was 4.2x (Segulah and Mergermarket).

The Callenberg case serves as an illustration of how buy-and-build strategies work in practice and it has many deal characteristics which are typical for these strategies, such as a stagnating industry, an unfocused subsidiary in a larger group and add-on acquisitions. The deal can be characterized as an initial acquisition of a "corporate orphan" division from an unfocused parent company. Thereafter the platform company made more complementary "missing link" acquisitions. Even though the profit margin declined somewhat, the threefold increase in revenues is the most probable reason to the strong multiple expansion, apart from the market conditions.

NVS

NVS is a Nordic heating, ventilation and sanitation installation firm historically focused on the Nordic market. In 2002, it was acquired by Segulah and Skandia Investment, two Swedish private equity firms, from its parent company NCC, in which group it was to a large extent neglected from the group management's attention. At this time, NVS had revenues of SEK 2.3bn and operating profit of SEK 48m. The entry multiple in the deal was EV/EBITDA 4.0x and the consideration SEK 431m. Soon after this deal, NVS started a focused strategy on expansion and profitability by a number of small acquisitions and organic growth, as well as reorganization. Four years later in 2006, NVS was sold to Triton, a UK-based private equity firm, for SEK 770m, or EV/EBITDA 8.0x. At this time, NVS had revenues of SEK 2.8m and operating profit of SEK 95m (Mergermarket).

The NVS case shows a very strong growth in the exit multiple and a strong increase in profit margins. This is mainly believed to be due to the clear and swift refocusing of the firm, a "consolidation" case within the company's market and favorable market conditions. Interestingly, despite a focus on expansion, NVS's revenues did not increase even close to the growth rate in profits and valuation multiples. However, a solid ground for further long-term growth is said to have been established and the company was professionalized and made more like a market leader.

Vaasan & Vaasan

Vaasan & Vaasan is a producer and distributor of bakery products, which is present in Finland and the Baltic states. EQT acquired Vaasan & Vaasan in 1998 from its former parent Cultor Corp., a food ingredients group, at a time when the bakery industry showed low growth as it was fragmented and mature. The total consideration was FIM 1bn (EUR 170m). A focus on a more industrial production was introduced and acquisitions were made in Sweden (Delice Scandinavica in 2003) and Lithuania (Vilniaus Duona). EQT exited the portfolio company in 2004 to the US-based private equity firm CapVest for a consideration of USD 317m (EUR 250m) and earned 4 times the equity invested. The determinants of the value creation in this transaction is estimated to be sales growth 39 percent, margin expansion 10 percent, multiple expansion 11 percent, and debt pay-down 40 percent (EQT).

During Vaasan & Vaasan's five years of EQT ownership, a strong growth in sales and profits was achieved partly by a number of cross-border acquisitions in order to create an industry leader with efficient production. We see here another "consolidation" case with within an earlier fragmented industry and the industrialization of an earlier labor-intense business. In this case, the strong multiple expansion can be partly explained by external market conditions but also factors for which revenues is a proxy. For example, the larger a company becomes the more probable it gets to gain a larger market size, more economies of scale and efficiencies in its production.

3.2 Interviews

In this section, the results from our interviews with private equity professionals are presented. This chapter is valuable since it shows how widespread the beliefs in a relative value-size relationship really are. Below, a joint summary of the interviews will be presented. This due to privacy reasons and also since we would like to describe the view of the industry as a whole, rather than the view of individual firms or individuals.

The views among private equity professionals on the issue that larger firms would be valued at a higher multiple are somewhat mixed but nevertheless follow a clear and interesting trend. At firms focusing on small and mid cap, it is usually argued that there should be such a relationship. The main reasons mentioned are the higher risk associated with smaller firms, lack of competing buyers and lack of diversified customers, product markets and internal firm infrastructure. At funds focusing on larger targets, the belief in this relationship is less articulated but is still mentioned, and other drivers are often highlighted more.

During the last decade, the availability of cheap credit and the number of competing buyout firms are mentioned as big reasons of the increase in valuation multiples of larger firms. This trend is however expected to be corrected somewhat during the current recession. Valuation levels for smaller firms have on the other hand been more stable.

Professionals also agree that there are often more improvements that can be done at smaller firms, such as more rapid growth and professionalization, which then could bring a higher relative valuation and new exit opportunities. However and maybe somewhat contradicting, some actors say that as firms grow "too" large, the number of exit alternatives diminish and leaves only public offerings as the only viable option, which would then bring down the competition among buyers and hence the valuation.

Despite a belief in a positive relationship between value and size, multiple expansion is never assumed in acquisition and IRR calculations as a rule. More common actually is to assume a negative multiple expansion due to general conservatism. It is argued that acquisitions usually should be able to generate attractive returns on a standalone basis since it is hard to assume ex-ante that all future add-on acquisitions will materialize completely.

4 Hypotheses

To test the relationship between transaction multiples and firm size, we need to state our hypotheses. From theory and observations, we have come down to the following two hypotheses.

Hypothesis 1: There is a positive relationship between transaction multiple levels and firm size.

This hypothesis is the result from a number of theories. We base this theory on first the size effect and its implications for undervaluation of small firms. Second the theories of liquidity and visibility support this hypothesis. In addition, this relationship is assumed to exist by many actors in the professional life. However, research on M&As shows no proof that firms would gain abnormally in value if they grow through mergers.

The, to some extent, disagreement between theories makes this phenomenon interesting to study, especially since the hypothesis has bearing and is recognized in practical professional organizations, but has no real foundation in theory and academics. The prevalence of buy-and-build strategies in practice makes us to believe in the first hypothesis.

Our second hypothesis takes the argument a step further. The pronounced strategy of many private equity firms, when pursuing a buy-and-build approach, is to buy small-size firms, merge them with other usually

small add-on acquisitions, and to grow them until they reach a certain size where they become visible to other larger potential buyers. During this increase in size, there is said to be an increase in valuation multiples, especially in buy-and-build cases (see interviews); this effect is referred to as multiple expansion or multiple arbitrage. For these small-sized acquisitions transaction costs are also smaller than for e.g. public firms. To investigate these characteristics further, our hypothesis is that there is a positive relationship between small firm sizes and valuation multiples, but as firms continue to grow further, this relationship becomes somewhat weaker, hence there may be a structural break in the size coefficient, i.e. whether the coefficient is different for a certain subsample compared to the rest of the data sample. Our objective is at the same time to investigate where, in terms of firm size, this break might be. Hence, the second hypothesis is:

Hypothesis 2: There is an inverse U-shaped structural break in the firm size coefficient for transaction multiple levels.

5 Sample and Data

In this paper, transaction data between 1994 and 2007 was used. For a discussion around the relevance of this data set, see chapter 6.3. The transaction observations were downloaded from the Capital IQ database, which entails descriptive and financial information of transactions occurring during the last years. Book-to-market ratios and average EBITDA-multiples sorted by year, industry and region, which intend to capture the effect of stock market valuations, were received from our tutor Per Strömberg. These have been calculated as the median of all observed transactions for the specific years, industries and regions.

The first criterion was that the EBITDA-multiple from the transaction should be disclosed and positive, which gave us 14,984 transactions. We then restricted the sample to completed transactions, which reduced our sample to 12,431 transactions. Thereafter, only mergers and acquisition were included, which lowered the sample size to 12,224 transactions. We thereafter chose the regions North America and Europe since the data from these regions usually is more reliable and frequently published. This shrank the number of transactions to 9,438. Due to the nature of its business and the exit multiple measure chosen, we excluded transactions with financial target companies, and ended up with a sample of 8,124 transactions. Then, we removed minority investments which gave us 6,518 observations. In addition, we removed transactions done in 2008 and 2009 due to lack of data for the controlling variables. Finally, transactions where revenue was missing were excluded. The final data set then consisted of 5,790 transactions.

In Figure 4 to 11, as well as in Table 1 and 2, we see some of the characteristics of the sample. We can observe that the non-financial transactions are somewhat evenly distributed across different sectors, with some bias towards industrials, consumer discretionary and information technology. Figure 9 shows that the majority of the transactions have taken place in North America. It might be more probable that this is due to that North American mergers are more frequently published and that they in a lesser extent take place in the private sphere. The cyclicality of mergers and acquisitions also becomes apparent from Figure 4. However, the low numbers of 1994 and 1995 may be due to a lack of data from the Capital IQ database that is used. Furthermore, the removal of negative EV/EBITDA observations may be unfair for small firms with negative earnings; however, these observations only make up a marginal fraction of the total sample.

6 Methodology

In order to evaluate our hypotheses, ordinary least squares regressions and Quandt likelihood ratio (QLR) tests were performed. We regressed the exit multiples against the size variable and a number of controlling variables to be able to assess the first hypothesis. The second hypothesis is then evaluated by QLR tests which study whether the exit multiple-size relationship is constant for all firm sizes, i.e. whether there is a structural break in the size coefficient (Quandt 1960 and Andrews 1993). A number of regressions based on subsamples were then conducted in order to see where such a break could be. This test has implications for our second hypothesis of which firm size that best suits a buy-and-build strategy.

Initially, a number of size variables were regarded such as revenue, market capitalization, total assets and number of employees. Market capitalization was excluded since these are obviously not available for the large number of private transactions. Other variables, such as total assets and number of employees, were omitted due to lack of explanatory power or multicollinearity. Revenue was chosen as it was the most significant single variable.

The second step was then to investigate the relationship between exit multiples and firm size by the following estimation equation while regarding a number of control variables.

$$\ln(EV/EBITDA)_i = \beta_0 + \beta_1 ln\ revenue + \beta_2 control\ variable_{1i} + \ldots + \beta_{43} control\ variable_{42i} + u_i$$

Thereafter, we performed a QLR test. This test analyses changes or breaks in the regression coefficients throughout the sample. This is desirable since the OLS or general relationship regression only estimates if the relationship holds “on average”, and this regression can be quite different from the true regression function for different subsamples. The test is of particular interest since one of our hypotheses is that

firms tend to get much more valuable, in relative terms, up to a certain size, after which the relationship is assumed not to be equally strong. This test is performed by adding additional dependent variables, for which you want to check the robustness, and let these additional variables be dependent on binary variables, $D(s)$, that equal zero and one before and after a certain break size, respectively. By varying the break size throughout the sample and simultaneously testing the hypothesis of the additional variable coefficients being zero, one can use the largest of the resulting F-statistics to test for a break at an unknown size (Stock and Watson 2003). Then the regression including the binary break indicator and the interaction terms is as follows.

$$\ln(EV/EBITDA)_i = \beta_0 + \beta_1 \ln revenue_i + \beta_2 control\ variable_{1i} + \ldots + \beta_{43} control\ variable_{42i} + \gamma_0 D(s) + \gamma_1 [D(s) \ln revenue_i] + u_i$$

We have then used three approaches to test where a structural break could be in the data sample. First, we regress on rolling samples of 2000 observations each over the entire sample. The length of a step was 50 observations. Second, we made a regression with the smallest 15 percent of the observations and let the sample expand by including larger and larger observations until the whole sample was regressed. Steps by 50 observations were used here as well. The final approach was performed the other way around. We started from the end with the largest 15 percent of the observations, and then expanded the sample backwards by including smaller and smaller observations. These approaches make it easier to interpret the characteristics of the revenue coefficient of the sample.

6.1 Variables

As a dependent variable, we had to choose a multiple since it is a relative measure unaffected by different firm sizes. The valuation multiple was chosen as enterprise value over earnings before interest, taxes, depreciation and amortization (EV/EBITDA) since this measure is more wide-spread and capital structure-neutral, compared to other conventional measures, i.e. the price-to-earnings ratio (Koller et al 2005). The ratios used are the implied multiples from the transactions and the natural logarithm was used to normalize these values and to make them less sensitive to outliers. In addition, we received higher adjusted R-square using natural logarithms than using absolute values. Earnings are taken from the target companies' last annual financial statements before the time of the transaction.

As aforementioned, the natural logarithm of revenue was used to estimate size, the independent variable, since this was the most significant single variable. The revenues are from the target company's last twelve month financials.

A number of control variables were introduced in order to control for certain transaction characteristics. These were as follows.

Year: Due to the cyclicality of the number of deals, seen in Figure 4, and the transaction valuation multiples, a control variable that accounts for the specific year of each transaction has been included in the regression representing all years reaching from 1994 to 2007.

Industry: Since different sectors usually trade at different valuation levels and have different characteristics, a control variable for the industry type is included. The industries follow Capital IQ's primary sector classification and are Consumer Discretionary, Consumer Staples, Energy, Financials, Healthcare, Industrials, Information Technology, Materials, Telecommunication Services, Utilities and Other. Excluded from the sample were financial companies as motivated in chapter 5, Sample and Data.

Region: To take into account the contingent discrepancy in valuation levels between North America and Europe, a region control variable was used. According to Koller et al (2005) North American firms, on average, trade at slightly higher multiples than European firms.

Valuation levels: Regardless if transactions are carried out in the public or private market, stock market valuations play an important role for the valuation. In order to adjust for this factor, we have introduced two control variables which measure the median and natural logarithmic EV/EBITDA and market-to-book ratio, respectively, sorted by year, industry and region, simultaneously. The years used were 1994 to 2007, while the industries were taken from the Fama and French 49 industry portfolio scheme. The company region in this variable was either Europe or North America. However, it is useful to have years, industries and regions as separate variables as well.

Deal attitude: To account for the deal attitude, variables were used to control for whether the deals were friendly or hostile.

Consideration: Since shareholders prefer cash over stock as acquisition consideration, they may accept different dollar considerations depending on which payment method is

used. Therefore, variables controlling for cash, combination of cash and equity, equity and other types of payment have been constructed.

Type of target: It could be interesting to see if acquisitions of specific types of companies influence the relative valuation. To test if this is the case, dummy variables for public or other private companies are tested for.

Type of seller: Variables to test for type of seller were constructed. By looking at what type of buyer there is in a transactions, one can draw conclusions of what kind of transaction that has taken place and what kind of target company that has been sold. These are now divided in independent firm, division and investment firm. For investment firms, many of the transactions are secondary buyouts but since both the seller and the buyer then have to be investment firms, this variable has not been renamed in that way. If investment firms do create value, a higher exit multiple would be expected. Therefore, we find it interesting to see how influential the type of seller, i.e. type of transaction, variable is.

Type of buyer: Type of buyer was tested for. The categories were public company, private company, and investment firm. Reasons for this variable is chiefly to see whether there is a difference between what financial and industrial buyers pay.

Initially, we started in a more parsimonious way where we excluded the industry, year and region control variables, since the market valuation level variables should take these effects into account. However, by including these variables the model gave us a higher explanatory power and a less significant intercept. We arrived at the final model by assessing relevant variables. A number of variables were omitted due to multicollinearity at the same.

7 Results and Analyses

The presentation and analysis of the results will take the following order. First, we will present the results from the overall regression, then the outcome of the QLR test and the additional subsample regressions will be showed. The results will then be discussed in the light of our hypotheses. Finally, conclusions of the analyses will be communicated.

7.1 General Relationship Regression

The results from this regression can be found in Table 3. Here we see that there is an insignificantly positive relationship between the multiple and size. The p-value amounts to 13.7 percent. Potential economic significance is also low. This rejects our first hypothesis that larger firms, on average, tend to be valued at a higher multiple in a transaction compared to smaller firms.

Moreover, when looking at the variables for different years, none is significant at ordinary significant levels. However, 1999 and 2000 are not surprisingly the closest ones to being significant due to the boom market at the time. Neither was the region nor the friendliness of the merger significant. A cash consideration proved negatively significant at a 1 percent significance level, at the same time as a combination of cash and equity was also negatively significant at a 5 percent level. This is in line with that investors prefer cash over stock, and may therefore accept a lower dollar consideration. The presence of the dot-com boom is also present in that the information technology sector variable was positively significant at a 1 percent level. Other industries such as healthcare and energy were positively and negatively significant at a 1 and 10 percent significance level, respectively. For the average multiple variables with regard to year, industry and region, the market-to-book ratio and the EV/EBITDA ratio were positively significant on a 1 and 10 percent significance level, respectively. For the target type, only the public company type variable was surprisingly negatively significant on a 1 percent significance level. Since public firms on average are larger than private firms, which can be seen in Table 1, this result contradicts our first hypothesis. This could potentially be further studied since the private/public status can be a proxy for size, but this lies outside the scope of this paper. The type of buyer firm was also very significant, rendering the public and private company variables all being positively significant at a 1 percent significance level. Public firms tended to pay somewhat more than private firms. For sellers, or type of transactions, divisional and independent company acquisitions were both significantly negative at a 2 and 1 percent significance level, respectively, while investment firms was dropped due to multicollinearity. We are aware that the intercept has a high t-value, which may show some lack of explanatory power of the variables; however, it, together with the adjusted R-squared value, is more satisfying than the previous tested regressions.

7.2 Quandt Likelihood Ratio Test

The results from the QLR test can mainly be found in Figure 12 to 14. We see that there exist two different structural breaks in the size regression correlation coefficient, both at a 1 percent significance level. The first break lies at sales between around USD 10-30m while the second break comes more in the form of a slow evolution of the regression function in the interval of USD 190-660m. Thus, we can draw the conclusion that the general relationship tested for in the first analysis is not representative for all

subsamples. Figure 15 to 17 give a better illustration of how the multiple-size relationship varies across firm sizes as we here have used a rolling sample. It is now seen that the relation is increasingly positive around USD 20-50m, after which the relationship starts to decline and, roughly, the relationship is negative for firms with annual sales between USD 270-630m. In these two ranges, the coefficient is significant at a 5 percent level, but in between these intervals, the relationship is not significant. Since there are obviously more observations of small firms than large firms in the sample, the intervals look different with different lengths, despite that they are based on roughly the same number of observations each, which can be seen in e.g. Figure 12 and 15. The positive relationship in the beginning of the sample and the negative relationship in the end are confirmed in Figure 18 to 21. Figure 18 and 19 use a data sample which starts with the smallest observation and expands more and more to the right with larger observations. Now the beta gets significantly positive during a large part of the total sample, since there are many strong positive observations among the smaller observations, and eventually diminishes, but never turns negative. Figure 20 and 21, on the other hand, start with the largest observations and expands to include more and more small observations. Here, beta turns significantly negative and stays there during a large part of the total sample, when plotting against number of observations, since the largest negative observations are now included in every regression. When plotting against ln(revenue), the interval with a negatively significant revenue coefficient is not equally long due to more widespread observations in the end of the sample. It is hard to draw any definite conclusions from these four cumulative figures regarding exact interval limits for the size coefficient, but it becomes clear that there are a number of influential observations in the beginning of the sample and in the end, respectively. These limits may be more easy to observe in the rolling regression in Figure 15 to 17, but the cumulative approach of Figure 18 to 21 shows other interesting characteristics of the sample, such as how the small and large observations affects the total outcome.

In line with our second hypothesis, we saw that there was an increasingly strong relationship until a certain firm size and a decreasingly strong relationship thereafter. What we however did not expect to see was, interestingly enough, that the multiple-firm size relationship eventually turned negative after a certain point in size. These results have implications for within which size intervals buy-and-build and similar strategies could be more profitable than elsewhere.

Furthermore, to avoid the impact of outliers, a DFBETA test was performed to see how influential each observation was. We see that the most powerful observations lie in the beginning of the sample. This is likely to be due to the more volatile nature of small firms with regard to valuation levels compared to revenues. However, this is not affecting the reliability of the earlier tests since no observation has outlier characteristics.

7.3 Discussion

A discussion around the relevance of the data sample and the approach is appropriate. In this paper, our main scope is to investigate the general relationship between transaction exit multiples and firm size. This has implications for buy-and-build strategies that assume such a relationship and are becoming more and more common. However, the empirical study in this paper does not test whether these strategies earn abnormal returns or not, but rather tests the general relationship. To get a feeling of how buy-and-build strategies work in practice, three examples have been included.

There are a number of reasons why a direct test of buy-and-build strategies is not conducted. One is that the transaction data includes both buy-and-build and other transactions. For the buy-and-build ones, there is no information about whether the target is a result of such a strategy or an add-on acquisition. For the rest of the transactions, we do not know the growth of the companies; hence it is hard to tell whether the exit multiples of firms increase as a firm grows or if the size of the companies has been more or less constant and that they are valued accordingly.

A way of empirically testing buy-and-build strategies directly would be to follow a number of platform, private and/or public, companies that are pursuing this strategy, and compare their value growth to those of another corresponding panel data set of non-buy-and-build companies, in order to assess any abnormal returns. This approach is however hard from a data availability point of view, but might be subject to further studies, why cross-sectional transaction data may be the only practical alternative. As earlier stated, the interviews with private equity professionals and the number of examples are used to complement the empirical study.

Moreover, the selection of dependent variables poses some issues with regard to testing these strategies as well. There is a risk that the size variable, in terms of sales, might be a proxy for other unknown variables, such as liquidity, public/private firm characteristics, gains from true economies of scale, synergies and increasing market share, which in turn apparently affects the valuation multiples. Although it is an interesting point, it has however no direct implications on the tests of our hypotheses.

Another issue is the choice of transaction data compared to data of listed companies. While analysing public firms' value and revenue growth might also be of interest and subject to further research, it has not that much implications for buy-and-build strategies that frequently use private transactions to grow and to exit. Furthermore, since this area has been well explored by a number of researchers, such as Banz (1981) and Fama and French (1993), we are aiming at casting some light upon another area of finance which has not previously received that much attention.

One final remark is regarding the size distribution of the data sample. While there are naturally more transactions of smaller firms than larger firms, this may have some implications for the representativeness of the sample. Since the first part of the analysis tests an overall relationship for all firm sizes, this regression might be distorted by the high number of small observations vis-à-vis large firms. This is to some extent seen in Figure 22's DFBETA measure. However, there are no influential outliers in the sample. Finally, we believe that our analysis is fair and reflects the true nature and characteristics of transactions at different firm sizes.

7.4 Conclusions

The first main finding in this paper is that there is no overall significant relationship between valuation multiple levels and the size of the firm, in terms of revenue. The second key finding is that such significant relationships do exist, but only for certain subsamples. This relationship is strong and positive for small-sized companies, while for larger companies this relationship turns negative. Exactly where the relationship shifts from positive to negative is, for obvious reasons, hard to tell. These findings were also, to some extent, confirmed by a number of private equity professionals and illustrated by the examples of buy-and-build strategies.

In the light of financial theory, the different characteristics for various firm sizes can be explained. First, the reason why small firms are undervalued compared to mid-sized firms can to a large extent be explained by a higher discount rate, which, according to the size effect theory, could be associated with "risky" small firms. Low liquidity and propriety deal processes are also believed to explain this phenomenon. However, growth opportunities, which are often related to small firms, should, in theory, increase the multiples for these companies, but this increase seems to be offset by the effects of the previously mentioned explanations. Second, for a bit larger firms, where this relationship is positive and significant, the higher multiple valuation levels can be explained mainly by an increased visibility and liquidity, and that the risk associated with small firms has diminished somewhat. The visibility and liquidity theories imply that there are a larger number of potential buyers for small and mid cap firms, than for very small-sized firms. This shows that there is a more efficient M&A market for mid-sized firms, where investment banks usually connect buyers, sellers and targets, than for small firms, where the process usually is more discretionary and more asymmetric. Third, the negative relationship for large firms can be explained by lower competition among buyers of these large firms. A second reason, in line with theory, is the lack of growth opportunities for large firms. On the other hand, the lower discount rates for large companies should, in theory, value these companies relatively higher. Theories that did not give any clear conclusions were economies of scale and agency costs.

These results are a possible explanation to the wide-spread presence of buy-and-build strategies and their focus on small to mid-sized companies. The rationale for such a strategy is often said to be to consolidate the industry and/or to gain market share; patterns that are more common in markets with no obvious market leaders. The consolidation motive is one possible explanation to why this is the most preferred size-interval for buy-and-build strategies.

This paper has implications for such investors and other practitioners who regard this issue. This paper could cast some light upon where, in terms of revenues, this strategy could be attractive, namely roughly between USD 20m and 50m. However, we are aware that a buy-and-build strategy may make sense for a number of reasons in addition to multiple expansion and that this is not the sole goal of pursuing such strategies. Therefore, our results should serve more as guidelines than explicit target ranges.

An area of further research would be to evaluate buy-and-build strategies from the private equity firms' point of view. Even though there now are some evidence of that larger firms are valued at a higher multiple than small firms, in general in a transaction for a certain interval of small and medium sized firms, it would be interesting to measure how the IRRs are affected by the intermediate bolt-on acquisitions and contingent capital infusions. Another interesting field of further studies would be to follow a cross-sectional set of companies as they grow across time and see how their valuation multiples change.

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9 Appendix

Table 1 Descriptive statistics for the transactions

		EV/EBITDA			Revenue		
	No. Obs	Mean	Min	Max	Mean	Min	Max
All Transactions	5 790	17.3	0.1	297.4	695.8	0.0	61 831.0
Consumer Discretionary	1 170	13.8	0.1	268.2	717.9	0.1	61 831.0
Consumer Staples	317	12.9	0.4	150.7	1 347.4	0.4	41 273.0
Energy	517	12.1	0.4	251.2	776.0	0.1	56 923.0
Healthcare	519	22.0	0.1	271.1	699.2	0.0	36 750.2
Industrials	1 179	14.8	0.1	247.0	497.4	0.1	13 474.0
Information Technology	1 238	26.6	0.1	291.1	294.5	0.1	40 393.0
Materials	464	11.4	0.7	264.9	1 199.0	0.2	43 885.3
Telecommunication Services	176	23.4	0.3	297.4	1 510.0	1.9	30 537.0
Utilities	138	10.5	0.5	49.5	1 613.3	0.3	27 037.2
Other Industry	72	16.0	0.4	152.5	21.2	0.0	227.8
1994	6	8.3	5.9	10.2	3 387.3	474.9	10 179.1
1995	36	23.2	1.3	260.3	953.2	27.6	6 691.7
1996	82	17.5	3.1	192.8	904.7	0.6	13 474.0
1997	192	15.7	0.3	176.2	521.1	1.9	20 585.0
1998	470	18.2	0.6	297.4	913.8	0.3	61 831.0
1999	527	22.5	0.3	279.8	566.1	0.0	12 937.7
2000	531	21.7	0.4	268.2	842.2	0.3	46 362.0
2001	456	15.5	0.1	247.0	696.1	0.2	40 393.0
2002	325	14.1	0.1	258.2	619.1	0.4	16 947.0
2003	425	13.9	0.1	254.1	405.1	0.4	14 679.6
2004	510	16.8	0.4	271.1	516.5	0.3	21 153.8
2005	560	18.5	0.1	291.1	816.9	0.1	30 537.0
2006	729	15.4	0.1	269.5	826.5	0.1	43 885.3
2007	941	16.4	0.2	264.9	648.6	0.1	27 037.2
North America	4 524	18.1	0.1	297.4	681.5	0.0	61 831.0
Europe	1 266	14.8	0.1	291.1	746.6	0.4	43 885.3
Friendly	5 740	17.4	0.1	297.4	677.5	0.0	61 831.0
Hostile	50	14.4	1.2	49.3	2 789.8	9.5	43 885.3
Cash	3 477	14.3	0.1	274.7	567.5	0.2	27 037.2
Common Equity	851	25.9	0.1	297.4	1 088.6	0.0	61 831.0
Other	764	19.6	0.1	291.1	1 100.4	0.1	56 923.0
Combinations	698	19.6	0.3	268.2	412.6	0.1	18 914.0
Target - Private Company	4 797	17.7	0.1	297.4	625.5	0.0	61 831.0
Target - Public Company	993	15.6	0.1	264.9	1 035.1	0.0	56 923.0
Seller - Independent Firm	3 733	16.8	0.1	291.1	710.6	0.0	61 831.0
Seller - Investment Firm	1 130	18.9	0.1	279.8	587.6	0.4	43 885.3
Seller - Division	927	17.4	0.1	297.4	767.6	0.1	27 037.2
Buyer - Public Company	3 159	19.3	0.1	291.1	802.4	0.0	61 831.0
Buyer - Private Company	1 828	16.8	0.1	297.4	474.4	0.0	26 366.0
Buyer - Investment Firm	803	10.8	0.2	267.0	780.2	2.0	24 978.0

Table 1 The table consists of descriptive statistics of the sample with minimum, maximum and mean values for EV/EBITDA and revenue.

Table 2 Transaction sample by year and industry

Year	Consumer Discretionary	Consumer Staples	Energy	Healthcare	Industrials	Information Technology	Materials	Telecom. Services	Utilities	Other Industry	Total
1994			1	1	3		1				6
1995	7	4	1	6	6	6	3	1	2		36
1996	22	3	2	6	19	14	7	1	7	1	82
1997	45	14	8	24	33	42	14	8	3	1	192
1998	100	27	27	40	102	87	40	18	12	17	470
1999	109	28	24	32	127	106	42	18	26	15	527
2000	103	39	40	43	112	131	41	9	12	1	531
2001	83	22	91	32	80	82	35	10	10	11	456
2002	53	27	30	30	79	56	34	5	4	7	325
2003	101	20	24	37	98	104	22	6	10	3	425
2004	118	25	48	48	82	115	36	22	10	6	510
2005	118	21	52	44	103	141	37	26	14	4	560
2006	149	37	71	62	145	147	75	27	14	2	729
2007	162	50	98	114	190	207	77	25	14	4	941
Total	1170	317	517	519	1179	1238	464	176	138	72	5790

Table 2 Transactions performed in our sample sorted by industry and year.

Table 3 Description of Variables in Regression

Variable	Type	Variable name	Characteristics and Comments
EV/EBITDA	Dependent	ln_ev_ebitda	Computed by natural logarithm
Revenue	Independent	ln_revenue	Computed by natural logarithm
Healthcare	Control	i_healthcare	Dummy
Consumer Discretionary	Control	i_consumerdiscretionary	Dummy
Industrials	Control	i_industrials	Dummy
Energy	Control	i_energy	Dummy
Telecom	Control	i_telecom	Dummy
Information Technology	Control	i_it	Dummy
Materials	Control	i_materials	Dummy
Consumer Staples	Control	i_consumerstaples	Dummy
Utilities	Control	i_utilities	Dummy
Other Industry	Control	i_otherindustry	Dummy
Year	Control	y1994-y2007	Dummy
Region Europe	Control	r_europe	Dummy
Region North America	Control	r_northamerica	Dummy
Average EV/EBITDA	Control	ln_a_ev_ebitda	Computed as an average value of transactions in the market by industry, year and region (natural logarithm)
Average Market-to-Book	Control	ln_a_mkt_book	Computed as an average value of transactions in the market by industry, year and region (natural logarithm)
Friendly deal	Control	p_friendly	Dummy
Hostile deal	Control	p_hostile	Dummy
Cash Consideration	Control	c_cash	Dummy
Combination Consideration	Control	c_combinations	Dummy - Combination of cash and equity
Common Equity Consideration	Control	c_commonequity	Dummy
Other Consideration	Control	c_other	Dummy
Target - Public	Control	t_public	Dummy
Target - Private	Control	t_private	Dummy
Seller - Division	Control	s_division	Dummy - Division of a company
Seller - Investment Firm	Control	s_investmentfirm	Dummy
Seller - Independent	Control	s_independent	Dummy - Sale of whole company
Buyer - Public	Control	b_public	Dummy
Buyer - Private	Control	b_private	Dummy
Buyer - Investment Firm	Control	b_investmentfirm	Dummy

Table 4 General regression

Source	SS	df	MS		Number of obs =	5570
Model	558.994281	35	15.9712652		F(35, 5534) =	22.78
Residual	3880.55626	5534	.701220863		Prob > F =	0.0000
					R-squared =	0.1259
Total	4439.55054	5569	.797189897		Adj R-squared =	0.1204
					Root MSE =	.83739

ln_ev_ebitda	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_revenue	.0093005	.0062596	1.49	0.137	-.0029707	.0215718
i_healthcare	.3375281	.0843529	4.00	0.000	.1721633	.502893
i_consumer~y	.1182448	.0774288	1.53	0.127	-.0335461	.2700356
i_industri~s	.0569993	.0775318	0.74	0.462	-.0949935	.2089922
i_energy	-.1414925	.0832542	-1.70	0.089	-.3047034	.0217185
i_telecom	.0671436	.0968638	0.69	0.488	-.1227474	.2570346
i_it	.2609061	.0807385	3.23	0.001	.1026269	.4191853
i_materials	-.0495434	.0830701	-0.60	0.551	-.2123933	.1133066
i_consumer~s	.1267427	.0869183	1.46	0.145	-.0436512	.2971367
i_utilities	(dropped)					
i_otherind~y	-.0762378	.1884046	-0.40	0.686	-.4455847	.2931092
y1994	(dropped)					
y1995	.2712184	.3708931	0.73	0.465	-.4558778	.9983146
y1996	.1759904	.3555742	0.49	0.621	-.5210746	.8730555
y1997	.1961732	.3486361	0.56	0.574	-.4872904	.8796369
y1998	.3104666	.3454142	0.90	0.369	-.3666809	.9876142
y1999	.3621635	.3450305	1.05	0.294	-.3142317	1.038559
y2000	.3655857	.3452734	1.06	0.290	-.3112856	1.042457
y2001	.0492086	.3456866	0.14	0.887	-.6284728	.7268901
y2002	.0181041	.3466007	0.05	0.958	-.6613695	.6975777
y2003	-.0052865	.3458427	-0.02	0.988	-.683274	.6727011
y2004	.1396377	.3455319	0.40	0.686	-.5377405	.8170158
y2005	.219034	.3454686	0.63	0.526	-.4582202	.8962881
y2006	.1751484	.3452928	0.51	0.612	-.5017611	.852058
y2007	.2320631	.3449156	0.67	0.501	-.4441069	.9082331
r_europe	-.0419411	.0307887	-1.36	0.173	-.102299	.0184169
r_northame~a	(dropped)					
ln_a_ev_eb~a	.1104468	.0625412	1.77	0.077	-.0121586	.2330521
ln_a_mkt_b~k	.3212086	.0375686	8.55	0.000	.2475595	.3948578
p_friendly	-.0631745	.1237566	-0.51	0.610	-.3057861	.179437
p_hostile	(dropped)					
c_cash	-.1700881	.0355868	-4.78	0.000	-.2398522	-.1003241
c_combinat~s	-.0900922	.0459448	-1.96	0.050	-.180162	-.0000224
c_commoneq~y	.0686699	.044918	1.53	0.126	-.019387	.1567269
c_other	(dropped)					
t_public	-.1237004	.031691	-3.90	0.000	-.1858272	-.0615736
t_private	(dropped)					
s_division	-.0893696	.038498	-2.32	0.020	-.1648408	-.0138984
s_investme~m	(dropped)					
s_independ~t	-.1276216	.0301197	-4.24	0.000	-.1866679	-.0685752
b_public	.2186411	.0363908	6.01	0.000	.1473008	.2899813
b_private	.1300767	.0375634	3.46	0.001	.0564376	.2037157
b_investme~m	(dropped)					
_cons	1.71935	.4020983	4.28	0.000	.9310795	2.50762

Table 4 Regression table for the entire sample, where ln(EV/EBITDA) is the dependent variable and ln(revenue) is the independent variable. Control variables were year, region, industry, type of target, type of bidder, type of seller and average ln(EV/EBITDA) multiple and ln(market-to-book) value by industry, year and region.

Figure 1 Number of follow-on acquisitions by private equity backed firms

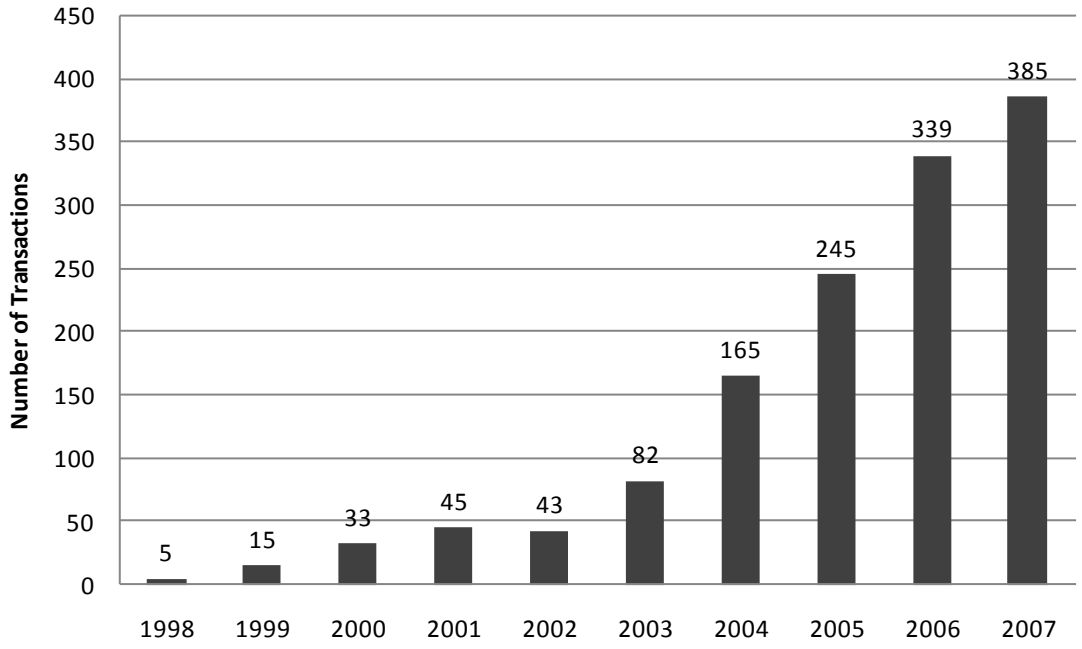

Figure 1. Source: MacDougall and Whiley 2008

Figure 2 Private equity strategy and profit growth

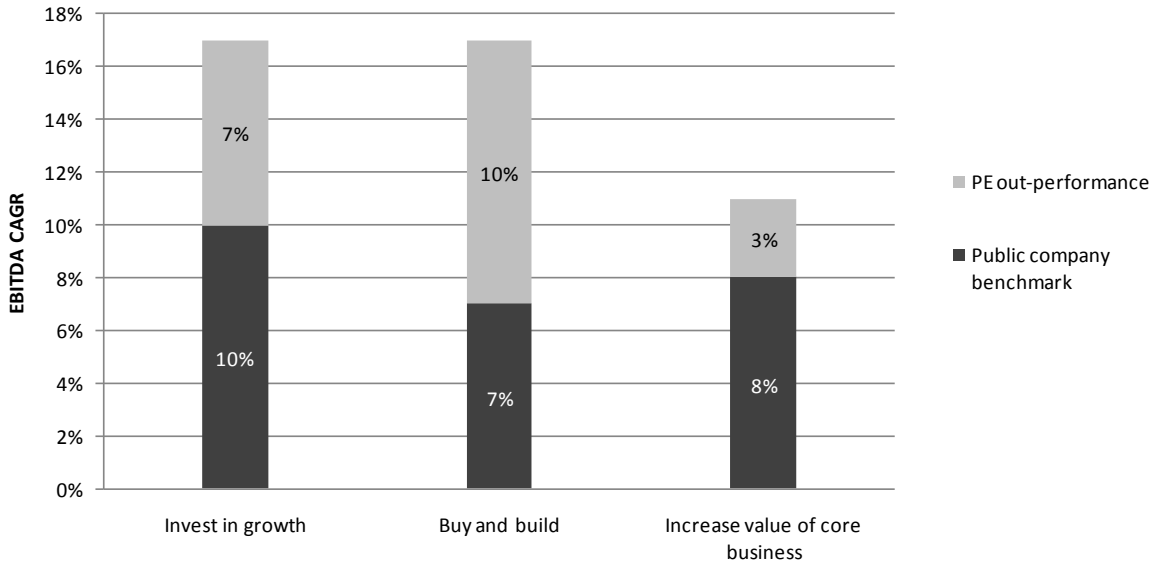

Figure 2. Source: Nicholson et al 2008

Figure 3 Type of seller and value growth

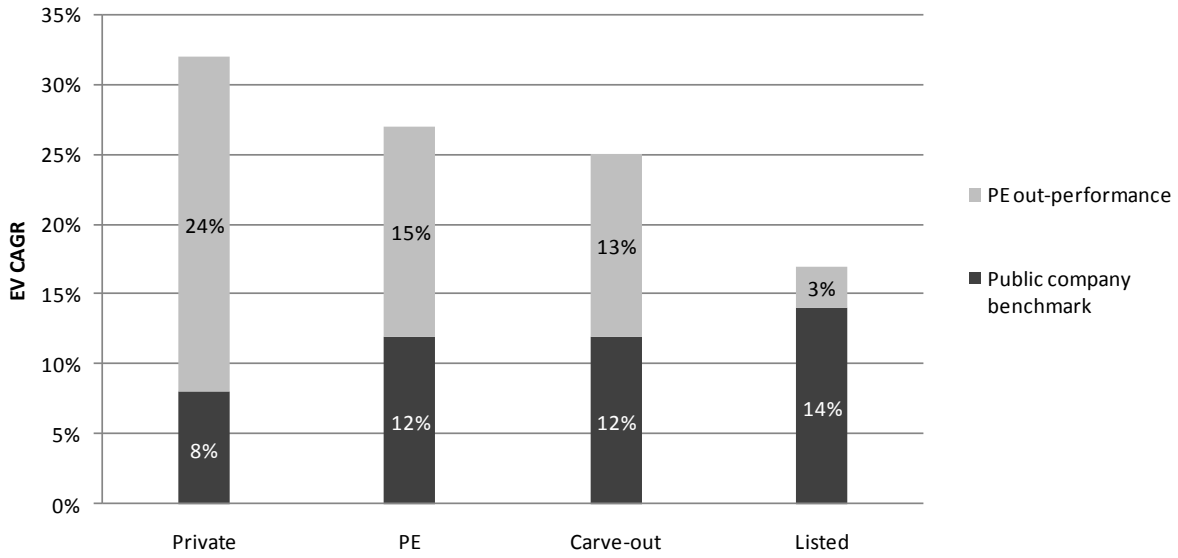

Figure 3. Source: Nicholson et al 2008

Figure 4 Transactions by year

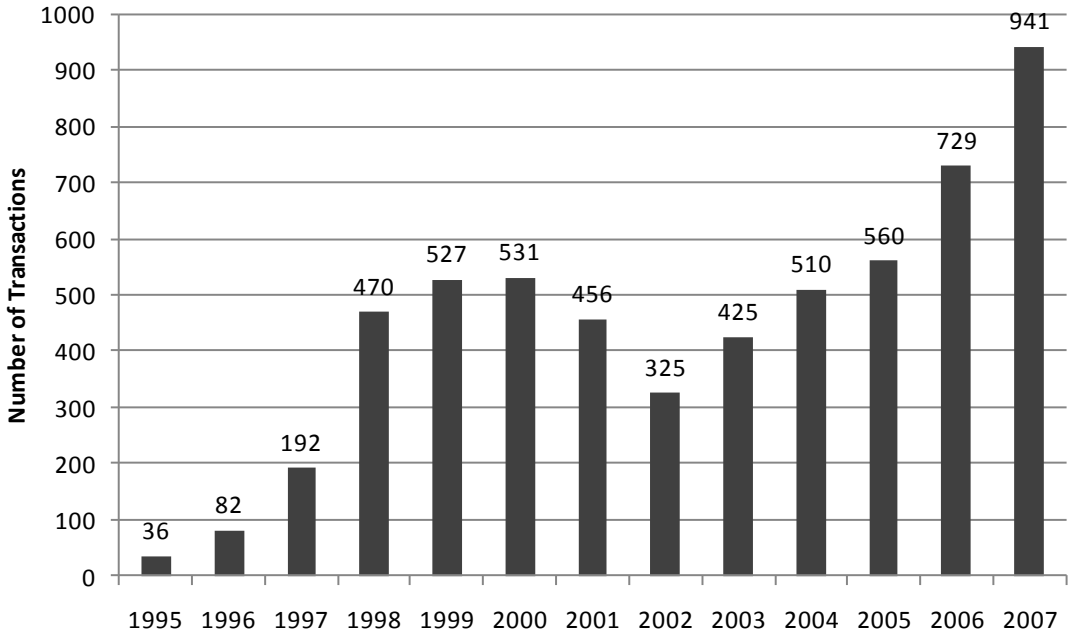

Figure 5 Transactions by industry

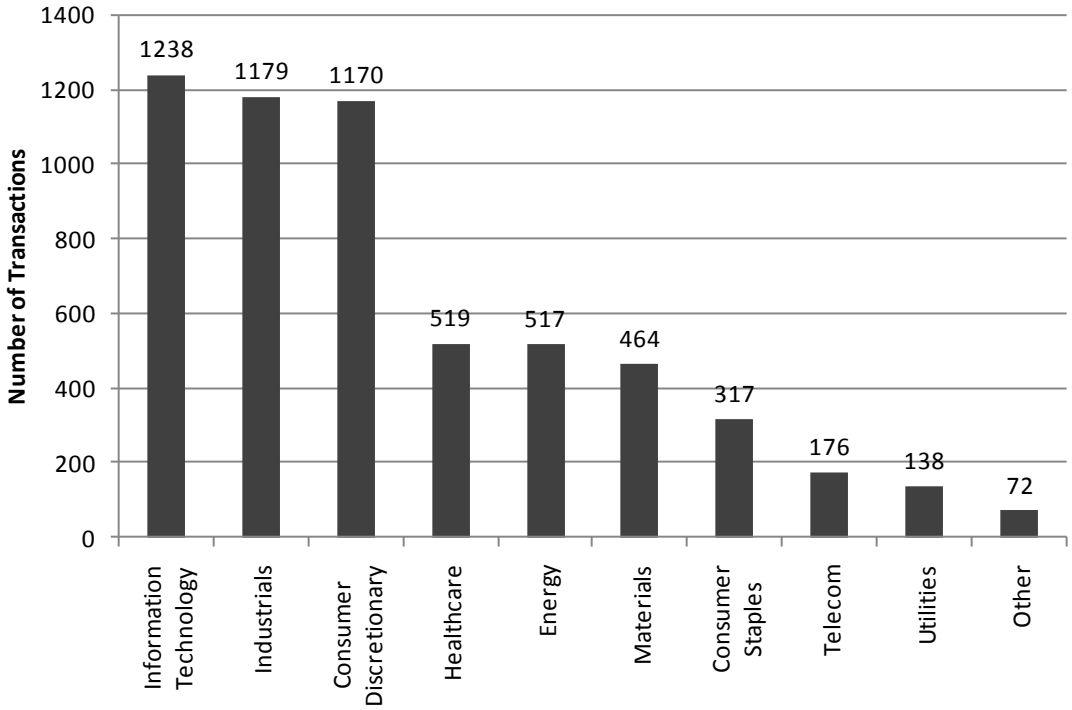

Figure 6 Transactions by type of buyer

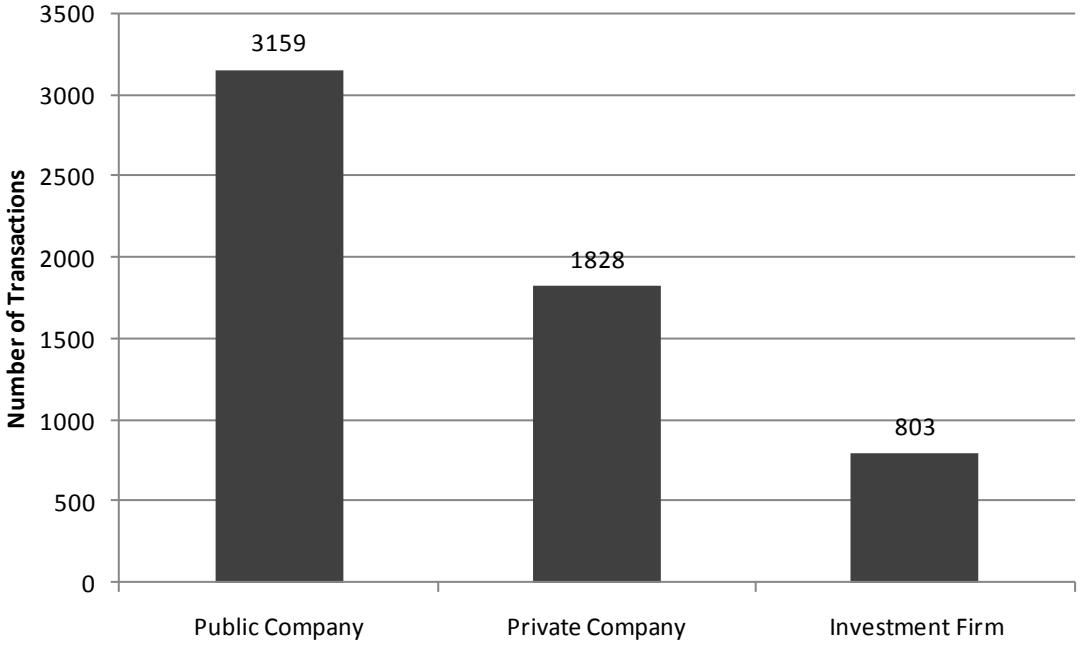

Figure 7 Transactions by type of target

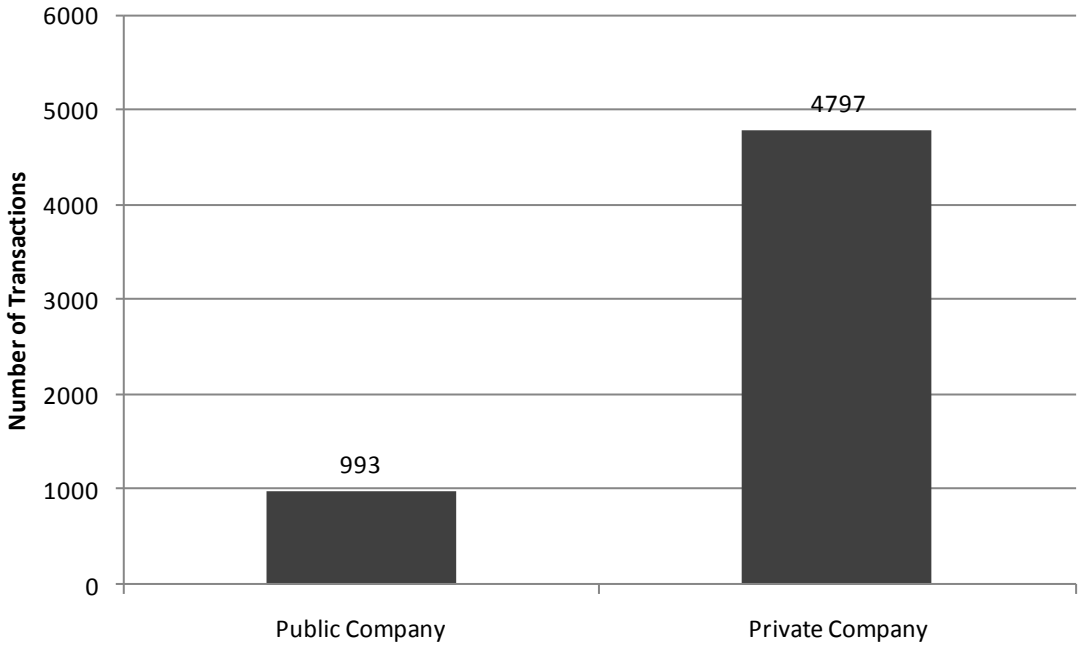

Figure 8 Transactions by type of seller, i.e. type of transaction

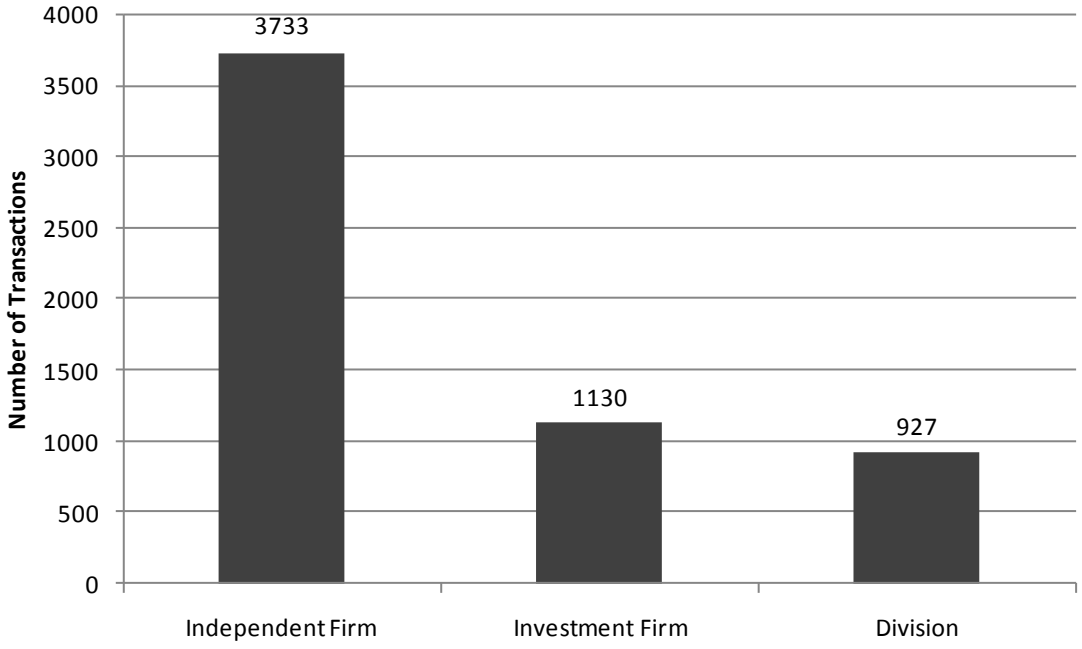

Figure 9 Transactions by region

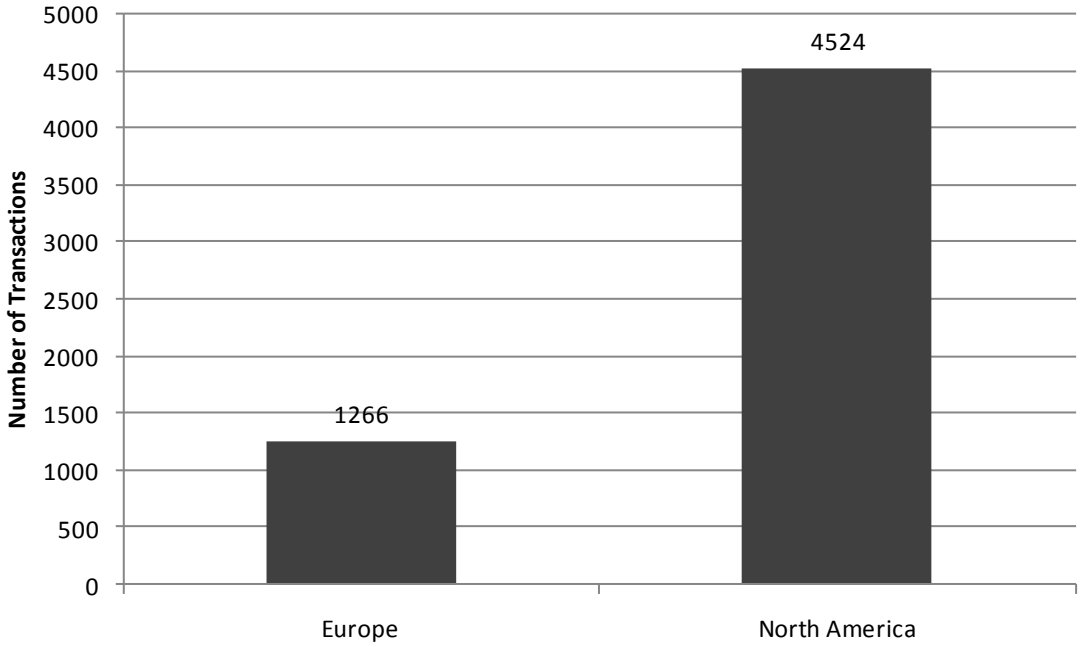

Figure 10 Largest revenue of all transactions divided into deciles (logarithm values)

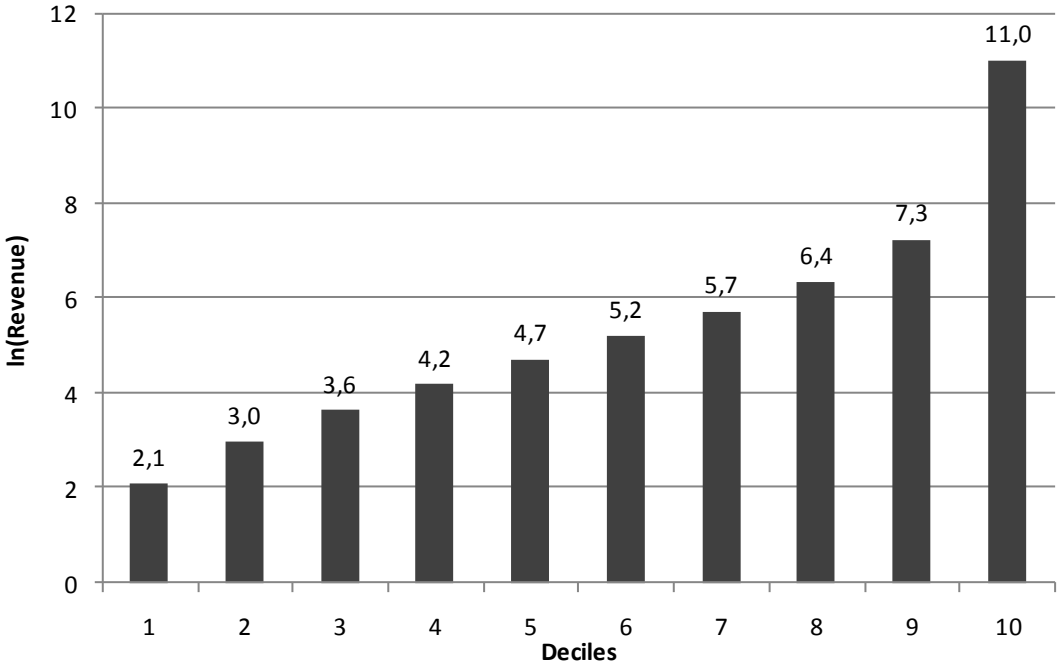

Figure 10 In this figure, all the transactions have been dived into ten deciles with an equal amount of transactions in each decile. The largest revenue (using the natural logarithm) for each decile is presented in the figure.

Figure 11 Largest revenue of all transactions divided into deciles (absolute values)

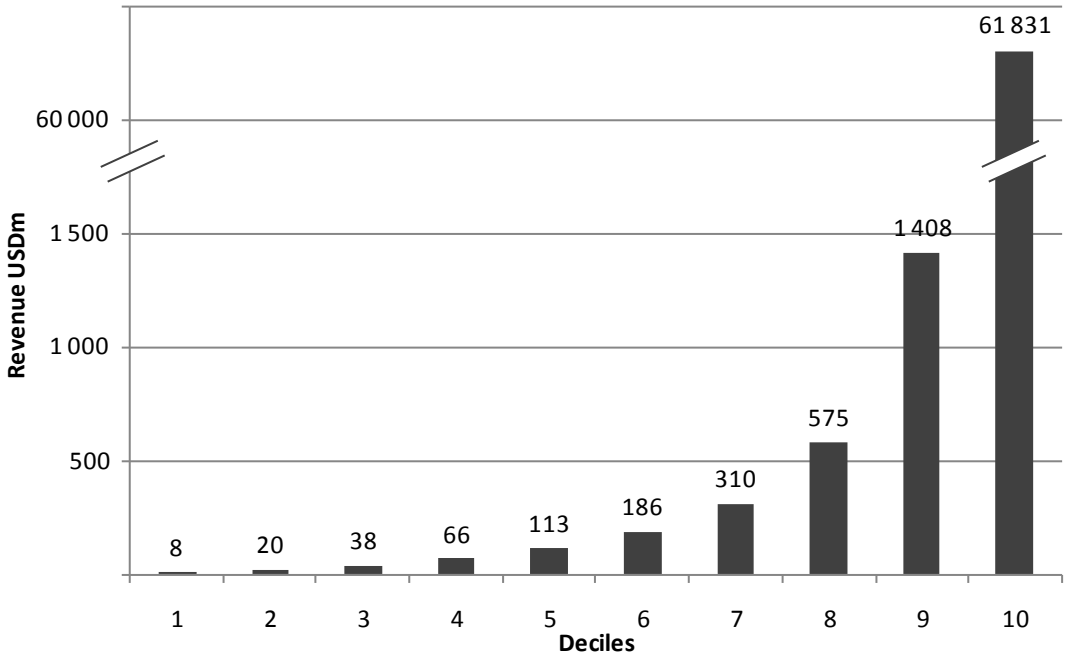

Figure 11 This figure is similar to Figure 10 but the revenues are in absolute numbers instead of logarithmic numbers. In this figure, all the transactions have been dived into ten deciles with an equal amount of transactions in each decile. The largest revenue for each decile is presented in the figure. The y-axis is broken due to the large values in the tenth decile.

Figure 12 Quandt Likelihood Ratio test by observations

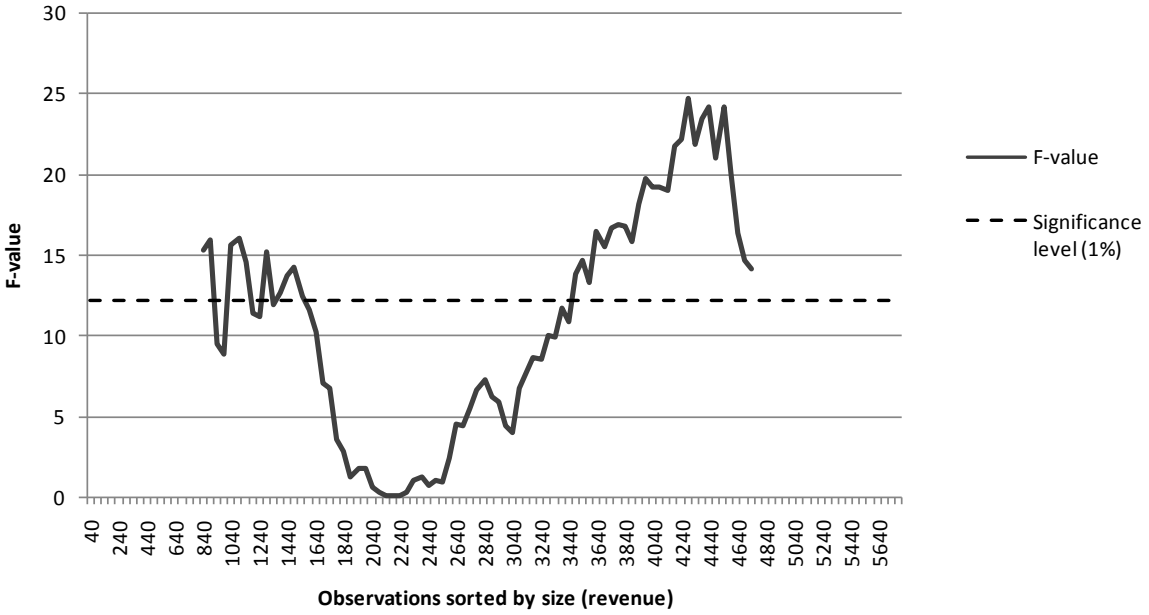

Figure 12 The Quandt Likelihood Ratio test measures potential structural breaks in the coefficients. Here, a structural break in the ln_revenue coefficient is tested for. If the F-values are larger than the significance level, a structural break is said to exist. This means that there could be a jump or a change of sign in the revenue coefficient at this point.

Figure 13 Quandt Likelihood Ratio test by ln(revenue)

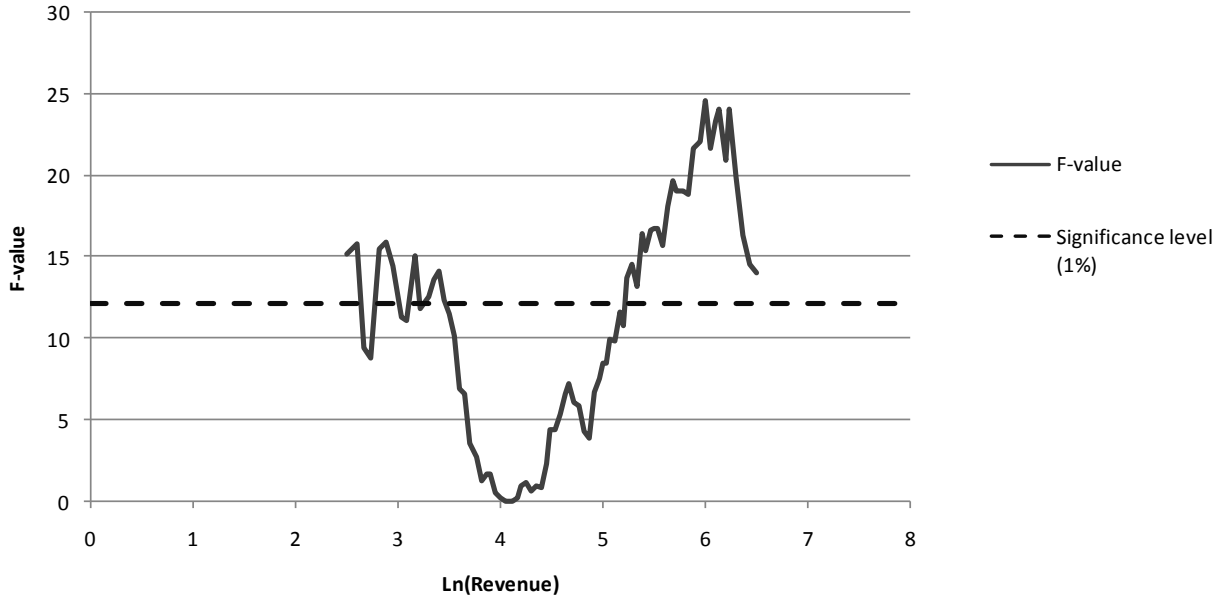

Figure 13 This figure is similar to Figure 12, but here the test has been plotted against ln(revenue) instead of observations. The Quandt Likelihood Ratio test measures potential structural breaks in the coefficients. Here, a structural break in the ln_revenue coefficient is tested for. If the F-values are larger than the significance level, a structural break is said to exist. This means that there could be a jump or a change of sign in the revenue coefficient at this point.

Figure 14 Quandt Likelihood Ratio test by absolute revenue

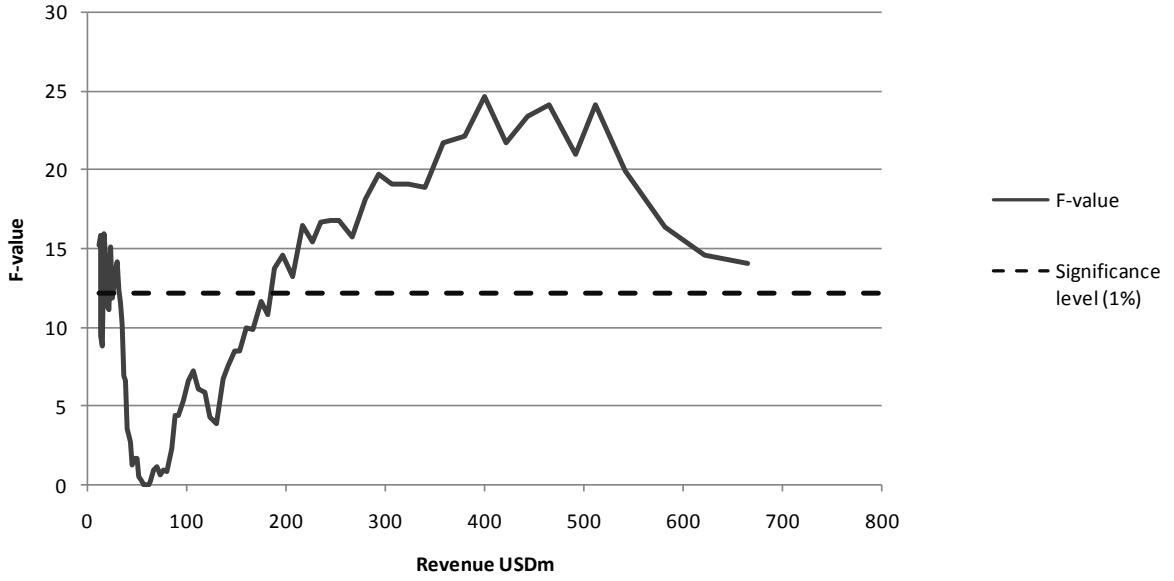

Figure 14 This figure is similar to Figure 13, but here the test has been plotted against absolute revenue instead of ln(revenue). The Quandt Likelihood Ratio test measures potential structural breaks in the coefficients. Here, a structural break in the absolute revenue coefficient is tested for. If the F-values are larger than the significance level, a structural break is said to exist. This means that there could be a jump or a change of sign in the revenue coefficient at this point.

Figure 15 Betas and t-values for the revenue coefficient from regressions with a rolling subsample plotted against the number of observations

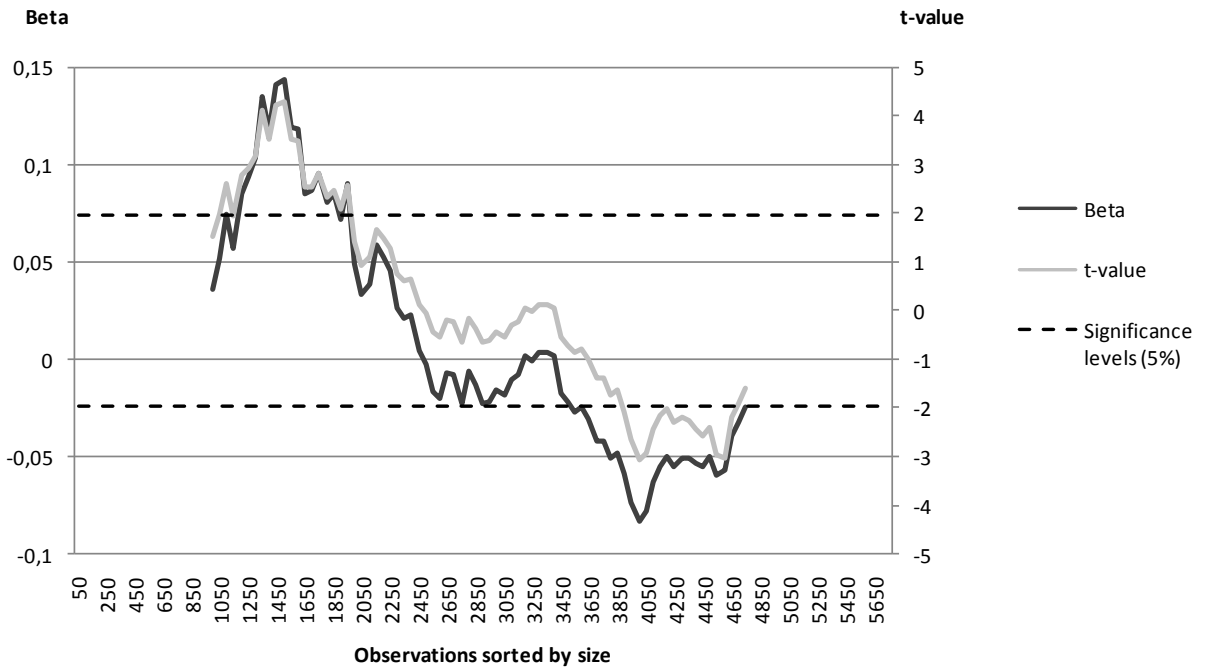

Figure 15 In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against observations sorted by revenue. Subsamples of 2,000 observations each have been rolled over the entire sample from left to right. The subsample rolls with steps of 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. The observations in the figure are the midpoints in each subsample. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 16 Betas and t-values for the revenue coefficient from regressions with a rolling subsample plotted against ln(revenue)

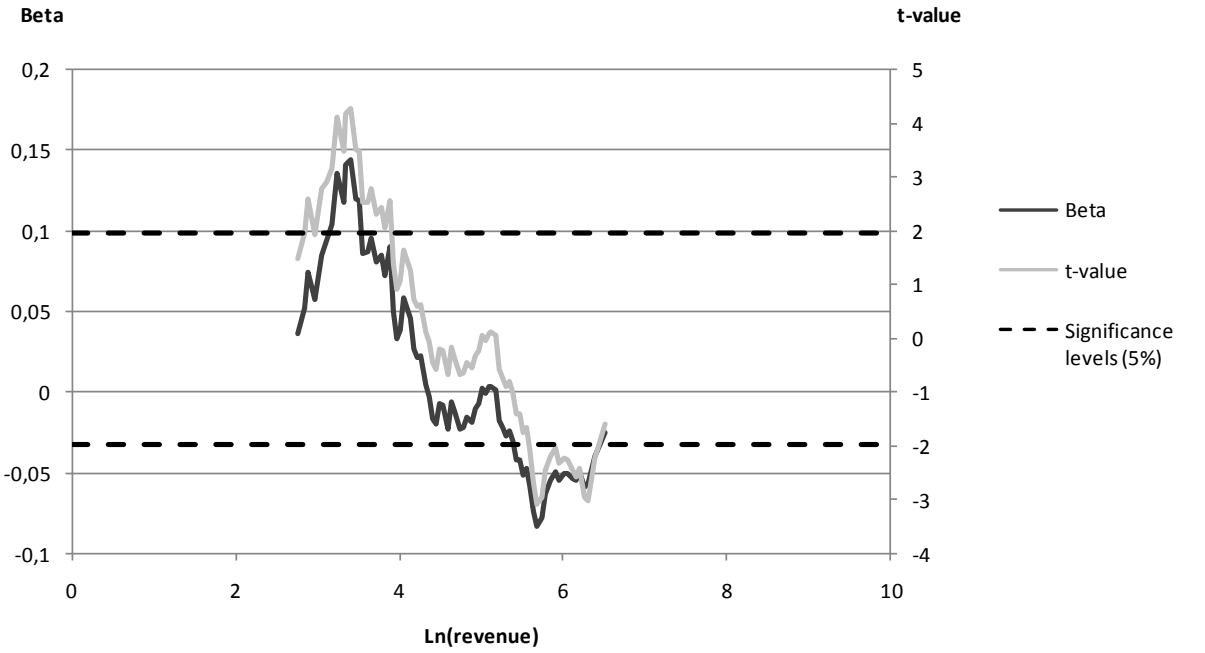

Figure 16 This figure is similar to Figure 15 but with ln(revenue) instead of observations on the x-axis. In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against ln(revenue). Subsamples of 2,000 observations each have been rolled over the entire sample from left to right. The subsample rolls with steps of 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. The observations in the figure are the midpoints in each subsample. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 17 Betas and t-values for the revenue coefficient from regressions using a rolling subsample plotted against absolute revenue

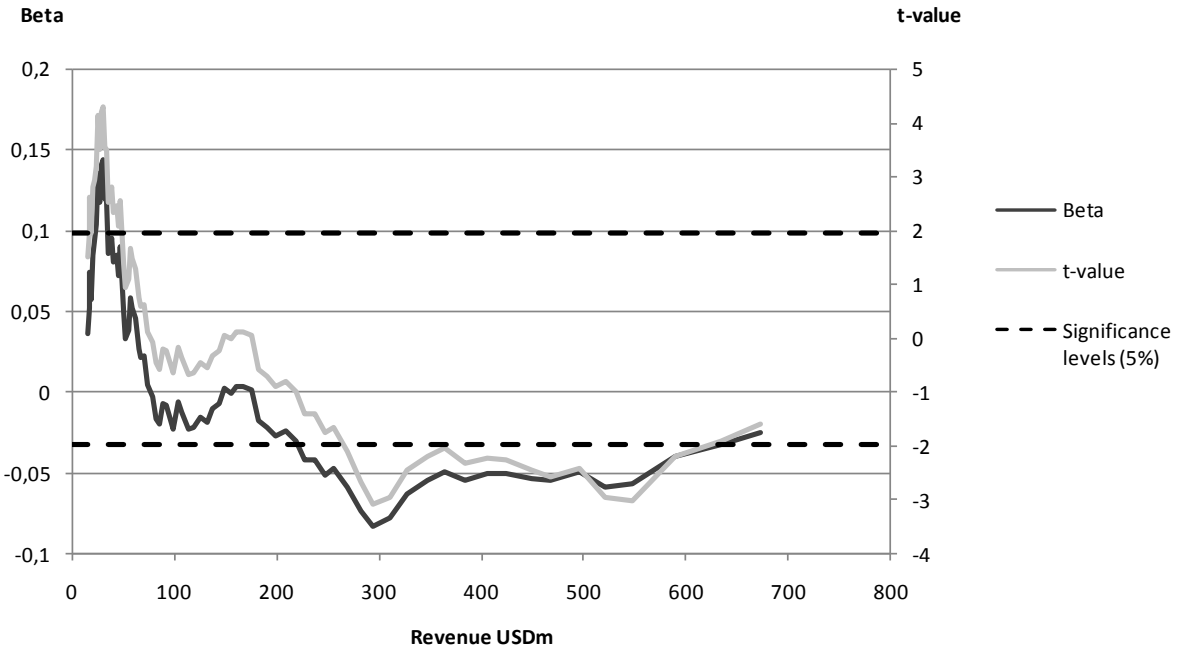

Figure 17 This figure is similar to Figure 15 and 16 but with absolute revenue on the x-axis. In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against absolute revenue. Subsamples of 2,000 observations each have been rolled over the entire sample from left to right. The subsample rolls with steps of 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. The observations in the figure are the midpoints in each subsample. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 18 Betas and t-values for the revenue coefficient from regressions using subsamples expanding from the left plotted against number of observations

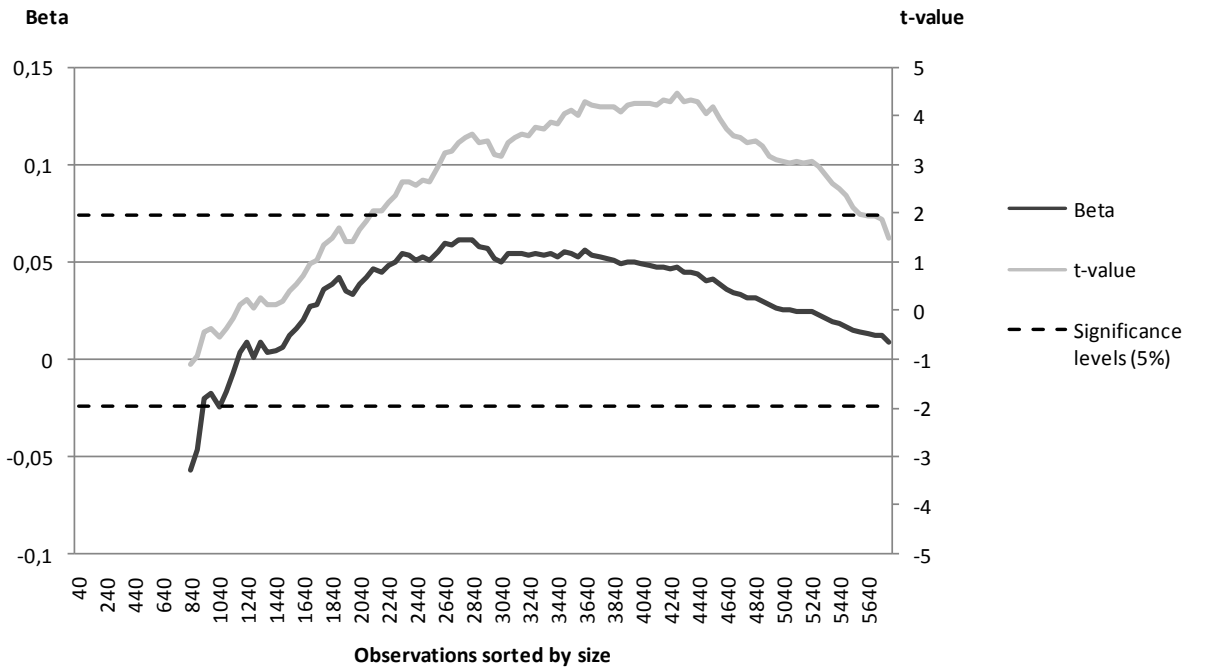

Figure 18 In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against observations sorted by size. The sample starts with the 850 smallest observations, and then expands to the right until all observations are included in the regression. Hence, the higher observation number, the larger sample is used. Each step is 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 19 Betas and t-values for the revenue coefficient from regressions using subsamples expanding from the left plotted against ln(revenue)

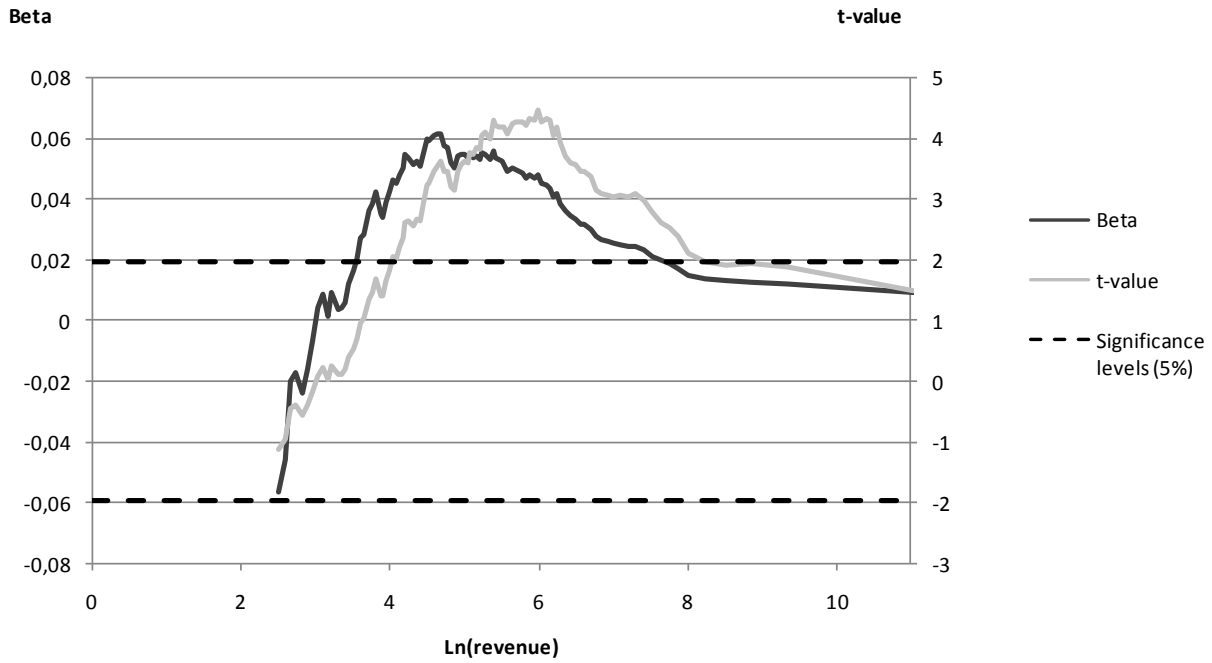

Figure 19 Similar to Figure 18 but with ln(revenue) instead of observations on the x-axis. In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against ln(revenue). The sample starts with the 850 smallest observations, and then expands to the right until all observations are included in the regression. Hence, the higher ln(revenue), the larger sample is used. Each step is 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 20 Betas and t-values for the revenue coefficient from regressions using subsamples expanding from the right plotted against number of observations

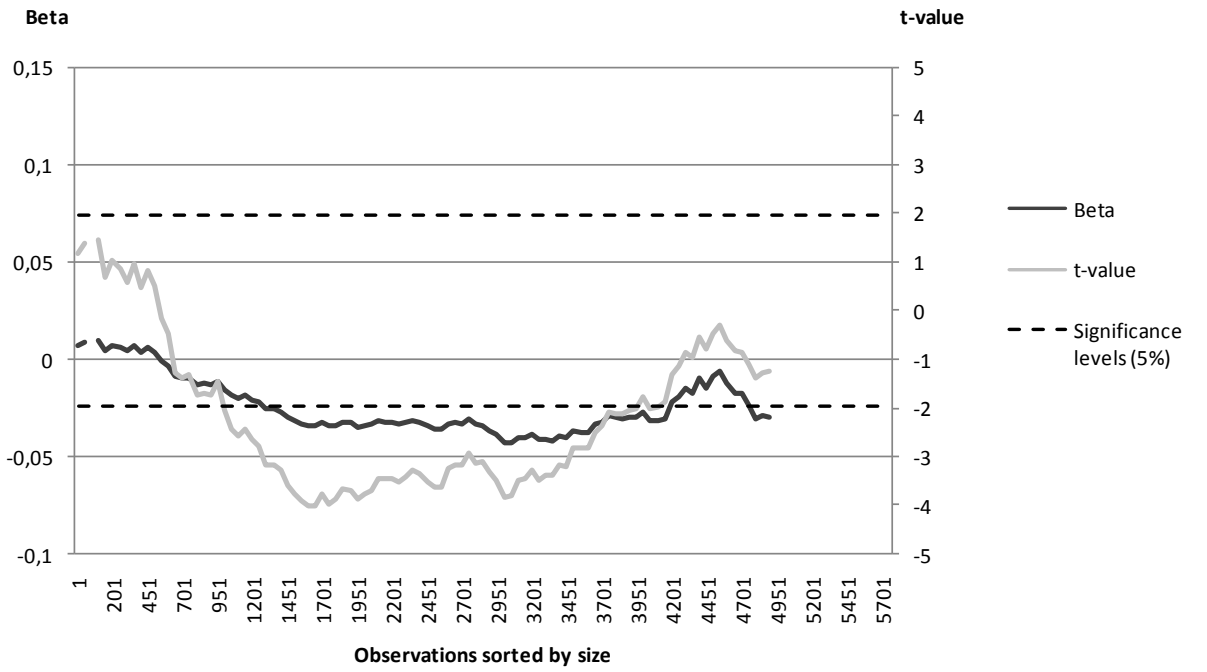

Figure 20 In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against observations sorted by size. The sample starts with the 850 largest observations, and then expands to the left until all observations are included in the regression. Hence, the lower observation number, the larger sample is used. Each step is 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 21 Betas and t-values for the revenue coefficient from regressions using subsamples expanding from the right plotted against ln(revenue)

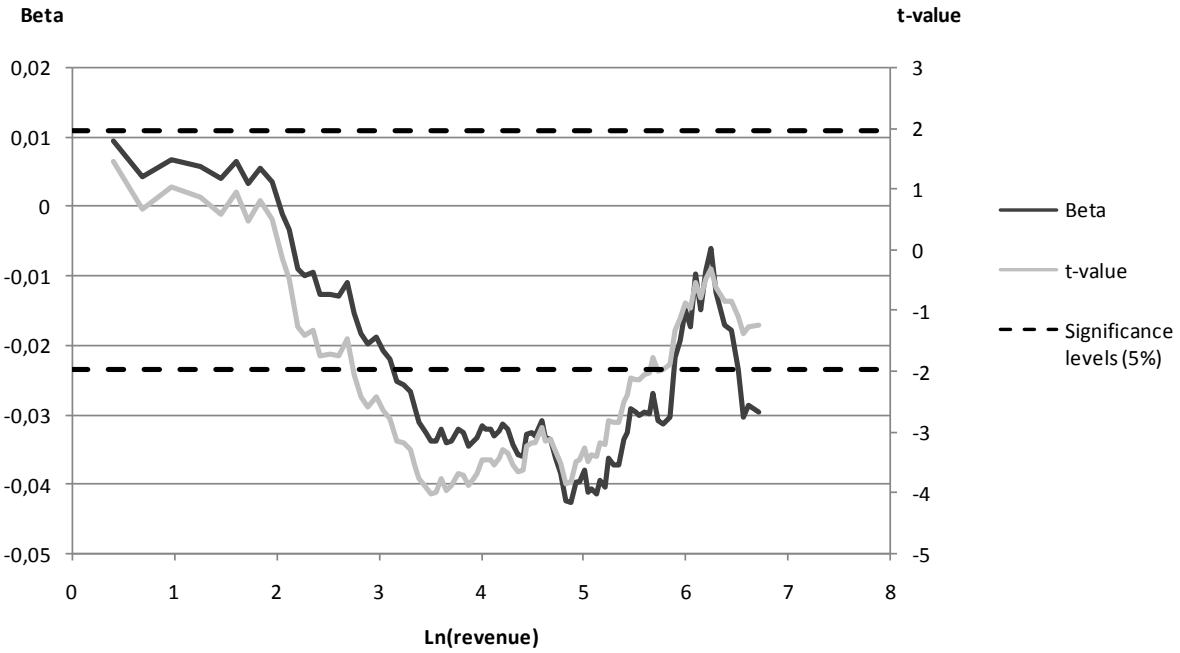

Figure 21 Similar to Figure 20 but with ln(revenue) instead of observations on the x-axis. In the figure, betas and t-values for the revenue coefficient from the regressions on several subsamples have been plotted against ln(revenue). The sample starts with the 850 largest observations, and then expands to the left until all observations are included in the regression. Hence, the lower ln(revenue), the larger sample is used. Each step is 50 observations, and for each regression, the beta-value and t-value for the revenue coefficient are shown in the figure. A beta value is significant if the corresponding t-value is outside the significance level boundaries.

Figure 22 DFBETA for revenue

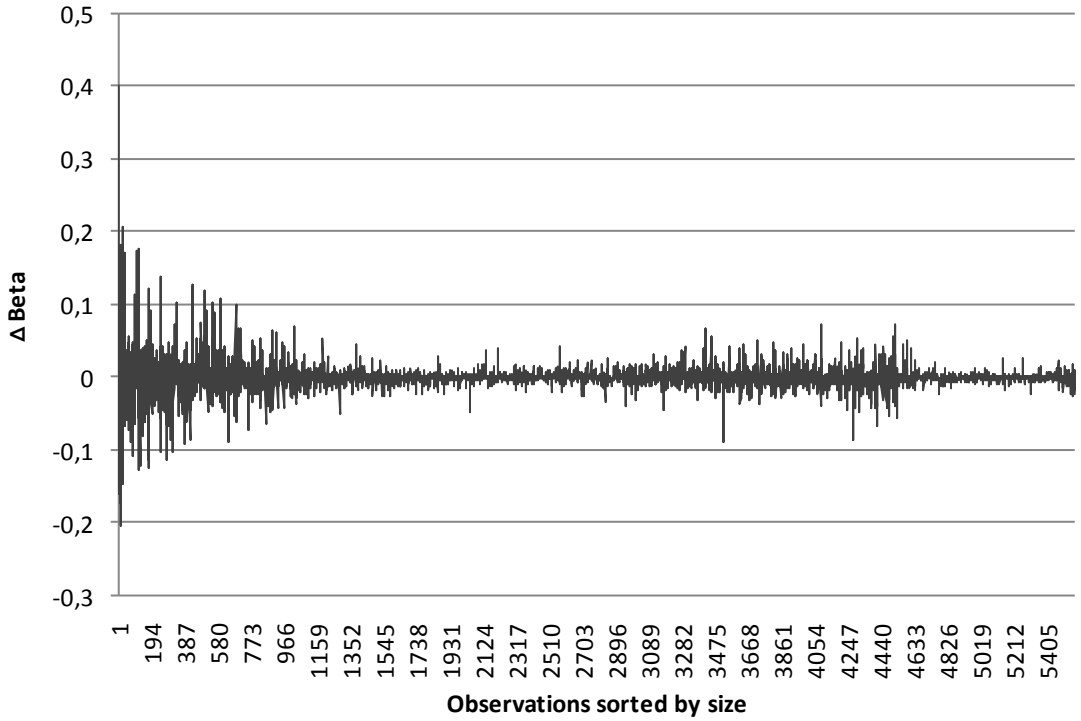

Figure 22 DFBETA is a method for detecting outliers. It is the difference between the regression coefficient when one observation is included or excluded. The larger absolute value, the more influential is the observation for the revenue coefficient.