

Working Paper (June 2006)

**Money Chasing Deals and Deals Chasing Money –
The Impact of Supply and Demand on Buyout Performance[☆]**

Oliver Gottschalg^{}, Daniel Zipser^{**}*

DO NOT CITE OR CIRCULATE WITHOUT PERMISSION

[☆] Financial support from the R&D Department at INSEAD, the HEC Foundation, the Wharton-INSEAD Alliance and the INSEAD Gesellschaft Scholarship is gratefully acknowledged. We would like to thank our research partners from the private equity community and Thomson Venture Economics for making this study possible through generous access to their data on buyout investments.

^{*} Prof. Oliver Gottschalg, HEC School of Management Paris, Assistant Professor of Strategy and Business Policy, 78351 Jouy-en-Josas, France, Tel: +33 67 00 17 66 4, e-mail: gottschalg@hec.fr

^{**} Dipl.-Kfm. Daniel A. Zipser, WHU, Otto Beisheim School of Management, Dresdner Bank Chair of Finance, Burgplatz 2, 56179 Vallendar, Tel: +49 69 71 62 52 28, Fax: +49 69 71 62 52 29, e-mail: dazipser@whu.edu

Abstract

This paper analyzes the impact of differences in supply of and demand for private equity financing on the performance of buyouts. Using a unique and proprietary sample of 684 buyout investments in North America and Europe, we show that buyout performance

(a) decreases when large volumes of private equity commitments are looking for suitable acquisition targets and (b) increases when macroeconomic conditions are such that demand for private equity financing is high. These findings remain unchanged if we control for the idiosyncrasies of individual investment periods, transaction size, holding period and industry sector of individual investment and the vintage year, the size or the age of the investing private equity fund. Our results support the view that the market for buyout target companies is not necessarily efficient, but that instead acquisition prices (and thereby transaction performance) depend on the competition by a limited number of private equity fund managers for a limited number of attractive investment opportunities.

JEL code: G23, G24, G11, G14

Key words: Private Equity funds, buyouts, performance, investment behavior

1 Introduction

The market for buyout¹ investments is characterized by a great degree of illiquidity, sticky capital commitments and substantial variance in the supply of and demand for buyout capital over time. This raises the question of whether this market is efficient, in the sense that exogenous shocks causing shifts in demand and supply have no impact on security pricing², or whether we observe price pressure effects (Scholes, 1972) in the sense that acquisition prices (and thereby transaction performance) depend on the competitive conditions in the market for buyout capital.

This paper analyzes the existence of price pressure effects in the buyout industry. It thus follows a number of studies looking at price pressure effects in various other empirical settings³, the majority of which supports the existence of price pressure effects in the short-run. Most closely related to this paper, Gompers and Lerner coined the term "money chasing deals phenomenon" for their finding that too much money chasing too few deals in the venture capital (VC) industry increases acquisition prices for venture capital participations (Gompers and Lerner, 2000).

The present study constitutes the first analysis of the impact of price pressure effects on risk-adjusted buyout performance at the level of the individual transaction. It links risk-adjusted transaction performance to various measures of the competitive conditions in

¹ In the literature buyout transactions are variously labeled (e.g., leveraged buyout, management buyout, institutional buyout, management buyin, etc.) and often used synonymously. In this paper the term "buyout" as being the broadest is preferred which comprises the different facets of this transaction type.

² Rf. for example Fama, 1970 or Fama, 1991 for an exhaustive discussion of existing theoretical and empirical research on the efficiency of financial markets.

³ For public companies rf. for example Shleifer, 2000; Wurgler and Zhuravskaya, 2002; Harris and Gurel, 1986; Shleifer, 1986; Dhillon and Johnson, 1991; Lynch and Mendenhall, 1997 and Goetzmann, 1986; for private companies rf. Gompers and Lerner, 2000; Gompers and Lerner, 2004 and Kaplan and Stein, 1993.

the market for buyout financing, while controlling for several alternative performance determinants at the fund-level and at the deal-level.

The corresponding empirical analysis was possible thanks to a unique and proprietary comprehensive dataset on thousands of North American and European buyouts entered between 1981 and 2003. Based on this data we calculate a profitability index that assesses the risk-adjusted return to investors relative to the performance of public market investments in the same geographic region and in the same industry sector for each deal. This approach is still novel in buyout research, as limited data availability has restricted most prior work to the use of fund-level performance or on performance measures that are not adjusted for risk.

We model risk-adjusted buyout performance as influenced by three proxies for the demand for buyout capital and by one proxy for the supply of buyout capital. We further control for the impact of (a) fund and investment size, (b) holding period, (c) particularities of transactions made during the time of the “new economy” boom and (d) the particularities of deals made in the first year of a fund’s life.

The results of our ordinary least squares (OLS) regression provide general support for the price pressure effect hypothesis in the buyout market. Not only do our findings show a significant and negative performance-impact of increasing supply of buyout funding (the money chasing deals phenomenon), but also the corresponding significant and positive performance-impact of increasing demand for buyout financing (deals chasing money).

These findings remain qualitatively unchanged if we include additional control variables to capture the effect of (a) idiosyncratic characteristics of individual investment periods, (b) industry sector of individual investment and (c) the age of the investing private equity fund. It is further noteworthy that the performance of North American buyouts is not as much influenced by changes in supply as it is the case for their European counterparts. This is consistent with the view that the North American buyout market is more mature, and thus efficient, than the European market buyout market.

This paper is structured into 6 chapters. Chapter 2 gives background information and shows the relevance of our research question from the standpoint of both theory and practice. Chapter 3 provides a brief overview of the theoretical foundations of argument. Chapter 4 describes the analyzed dataset. Chapter 5 presents the empirical analyses and the results. Chapter 6 discusses the implications of our findings and concludes the paper.

2 Background

Buyout investments represent one investment class within the Private Equity (PE) asset category. This category is characterized by a specific governance structure based on the relationship between institutional investors and an intermediary (the PE fund). A PE fund is usually structured as a limited liability partnership, and is comprised of a management team (the general partner, GP), which manages the investments of the limited partner (LP). The PE fund's investors hold shares of the limited partnership. Specialized buyout funds invest in companies that are in later stages of their lifecycle. Subsequent to the transactions the target companies' shares are not publicly traded.

Additionally, but usually in smaller portions than the institutional investors, the target company's management team, its employees or new external managers can subscribe for equity stakes.⁴

This special type of corporate acquisition has received increasing attention over the last decades from both the investor and academic community. This is primarily due to the steep increase in fund inflows into this asset class, which led to a rise in both the average size and the annual number of newly raised funds.

Buyouts already existed in the 1970s, but first evolved into a phenomenon of economic relevance during the 1980s in the United States. In the period between 1979 and 1989 more than 2.000 buyouts were conducted with a total transaction value of above 250 billion USD (Opler and Titman, 1993). Until today, the largest buyout ever was the acquisition of RJR Nabisco by the PE Firm Kohlberg, Kravis & Roberts (KKR) in 1989 with a transaction value of 29 billion USD (Dammon et al., 1993; SDC Platinum). The first boom of the buyout market with the corresponding increase in the capital inflow into buyout funds was stopped by the breakdown of the high yield bond market in 1990. High yield bonds were typically used to provide debt financing for the highly leveraged transactions of this period. The buyout segment gained importance again during the 1990s, not only in the US, but also in Europe, where the buyout market became sizable for the first time. Until today, the peak of buyout activity was the period from 1998 to 2000 during which more than 700 new buyout fund were raised (VentureXpert).

⁴ A comprehensive overview of buyouts, venture capital, private equity in general, and typical transaction characteristics is given by: Lowenstein, 1985; Sahlman and Stevenson, 1985; Wright and Coyne, 1985; Jensen, 1986; Smith, 1986; Jensen, 1989a; Jensen, 1989b; Kaplan, 1989a; Kaplan, 1989b; Kaplan and Stein, 1993; Lichtenberg and Siegel, 1990; Sahlman, 1990; Kaplan, 1991; Gompers, 1996; Black and Gilson, 1998; Wright and Robbie, 1998; Gompers and Lerner, 1999; Gompers and Lerner, 2000; Cotter and Peck, 2001; Berg and Gottschalg, 2005.

In parallel to the increasing interest of the investor community, more and more academic research has looked at different facets of the buyout phenomenon.⁵ Despite these research efforts one could argue that to-date the buyout market still remains ‘under-researched’ relative to its economic importance and compared to the exhaustive research conducted on other asset classes, such as for example mutual funds. One key reason for the lack of quantitative research on buyouts is the general difficulties to obtain access to information on relevance variables, such as the characteristics of individual investments or transaction performance.

Within the field of buyout research, studying price pressure effects is of particular interest as both the supply of and the demand for buyout funding is very cyclical. In the last years, there has been consistently more capital flowing into buyout funds, than has been invested by them. A cumulative capital inflow into buyouts funds of 260 million USD between 1998 and 2000 substantially surpasses the aggregate buyout funds investments of 100 billion USD over the same time period. The corresponding ‘overhang’ in available capital in buyout funds did not decrease over the following years either.

The cyclical inflow in buyout funds leads to direct changes in the supply of funding for buyout investments. This is caused by the structure of buyout funds, which are mostly closed-end investment funds with an investment horizon of 10 years. The fund manager is thus obligated to invest the capital committed by the investors within this period of

⁵ Rf. Berg and Gottschalg, 2005 for a comprehensive overview over the literature on value generation in buyouts.

time. High fund inflows together with the closed fund structure lead to competition among fund managers for suitable acquisition targets.

Similarly, the determinants of how many buyout target companies are available at any point in time vary substantially. The demand for buyout financing can be expected to be influenced by several macroeconomic factors. As buyouts are part of the overall M&A market, one would assume, for example, that the number of available buyout targets correlates with the size of the M&A market. Furthermore, the firms' need for external financing may influence their tendency to seek buyout funding, be it through a buyout of the entire firm or the divestiture of an individual division through a spin-off buyout. Finally, there may be a trend over time in the sense that buyout financing became increasingly accepted in the investor community and that thereby the share of overall takeover candidates that are available for buyout financing has increased.

Hence the competitive conditions in the market for buyout financing vary according to fluctuations on both the demand and the supply side. This paper studies whether this competition for a limited amount of deals causes price pressure leading to higher prices for acquisition targets and thus to lower return to investors.

3 Theoretical considerations

The question of whether changes in the supply of and demand for buyout funding influence acquisition prices for buyouts and thereby the performance of these investments is inherently linked to the more fundamental theoretical question of whether and under what circumstances financial markets are efficient in the pricing of investment opportunities or whether one observes price pressure effects.

The Efficient Market Hypothesis (EMH) is one of the central premises in finance theory. It claims that security prices fully reflect all available information at all times (Fama, 1970). Demand being perfectly elastic, exogenous supply or demand shifts then do not lead to a change in market price. Independent of demand for or supply of a security, a market price exists for each security which reflects the available information about expected risk and return of the security (Shleifer, 1986 and Scholes, 1972). If markets are efficient, an increased capital inflow into buyout funds and the corresponding increase in the supply of buyout financing should thus not result in increased prices or lower returns of buyouts. The EMH assumes that every security can be substituted by another security or a combination of securities.⁶

While buyouts differ from public securities analyzed in prior research on price pressure effects (Harris and Gurel, 1986, Shleifer, 2000 und Wurgler and Zhuravskaya, 2002 among others) in many respects, the following analogy can be made. Many buyouts companies have close substitutes among public companies and sometimes even used to be publicly traded themselves prior to the buyout. Furthermore, the absolute amount of capital inflow into buyout funds is still small compared to the overall capitalization of public equity markets.⁷ Hence there are reasons to believe that, as long as the shocks to supply and demand are exogenous, neither expected risk nor return of the security should be affected by variations in supply and demand. Following the reasoning of the EMH, changes in supply of and demand for buyout funding should therefore have no impact on the pricing and performance of buyouts.

⁶ Rf. Modigliani and Miller, 1958 and Miller and Modigliani, 1961.

⁷ Rf. Gompers and Lerner, 2000 for the analogy with the Venture Capital industry.

An important counterargument to the EMH comes from behavioral finance theory that considers the possibility of systematic and significant deviations from the market price under certain conditions.⁸ Of those conditions, the price pressure effect is of particular relevance to this paper (Scholes, 1972). From the perspective of behavioral finance theory, an exogenous shock in supply or demand for a security leads to a short-term change in the price for this security. For example, an exogenous increase in the capital inflow into a certain asset class that does not reflect changed expectations regarding risk or return for corresponding securities will lead to an over-supply of capital seeking to purchase this security and thus to a short-term increase of the market price. As this price increase is only short-term, the risk-adjusted return to the investors during this short period is low relative to other securities. This holds true when every security can be regarded as unique in the sense that it cannot be fully substituted through other securities (Durand, 1959).

This paper analyzes the existence of price pressure on buyout pricing over the period 1981 to 2003 for European and American buyouts. It complements empirical work on index admission of public companies (Harris and Gurel, 1986; Shleifer, 1986; Dhillon and Johnson, 1991 and Lynch and Mendenhall, 1997), fund inflows into open investment funds (Warther, 1995 and Wermers, 1999), share buybacks (Davidson III and Chhachhi, 1996; Masulis, 1980; Dann, 1981; Vermaelen, 1981 and Davidson III and Garrison, 1989), block trades (Dann et al., 1977 and Kraus and Stoll, 1972) and Venture Capital (Gompers and Lerner, 2000).

⁸ For an overview cf. Shleifer, 2000, for an example cf. Black, 1986.

Large scale empirical studies on price pressure effects in the context of private companies are limited due to previously discussed data restrictions. One noteworthy exception is the work of Gompers and Lerner (Gompers and Lerner, 2000). They analyze the impact of Venture Capital fund inflow on venture evaluations and find that inflows into venture funds increase the valuation of these funds' new investments. The phenomenon that they call "money chasing deals" is consistent with the theory that competition for a limited number of attractive investments leads to rising prices for venture investments.

Ljungqvist and Richardson and Diller and Kaserer conduct similar analyses in the context of the overall private equity industry (Ljungqvist and Richardson, 2003 and Diller and Kaserer, 2005). Both studies provide first evidence that change in demand and supply influences returns of the private equity industry, including the buyout segment. Diller and Kaserer conduct analyses on the funds-level and look at the impact of fund inflows, skilled PE companies and risk on the performance of private equity funds (Diller and Kaserer, 2005). They show that fund inflows affect fund performance as one would expect according to the behavioral finance theory. The focus of the work of Ljungqvist and Richardson is on fund level as well and their findings are consistent with the price pressure effect hypothesis (Ljungqvist and Richardson, 2003). They also provide first indications on the impact of supply and demand on deal-level performance, but as the authors acknowledge, data limitations restrict them from calculating accurate performance measures at the deal level and more precise operationalizations for supply and demand.

4 Dataset and sample composition

4.1 Overview

Difficulties in obtaining relevant information in sufficient depth and breadth for a comprehensive statistical analysis have traditionally been an obstacle to large-scale empirical research in the private equity industry. Insufficient data transparency and data availability is primarily caused by the nature of a segment of financial markets that calls itself the *private* equity industry and in which the publication of acquisition and selling prices are uncommon. Most investments are entirely private transactions where no disclosure requirements exist. This paper is unique in the way that it uses an exhaustive proprietary data set with comprehensive information on the 684 investments of 170 buyout funds raised between 1977 and 2000 with a total committed volume of 70 billion USD.

This database has been composed based on information that have been made available from either the buyout fund managers (General Partners) directly and through collaborations with large institutional investors in buyout funds. These so-called Limited Partners (typically pension funds, large financial institutions, specialized fund-of-fund investors) in the Limited Liability Partnerships provide capital to buyout funds and collect a large amount of information on buyout funds in the context of due diligence processes. Our research partners are among the world's largest investors in private equity funds and collectively manage commitments in excess of USD 40 billion. Each of these institutions screens several hundred newly raised buyout funds each year during their due diligence process.

Most of our information on buyout funds and investments has been extracted from offering documents (the so-called Private Placement Memorandum – PPM), in which private equity fund managers describe their previous transactions for fund-raising purposes. PPMs are submitted by the General Partner to potential investors and used by these to assess the quality and strategy of the General Partner. Typically, PPMs contain information about the complete “track record”, *i.e.* a chronological list of all buyout investments with individual transactions details and deal-level performance. Because PPMs are confidential they have rarely been used in academic research so far. In our case, all data had to be “sanitized”, *i.e.* the names of General Partners, Limited Partners and portfolio companies have been replaced by numeric codes prior to being entered in our database. The data about buyout transactions used for this paper are the acquisition and sales date and price, the status of investment (realized or unrealized) as well as general information about buyout companies' location and industry affiliation. Relevant information about the investing buyout funds include the year in which the fund was raised (the so-called vintage years), the amount of capital committed to the fund and the fund's geographic investment focus.

The data contained in this proprietary database has been complemented with information contained in commercially available data sources about the buyout industry (Thomson Financial VentureXpert) and general financial market information (SDC Platinum). In particular, this additional data includes the total amount of capital raised by all buyout funds in a given year and the corresponding aggregate yearly investments of all buyout funds. This data source, Thomson Financial VentureXpert, has been used extensively in prior research (Kaplan and Schoar, 2005; Gottschalg et al., 2004 and

Diller and Kaserer, 2005) and is regarded as a representative database for the entire buyout universe by academics and practitioners alike.

4.2 Sample description

To derive a suitable sample of buyouts from the overall PPM database, we looked at the 2274 buyouts made by 170 buyout funds in the database and excluded all transactions with at least one of the following characteristics:

- **Unrealized buyouts:** The database includes buyouts that are still unrealized. Unrealized in this context means that a PE Firm acquires a company, but has not sold it yet. As no pricing takes place for these portfolio companies, determination of a reliable performance measure is not possible and thus the buyout has to be excluded from our analysis.
- **Incomplete information:** Due to the inevitable heterogeneity of the data source for the database (there is no standard format for PPMs), sufficient data to conduct the analyses are not available for all buyouts. We therefore only consider transactions for which information on the investment amount, acquisition and exit date, performance, the location, and the industry affiliation of the buyout were available.
- **Out-of-Scope:** The sample is restricted to European and American buyouts between 1981 and 2004. All other buyouts were excluded from the analysis.

Based on these criteria, we obtain a sample of 684 buyouts for which all required information is available from the proprietary PPM database. These 684 buyouts have

been made by 170 buyout funds. Table 1 shows that approximately one quarter of the funds has a European investment focus. Only a small fraction (approximately 5%) of each fund's investments is outside its geographic investment focus. The smallest fund has a committed fund volume of 5 million and the largest of 5.7 billion USD. The median size of European funds in the sample is above the median of American funds.

<<< Insert table 1 >>>

Three quarters of the buyouts in the sample were North American companies. This ratio is approximately the same for the total amount of equity invested, which implies that deal sizes are about the same on average in both regions. The average (median) buyout has an equity investment of 23 (11) million USD. The largest buyout of the sample with an equity investment of 535 million USD was conducted in Europe.

<<< Insert table 2 >>>

The company's industry affiliation has been codified according to the DataStream classification (level 4) based on the information made available by our research partners. The largest industry class of buyouts in this sample is cyclical services, which includes among others retail, hotels, media and entertainment as well as transport services. Further, a high number of buyouts were conducted in information technology and non-cyclical consumer goods.

>>> Insert table 3 <<<

4.3 Sample representativeness

As buyout investments are confidential and information on even basic characteristics of the overall population is not publicly available, it is difficult to assess how representative this sample is. One possibility to nevertheless gain some insights into sample representativeness, is to compare our sample to the largest and most comprehensive commercially available database on buyout funds (Kaplan and Schoar, 2005). This database (VentureXpert) is managed by Thomson Financial Venture Economics and provides aggregate performance information on approximately 800 US and European buyout funds. In the following differences between our sample and VentureXpert funds are analyzed.

The average fund size of our sample (422 million USD) is slightly larger than the average size funds raised over the same time period according to VentureXpert (372 million USD) though differences in means are not statistically different at conventional levels (F-value of 0.046 for different variances and t-value of -0.862 for different means). The share of funds with investment focus on North America relative to Europe is also not different at conventional levels. In our sample, 77% of the funds focus on North American investments while 72% of the funds in VentureXpert do.

There exists however a significant difference in mean fund performance ($p < 5\%$). The average (median) performance of the funds in our sample is 29.0% (16.7%) as compared to 17.2% (12.7%) for the VentureXpert database. This upward bias of our sample could be result of one or several of the following factors. First, one has to suspect some form of survivorship bias inherent in our research design, as we can assume that only PE Firms that were reasonably successful with their first fund send a

PPM to raise money for a subsequent fund. The worst performing buyout associations will thus be excluded from our sample. Furthermore, we need to consider that PPMs are marketing instruments and that some bias may arise from the self-reported nature of information they contain. Finally, there may be some level of selection bias, as our research partners do not necessarily receive all PPMs and we only received a (random) subset of their data. This upward bias however, has only limited consequences, as the objective of this study is to explain the performance impact of supply and demand variation, rather than to assess the overall average returns to this investment category. As there is little reason to believe that the upward bias in our sample has a systematic influence on the price pressure effect for buyout investments, this finding should not a priori limit the generalizability of our results.

5 Empirical analyses

This paper analyzes the impact of supply and demand for buyout capital on the return to the buyout investors. Drawing on price pressure theory, it predicts that an increase in the supply of buyout capital will lead to higher prices. Along the same lines, it also predicts that an increase in demand for buyout capital will lead to a price decrease. Consequently buyout companies acquired in the years with high supply are expected to have *ceteris paribus* a lower return to investors ("money chasing deals") while years with high demand are expected to have *ceteris paribus* a higher return ("deals chasing money").

In the following, measurement and operationalization of the variables to test these hypotheses are described and the results of the empirical analysis along with several assess are presented.

5.1 Operationalization and measurement of independent variables

Supply of capital available for buyout investments is approximated by the total amount of money available to all buyout funds that are active in a given region at a given point in time. The accurate assessment of this variable is challenging as it requires the consideration of cumulative capital commitments to and investments by buyout funds over long time.

Prior research (Ljungqvist and Richardson, 2003 and Diller and Kaserer, 2005) has simply used capital inflows into buyout funds in a given year as a proxy for the relevant supply of buyout capital in this year. However fund commitments are invested over the entire life of the funds (usually 10 years) so that funds from several vintage years compete for acquisition targets in any given year. Consequently this approximation can be misleading, particularly if one year with very low capital inflows follows a year with high capital inflows. By only looking at same-year capital inflows, the following year would be treated as low demand although the capital from the prior year has not been fully invested yet but is still "chasing deals" as well.

In contrast to existing research, we therefore operationalize supply of buyout financing through a variable that more accurately captures the overall stock of capital available to all active buyout funds. The corresponding variable *capital overhang* considers not only capital inflows, but also the past investments done by these funds. This is possible thanks to our cooperation with the Venture Economics division of Thomson Financial, which provided detailed information on fund commitments and investments over the

fund life.⁹ This information is critical in determining the capital available (the buyout capital supply). The capital overhang is determined by the committed capital to all funds raised in the and prior to the year of the respective buyout lowered by the amount that was already invested at the date of the regarded acquisition. To avoid that committed capital that the fund managers returned to the investors is no longer included as capital supply, capital that was not invested by a fund after 10 years, is excluded from the calculations.

Further, capital supply needs to be differentiated among the funds' focus on different maturity and geography of companies. We only consider private equity funds with an explicit focus on buyout investments for the calculation of buyout capital overhang. Funds that are primarily investing in venture capital or real estate are not included. To consider the regional specialization of most buyout funds, we differentiate between funds with an investments focus on North America and those with an investment focus on Europe. The capital overhang is determined on this level as competition for a European buyout (for example) primarily stems from funds with investment focus on Europe. Capital overhang is determined as a log function per year in 1995 USD allowing comparability between the years. In our (unreported) robustness checks we used alternative operationalizations of this variable in terms of (a) the treatment of fund commitments prior to the investment year and (b) the treatment of the geographic fund focus but all findings remained qualitatively unchanged.

⁹ The authors would like to thank Gemma Postlethwaite and Jesse Reyes from Thomson Venture Economics for providing generous access to their data.

The *demand* for buyout capital is measured along three dimensions. The first one captures the availability of acquisition targets based on the number of owners currently selling their companies, the second one considers the tendency of companies to look for external financing sources and the third approximates the general acceptance of buyouts as a mean of financing.

The demand of owners selling their companies is operationalized by the actual level of *M&A activity*. M&A activity includes the divestiture of subsidiaries of large corporations as well as the sale of entire companies by their current owners. M&A volumes are drawn from the SDC Platinum database as the aggregate enterprise value (including net debt) of all transactions in a given period and region. To measure the demand of owners selling their companies more accurately, quarterly M&A volumes per region (Europe and North America) in 1995 USD are used.

As a second proxy for the demand for buyout financing we consider the *companies' investment opportunities and the corresponding need for external financing* (debt or equity). This factor is operationalized through the **Tobin Q**. This proxy has been widely used in prior studies (Brainard and Tobin, 1968; Tobin, 1969 and Tobin, 1978). A higher value for Q stands for more investment opportunity (e.g. Lindenberg and Ross, 1981). We follow the Chung and Pruitt approximation to determine Tobin's Q¹⁰ as follows (Chung and Pruitt, 1994):

$$Q \text{ (approximation)} = (\text{MVE} + \text{PS} + \text{DEBT})/\text{TA}$$

¹⁰ In comparison to more sophisticated means of calculations, Chung and Pruitt, 1994 prove that their approximation equals at least 96.6% of the exact calculation.

MVE represents the market capitalization, PS the liquidation value of quoted preferred stock, DEBT the short term liabilities and TA the book value of assets. Tobin's Q is determined on a yearly basis per industry and region. Industry classification follows the DataStream classification (level 4) analogue to the buyouts in our sample.

Differentiation between Europe and North America applies. All information is taken from the DataStream database.

The third mean to assess the demand for buyout capital is the *social acceptance of buyout capital*, which has an effect on demand for buyout financing beyond the two prior variables. Here the rationale is as follows: Even if owners are interested in selling companies and/or the companies' financing need is high, it is possible that sellers simply do not turn to buyout fund managers to sell their companies. In other words it is possible that we find no demand for buyout capital simply because the social acceptance for buyout capital as a mean of financing is low. In fact, the Private Equity industry went through significant changes over the last decades and gained acceptance among investors and sellers over this course. The acceptance of and the level of professionalism in the buyout industry has increased over this time period with more players accepting Private Equity as an asset class (Ljungqvist and Richardson, 2003). To operationalize this effect of the time trend related to the social acceptance of buyout financing, we follow the work of Ljungqvist and Richardson (Ljungqvist and Richardson, 2003):

$$\text{Time trend} = \frac{1}{\sqrt{\text{acquisition_year}}}, \text{ scaled to } 1981 = 1.$$

Further variables are included in the regression models to control for additional effects. A dummy variable is included for buyouts that have been conducted during the time of the *new economy* (1 for buyouts in 1999 and 2000, 0 for all others). This variable should control for the idiosyncrasies of this investment period with its increased valuation levels. We further control for the potential performance impact of *fund size* and *investment size* of the respective buyout (in 1995 USD). Both variables have been found to influence buyout performance in prior studies.¹¹ Two additional control variables are included to capture the effect of differences in the *holding period* of the buyout and for buyouts that have been conducted in the *first year of the fund*. A longer holding period provides the fund managers with more time to implement changes, while on the other side it is argued that value is already created by selecting the right company before the acquisition. Buyouts during the fund's vintage year may have some particularities as these deals may be used in the marketing efforts of the fund raising. The results of our study hold, however, irrespective of the removal of one or several of these control variables from our model.

<<< Insert table 4 >>>

Descriptive statistics of the theoretical independent variables used in this study are given in table 4.

¹¹ Rf. Kaplan and Schoar, 2005 and Gottschalg et al., 2004.

5.2 Performance measurement

Buyout performance is measured as the total risk-adjusted return to the investors through a profitability index (PI). The PI represents the most sophisticated indicator to measure buyout performance and has several advantages over the widely used IRR measure (Kaplan and Schoar, 2005).¹² Its calculation requires information about the risk inherent in the buyout as well as the timing of its cashflows. The PI is defined as the ratio of the present value (PV) of all realized proceeds from an investment over the total invested capital and can be written as follows:

$$PI = \frac{PV(\text{realized_proceeds})}{PV(\text{invested_capital})} * 100 .$$

The key challenge in the calculation of the PI stems from the need to find the appropriate discount rate to calculate the PVs. Using overall public market returns as a the discount rate implicitly assumes that all buyouts carry the same systematic risk (beta of 1). This assumption has been frequently questioned (Kaplan and Schoar, 2005; Gottschalg et al., 2004 and Gottschalg and Groh, 2006). This study aims to more accurately capture the operating risk of different buyout investments in the performance measure based on a risk-adjustment according to the region and the industry the acquired company is operating in. To this end return data on 70 DataStream indexes are used as the basis for the calculation of the discount rate in the PI formula. Gottschalg et al. follow a similar approach in determining the operating risk-adjusted performance of private equity investments (Gottschalg et al., 2004).

¹² As a robustness check we replicated the analyses performed in this paper with the IRR as performance measure and the results qualitatively confirmed the findings of our study.

A PI of 100 indicates that the risk-adjusted return of the buyouts equals the one of a comparable stock quoted company. A PI above indicated a positive abnormal return, where as a PI below 100 indicated a negative one. The following descriptive statistics include only the buyouts with a strictly positive PI; i.e., those 608 buyouts that did not file bankruptcy. Bankrupt buyouts will be treated separately in a later section. The median PI in the sample is 207. Table 5 contains information on the buyouts in our sample by acquisition year. The table contains information about the number of buyouts, the invested equity by the PE fund and the minimum, maximum and median PI. The last column states significant deviations of the median PI by acquisition year (measured by a t-test and indicated by *). Differences exist in the years 1990/1991, 1993/1994, 1996 as well as 1999/2000. These differences are only descriptive in kind and their origins, including the hypothesized impact of supply and demand for buyout capital, will be later assessed in the econometric analyses.

>>> insert table 5 <<<

Table 6 and 7 follow the same structure as table 5, but report average performance according to industry and country of the buyout respectively. Buyouts in the industries resources, non-cyclical consumer goods and services as well as financial institutions show significant deviation from the mean ($p < 10\%$). Deviations for countries or regions are not identified with the sole exception of French buyouts. The small number of French buyouts in the sample needs to be kept in mind, however.

>>> Insert table 6 <<<

>>> Insert table 7 <<<

5.3 Basic econometric results

The impact of supply and demand on buyouts has to be expected to be different depending on whether buyouts are successfully divested or completely written off. On the one hand, abnormally high acquisition prices increase *ceteris paribus* the risk of insolvency as they require high levels of debt service payments for a given level of fundamental performance. Hence supply and demand should have an influence on the likelihood of bankruptcy. For successful (i.e. non-bankrupt) buyouts, on the other hand, supply and demand influence the acquisition price and thereby the performance of the transaction. As the bankruptcy events (with $PI = 0$) cannot necessarily be seen as a continuation of the assumed linear relationship between supply and demand on the one hand and performance of the other, the analysis will be carried out separately for buyouts, which filed bankruptcy during the holding period. We first focus therefore on the 608 buyouts in our sample that did not go bankrupt and then specifically look at the determinants of bankruptcy in a separate analysis.

Non-Bankrupt Buyouts

To assess the impact of supply of and demand for buyout funding on the performance of the 608 non-bankrupt buyouts, we use an ordinary least squares (OLS) regression with White heteroscedasticity consistent standard errors. The dependant variable is the log of *PI* and the independent variables are the *capital overhang* to proxy supply and *M&A volume*, *Tobin Q* and *time trend* to proxy demand. In addition, we control for the impact of *fund size* and *buyout size*, the *holding period* and acquisitions during the time of the *new economy* or in the *first fund year* through control variables. We applied OLS

regression due to its ease of application and robustness (Cohen et al., 2002). The corresponding equation of the OLS regression reads as follows:

$$PI_n = \alpha + \beta_1 * Capital\ Overhang_n + \beta_2 * M\&A\ Volume_n + \beta_3 * Tobin-Q_n + \\ \beta_4 * Time\ Trend_n + \beta_5 * New\ Economy_n + \beta_6 * Fund\ Size_n + \\ \beta_7 * Buyout\ Size_n + \beta_8 * Holding\ Period_n + \beta_9 * First\ Fund\ Year_n + \text{error terms } \varepsilon_n$$

Table 8 shows the results of the regression analysis. The left column shows the variables followed by expected sign of the coefficient. The right column shows standardized correlation coefficients and below (in brackets) White heteroscedasticity consistent standard errors. The significance of the correlation coefficients is shown as ‘*’ with *** representing 1% significance level (two-sided), ** 5% and * 10%. The bottom of the table shows various model specification and diagnosis tests.

>>> Insert table 8 <<<

The results of table 8 can be summarized as follows:

- **Supply** of buyout capital: The effect of the analyzed variable on buyout performance is highly significant and negative ($p < 1\%$). This is consistent with the prediction that an increase in the available buyout capital leads to an increase in acquisition prices and thus to a lower return to the shareholders. This effect is also of great economic significance as an increase of 1% in the capital overhang leads to a decrease of the PI by 0.4%.

- ***Demand*** of buyout capital: All three analyzed variables are significant with the expected sign ($p < 1\%$ for M&A volume and Tobin-Q; $p < 5\%$ for time trend). An increase in M&A activity, an increase of companies' need for financing and higher acceptance of buyouts all lead to significantly higher buyout performance which is consistent with the prediction that greater demand for buyout capital lowers acquisition prices ($p < 1\%$).

It can be concluded that our results confirm the hypothesized negative relationship between supply of buyout financing and buyout performance and the hypothesized positive relationship between the demand for buyout financing and buyout performance, as all coefficients have the expected sign and are statistically significant in their impact on buyout performance. This finding is in line with the related study by Gompers and Lerner who document the existence of the “money chasing deal” effect on the pricing of venture capital participations (Gompers and Lerner, 2000).

Model fit and diagnosis tests are reported at the end of table 8. The only violation of the regression assumptions are that residuals are not normally distributed. This does not harm the validity of the model as the sample size is large. However, to further elaborate this issue a bootstrapping analysis shall be conducted to further validate the results.¹³ An R^2 of 5.7% for the overall model also makes intuitive sense. It shows the relevance of the price pressure effect as a determinant of buyout performance. On the other hand intuitively one would not expect the level of competition for buyout investments to explain much more than 5 to 10 percent of the overall variation in buyout performance.

¹³ Rf. appendix

After all, our model does not include any measures of other important variables such as the structure of the deal or any initiatives taken to restructure the company after its acquisition.

Determinants of Bankruptcy

We can then shift our focus to the question of whether supply of and demand for buyout financing influence the likelihood of buyouts going bankrupt. To address this question, we perform a logistic regression analysis (maximum-likelihood logit estimation with White heteroscedasticity consistent standard errors). A dummy variable (1 for bankrupt buyouts) is created and used as the dependant variable. The independent variables remain as before. Table 9 shows the results of the analysis in the same format as table 8.

>>> Insert table 9 <<<<

The results show that supply of and demand for buyout capital does not significantly affect the likelihood of buyout bankruptcy. It is noteworthy, however, that large funds seem to be more likely to invest in buyouts that eventually go bankrupt. A possible explanation of this effect is that smaller funds are more risk averse and avoid investing in buyout companies with a high likelihood of failure. Another interesting though intuitive finding is that a longer holding period increases the likelihood of bankruptcy. In fact this result may well be the manifestation of the inverse causality. If a buyout goes bankrupt, the buyout fund manager has incentives to wait as long as possible until she reports the bad news.

Differences between Europe and North America

European and North American buyouts have different structures and different maturity.¹⁴ In the following, we analyze structural differences in the effect of the supply for and the demand of buyout financing between transactions in North America and Europe. To this end, the sample is divided into these two regions. The same regression model is used as in prior analyses. Table 10 shows the results.

>>> Insert table 10 <<<

The results for Europe and North America overall support the price pressure effect hypothesis. However, there appear to be some significant differences between the two sub-samples with respect to the nature of the price pressure effect

The most important difference is that for North American buyouts the supply of buyout capital (the "money chasing deals" phenomenon) is not statistically significant. For European buyouts, however, this capital supply effect is significant ($p < 5\%$). On the capital demand side, we also see important differences. The performance effect of M&A activity is positive and statistically significant ($p < 1\%$) for European as well as North American buyouts. For European companies no impact of demand caused by need for internal financing (as measured though Tobin's Q) was identified, while this effect is significant and positive ($p < 5\%$) for North American Buyouts.

A look at the control variables indicates that buyouts executed during the time of the new economy performed worse in Europe ($p < 1\%$), but no significant differences could

¹⁴ Rf. Desbrières and Schatt, 2002 for an exhaustive discussion.

be identified for North American buyouts. Moreover buyouts in the first fund vintage year were only performing better in North America ($p < 10\%$). Overall it is interesting to see that the explanatory power of our model is much larger for the European subsample (R^2 of 10%) than for the sample of North American Buyouts (R^2 of 5.4%).

6 Conclusion

It was the objective of this paper to analyze whether or not differences in the supply of and the demand for private equity financing have a significant influence on the performance of buyouts. We thereby assess whether the market for buyout financing can be considered “efficient” in the sense of the efficient market hypothesis (Fama, 1970) or whether price pressure effects (Scholes, 1972) exist as suggested by behavioral finance theory. The latter predicts acquisition prices (and thereby transaction performance) to depend on the supply of and the demand for buyout capital.

To test this hypothesis, we modeled risk-adjusted buyout performance as determined by three proxies for the demand for capital for buyout transactions and by one proxy for the supply of buyout capital. We further control for the impact of (a) fund and investment size, (b) holding period, (c) particularities of transactions made during the time of the “new economy” boom and (d) the particularities of deals made in the first year of a fund’s life. The results of our analysis provide general support for the existence of price pressure effects in the buyout market, as the supply of buyout funding has a significant and negative impact on risk-adjusted buyout performance and the demand for buyout funding have a significant and positive impact on risk-adjusted buyout performance. Hence we find evidence for the presence of a “money chasing

deals” phenomenon (Gompers and Lerner, 2000), as well as of the corresponding effect of “deals chasing money”.

These findings are robust to different operationalizations of our independent variables and remain qualitatively unchanged if we include additional control variables to capture the effect of (a) idiosyncratic characteristics of individual investment periods, (b) the industry sector of individual investments and (c) the age of the investing private equity fund. It is further noteworthy that US buyouts are not as much influenced by changes in supply as their European counterparts. This is consistent with the notion that the North American buyout market is more efficient than the European market.

Our results support the view that the market for buyout target companies is not necessarily efficient, but that acquisition prices (and thereby transaction performance) depend on the competition by a limited number of private equity fund managers for a limited number of attractive investment opportunities. This is consistent with the findings by numerous other empirical studies that found evidence for the existence of price pressure effects in other markets.¹⁵

Our results have also important implications for practitioners. If capital supply is indeed negatively related to buyout performance, the increasing capital overhang in recent years may be one factor that contributes to a falling average performance of this asset class. As capital commitments into buyout funds currently rise towards new peaks,

¹⁵ For public companies cf. for example Shleifer, 2000; Wurgler and Zhuravskaya, 2002; Harris and Gurel, 1986; Shleifer, 1986; Dhillon and Johnson, 1991; Lynch and Mendenhall, 1997 and Goetzmann, 1986; for private companies cf. Gompers and Lerner, 2000; Gompers and Lerner, 2004 and Kaplan and Stein, 1993.

investors may raise concerns about the expected future return to buyout fund investments.

Appendix

Additional Robustness Checks

In order to assess the validity of the regression model this section contains several robustness tests. As indicated in chapter 5.3 (table 8), the assumption of normally distributed residuals is violated for this model. This is not expected to impact the validity of the results because of the large sample size. To gain further confidence in our findings, a boot-strapping analysis is conducted to assess validity.¹⁶ The bootstrap confidence intervals for the regression coefficients are displayed in table 11. The coefficient is significant if the derived interval does not include 0.

The results of the bootstrapping analysis support the results shown in chapter 5.3. This insight applies for all variables of the initial analysis and further supports the importance of supply and demand effects on buyout performance.

>>> Insert table 11 <<<

As a second test for robustness of the discussed results, a robust regression is conducted. Large residuals can influence the efficiency of the OLS results. The robust regression method provides more efficient results in case of influential outliers in the sample. The applied robust regression represents the iteratively weighted least squares method, which gives lower weight to large residual values.¹⁷

¹⁶ For a technical description of the bootstrapping method cf. Hall, 1994.

¹⁷ For an exhaustive description of the method cf. Huber, 1981.

<<< Insert table 12 >>>

The results of the robust regression (rf. table 12) further support the prior results. The only difference is that the holding period is now significant ($p < 1\%$). The longer the buyout fund has the buyout in its portfolio, the lower their return is. This supports the argument that buyout funds are able to improve the company value in the short-term to maximize value for the investors. It can be concluded that the presented results are robust to various different statistical methods.

To further verify the sensitivity of our results to the effect of additional fund, investment or industry characteristics, we conducted three additional robustness checks. In these we added three sets of control variables to our OLS regression model. In the first model (table 13), we added dummy variables for eight industry categories according to DataStream. Our analysis shows that the findings regarding the price pressure effect are qualitatively unchanged. Only one of the industry dummy variables is statistically significant, indicating that buyouts in the sector of non-cyclical services have *ceteris paribus* significantly underperformed in our sample. Similarly, we added dummy variables to control for performance differences among buyouts that have been entered during different years of the fund age (table 14). Here again the findings regarding the price pressure effects are qualitatively unchanged and none of the additional control variables has a significant influence on buyout performance. Finally, we added control variables for the effect of different investment periods, with a dummy variable for investments made prior to 1990 and post 1995 (table 15). As these variables are by design highly correlated with the variable “Time Trend”, the VIF in the full model increased substantially (table 15 column 1). We hence removed the variable

“Time Trend” from the model (table 15 column 2) and found the dummy variable for post 1995 deals to have a significant and positive impact on buyout performance, which suggest that transactions in the second half of the 1990s performed better. Again, our findings regarding the price pressure effects did not change qualitatively in either of these specifications of our model.

<<< Insert table 13 >>>

<<< Insert table 14 >>>

<<< Insert table 15 >>>

Overview of tables

Table 1 Overview of funds

Investment focus	Funds		Committed fund volume (million USD)				Total	Percent
	Number	Percent	Average	Median	Min	Max		
Europe	39	23%	538	235	31	5,655	20,963	29%
North America	131	77%	388	200	5	3,750	50,801	71%
Total	170	100%	422	200	5	5,655	71,764	100%

Table 2 Overview buyouts

Region of buyouts	Buyouts		Equity invested (million USD)				Total	Percent
	Number	Percent	Average	Median	Min	Max		
Europe	170	25%	25	11	0	535	4,200	26%
North America	514	75%	23	12	0	350	11,808	74%
Total	684	100%	23	11	0	535	16,008	100%

Table 3 Buyouts per industry

Industry	Buyouts		Equity invested (million USD)				Total	Percent
	Number	Percent	Average	Median	Min	Max		
Resources	18	3%	15	10	0	50	262	2%
Basic material	69	10%	23	11	0	535	2,059	13%
General industries	23	3%	16	9	1	65	370	2%
Consumer goods (cyclical)	73	11%	30	13	0	342	1,430	9%
Consumer goods (non-cyclical)	97	14%	18	9	1	172	1,750	11%
Services (cyclical)	208	30%	24	16	0	107	5,002	31%
Services (non-cyclical)	28	4%	29	20	2	123	811	5%
Information technology	127	19%	22	8	0	535	2,745	17%
Financial institutions	41	6%	39	10	0	350	1,579	10%
Total	684	100%	23	11	0	535	16,008	100%

Table 4 Descriptive statistics of independent variables

	Min	Max	Average	Median
Supply of buyout capital				
Capital overhang (available capital for fund managers)	6,5	11,5	10,0	10,1
Demand for buyout capital				
M&A volume	23,392,000,000	728,334,000,000	177,159,000	130,391,000
Tobin-Q	0,2	73,1	1,7	1,2
Time trend	0,994	0,999	0,997	0,996
Control variables				
New economy	0	1	0,09	0
Fund size	9	5,455	455	239
Buyout size	0	350	22	11
Holding period	0	16	3,5	3
First fund year	0	1	0,09	0

Table 5 Profitability index by acquisition year

Acquisition year	# Buyouts	Invested capital (USD millions)	Profitability index			Significantly different from mean
			Min	Max	Median	
1984	7	19	91	368,165	185	
1985	8	60	12	776	217	*
1986	17	204	162	72,955	427	
1987	4	81	111	230	144	**
1988	23	680	9	4,147	297	
1989	14	476	50	3,966	180	
1990	22	699	11	851	167	*
1991	36	660	13	1,168	222	*
1992	42	659	3	4,498	179	
1993	59	992	13	1,612	204	*
1994	56	1,056	9	1,281	132	*
1995	64	1,582	23	210,244	153	
1996	69	1,667	24	2,657	163	*
1997	84	2,021	3	37,014	239	
1998	44	725	57	9,925	265	
1999	33	753	47	1,143	256	*
2000	19	706	45	2,151	227	*
2001	4	176	232	790	361	
2002	2	68	329	577	453	
2003	1	6	282	282	282	
Total	608	13,290	3	368,165	207	

n.b. deviation from mean based on the respective sub sample in comparison to the remaining sample based on a t tests; level of significance: *** 1% ** 5% * 10%

Table 6 Profitability index by industry

Industry	# Buyouts	Invested capital (USD millions)	Profitability index			Significantly different from mean
			Min	Max	Median	
Resources	16	261	23	1,666	163	*
Basic materials	60	1,678	3	1,873	240	
General industries	23	362	12	9,898	262	
Consumer goods (cyclical)	65	1,159	9	5,629	207	
Consumer goods (non cyclical)	91	1,515	33	2,667	204	*
Services (cyclical)	189	4,296	9	210,245	206	
Services (non cyclical)	24	708	11	732	148	*
Information technology	102	1,827	3	368,165	225	
Financial institutions	38	1,484	5	1,077	227	*
Total	608	13,290	3	368,165	207	

n.b. deviation from mean based on the respective sub sample in comparison to the remaining sample based on a t tests; level of significance: *** 1% ** 5% * 10%

Table 7 Profitability index by region

Country	# Buyouts	Invested capital (USD millions)	Profitability index			Significantly different from mean
			Min	Max	Median	
Europe	157	3,572	3	37,014	255	
United Kingdom	77	1,569	13	6,237	227	
Germany	25	619	35	37,014	350	
France	18	450	25	982	275	*
Sweden	9	234	113	1,281	329	
Others	28	700	3	5,149	224	
North America	451	9,718	3	368,165	194	
USA	443	9,530	3	368,165	193	
Others	8	188	5	1,818	270	
Total	608	13,290	3	368,165	207	

Table 8 Results OLS regression: Applied OLS regression uses White heteroscedasticity consistent standard errors. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4
Supply of buyout capital		
Capital overhang (available capital for fund managers)	-	-0.393*** (-3.60)
Demand for buyout capital		
M&A volume	+	0.214*** (2.87)
Tobin-Q	+	0.082*** (3.69)
Time trend	-	-0.201** (-2.33)
Control variables		
New economy		-0.038 (-0.95)
Fund size		-0.038 (-1.04)
Buyout size		0.020 (0.33)
Holding period		-0.009 (-0.09)
First fund year		0.061 (1.59)
<hr/>		
N		608
R ²		5.7%
Adjusted R ²		4.3%
F		7.33***
Durbin-Watson d statistics		1.743
Bera-Jarque test (Chi ² -value)		826.9***
Shapiro-Wilk test (z-value)		7.948***
Akaike information criterium		2.810
Schwarz information criterium		21.912
Maximal VIF		5.24
Average VIF		2.50

Table 9 Results of logistic regression: Applied maximum-likelihood logit estimation uses White heteroscedasticity consistent standard errors. The table shows standardized coefficients with z-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4
Supply of buyout capital		
Capital overhang (available capital for fund managers)	-	-0.353 (-1.06)
Demand for buyout capital		
M&A volume	+	-0.122 (-0.61)
Tobin-Q	+	-0.096 (-1.25)
Time trend	-	-0.149 (-0.53)
Control variables		
New economy		-0.127 (-0.89)
Fund size		-0.308*** (-2.63)
Buyout size		-0.038 (-0.33)
Holding period		-0.560*** (-3.51)
First fund year		0.332** (2.13)
<hr/>		
N		684
Pseudo R ²		8.5%
Wald Chi ²		38.30***
Durbin-Watson d statistics		1.991
Bera-Jarque test (Chi ² -value)		826.9***
Shapiro-Wilk test (z-value)		13.291***
Akaike information criterium		0.668
Schwarz information criterium		18.340

Table 10 Regression results Europe and North America: Applied OLS regression uses White heteroscedasticity consistent standard errors. The sample was split into buyouts conducted in North America and buyout in Europe. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	Europe PROF_DS4	North America PROF_DS4
Supply of buyout capital			
Capital overhang (available capital for fund managers)	-	-0.374** (-2.28)	-0.233 (-1.28)
Demand for buyout capital			
M&A volume	+	0.423*** (3.13)	0.210*** (2.57)
Tobin-Q	+	0.062 (1.04)	0.123** (2.22)
Time trend	-	-0.114 (-0.79)	-0.009 (-0.06)
Control variables			
New economy		-0.295*** (-2.74)	-0.025*** (-0.50)
Fund size		-0.159 (-1.43)	-0.024 (-0.61)
Buyout size		0.231 (1.21)	-0.013 (-0.22)
Holding period		-0.024 (-0.26)	-0.014 (-0.11)
First fund year		-0.046 (-0.70)	0.084* (1.79)
<hr/>			
N		157	451
R ²		10.0%	5.4%
Adjusted R ²		4.5%	3.5%
F		14.56***	2.50***
Durbin-Watson d statistics		0.865	1.46
Bera-Jarque test (Chi ² -value)		53***	1061***
Shapiro-Wilk test (z-value)		3.398***	7.776***
Akaike information criterium		2.854	2.824
Schwarz information criterium		29.014	29.877
Maximal VIF		5.03	8.35
Average VIF		2.83	2.98

Table 11 Results of regression with bootstrap confidence intervals: Applied OLS regression uses bootstrap confidence intervals. The table shows standardized coefficients with t-values in brackets. The bootstrap confidence intervals for the regression coefficients are displayed in brackets. The coefficient is assumed significant if the derived interval does not include 0. This is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4		
		1% level	5% level	10% level
Supply of buyout capital				
Capital overhang (available capital for fund managers)	-	-0.393*** [-0.67,-0.10]	[0.07,0.35]	[0.09, 0.35]
Demand for buyout capital				
M&A volume	+	0.214*** [0.03,0.40]	[0.07,0.35]	[0.09, 0.35]
Tobin-Q	+	0.082* [-0.07,0.43]	[0.00,0.31]	[0.01,0.25]
Time trend	-	-0.201*** [-0.46,-0.01]	[-0.38,-0.05]	[-0.34,-0.06]
Control variables				
New economy		-0.038 [-0.14,0.07]	[-0.11,0.05]	[-0.10,0.03]
Fund size		-0.038 [-0.13,0.05]	[-0.11,0.04]	[-0.10,0.03]
Buyout size		0.020 [-0.20,0.18]	[-0.11,0.13]	[-0.09,0.12]
Holding period		-0.009 [-0.22,0.24]	[-0.19,0.18]	[-0.16,0.14]
First fund year		0.061 [-0.04,0.15]	[-0.01,0.14]	[0.00,0.12]

Table 12 Results robust regression: Applied robust regression represents the iteratively weighted least squares method, which gives lower weight to large residual values. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4
Supply of buyout capital		
Capital overhang (available capital for fund managers)	-	-0.217*** (-2.88)
Demand for buyout capital		
M&A volume	+	0.111** (2,01)
Tobin-Q	+	0.091*** (2,75)
Time trend	-	-0.098 (-1.45)
Control variables		
New economy		-0.004 (-0.08)
Fund size		-0.067 (-1.57)
Buyout size		0.056 -1.25
Holding period		-0.109*** (-2.68)
First fund year		0.065* (1.96)
N		608
F		4.20***

Table 13 OLS regression with industry dummies: Applied OLS regression uses White heteroscedasticity consistent standard errors. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4
Supply of buyout capital		
Capital overhang (available capital for fund managers)	-	-0.397*** (-3.48)
Demand for buyout capital		
M&A volume	+	0.221*** (2.88)
Tobin-Q	+	0.087*** (3.41)
Time trend	-	-0.205** (-2.41)
Control variables		
New economy		-0.047 (-1.14)
Fund size		-0.033 (-0.88)
Buyout size		0.021 (0.34)
Holding period		-0.005 (-0.05)
First fund year		0.059 (1.53)
Industry dummies		
Financial institutions		-0.041 (-0.94)
Resources		-0.034 (-0.89)
Services (non-cyclical)		-0.094*** (-2.61)
Consumer goods (non-cyclical)		-0.049 (-1.03)
Information technology		-0.047 (-0.63)
General industries		0.046 (1.01)
Services (cyclical)		-0.058 (-0.95)
Consumer goods (cyclical)		-0.051 (0.315)
<hr/>		
N		608
R ²		7.0%
Adjusted R ²		4.3%
F		4.19***
Durbin-Watson d statistics		1.726
Bera-Jarque test (Chi ² -value)		881.2***
Shapiro-Wilk test (z-value)		8.026***
Akaike information criterium		2.827
Schwarz information criterium		65.134
Maximal VIF		5.31
Average VIF		2.09

Table 14 OLS regression with fund age dummies: Applied OLS regression uses White heteroscedasticity consistent standard errors. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4
Supply of buyout capital		
Capital overhang (available capital for fund managers)	-	-0.392*** (-3.55)
Demand for buyout capital		
M&A volume	+	0.219*** (2.91)
Tobin-Q	+	0.085*** (3.69)
Time trend	-	-0.194** (-2.20)
Control variables		
New economy		-0.038 (-0.91)
Fund size		-0.033 (-0.89)
Buyout size		0.024 (0.38)
Holding period		-0.011 (-0.12)
Fund age		
First fund year		0.087* (1.82)
Second fund year		0.018 (0.37)
Third fund year		
Fourth fund year		0.023 (0.51)
Fifth fund year		0.064 (1.47)
Sixth fund year		0.035 (0.97)
Seventh and later fund years		0.041 (0.75)
<hr/>		
N		608
R ²		6.2%
Adjusted R ²		4.0%
F		5.06***
Durbin-Watson d statistics		1.728
Bera-Jarque test (Chi ² -value)		803.5***
Shapiro-Wilk test (z-value)		7.929***
Akaike information criterium		2.825
Schwarz information criterium		50.930
Maximal VIF		5.29
Average VIF		1.97

Table 15 OLS regression with investment period dummies: Applied OLS regression uses White heteroscedasticity consistent standard errors. The table shows standardized coefficients with t-values in brackets. Significance level (two-sided) for the coefficients is illustrated by *** (1%), ** (5%) and * (10%).

	Expected sign	PROF_DS4	PROF_DS4
Supply of buyout capital			
Capital overhang (available capital for fund managers)	-	-0.392*** (-3.73)	-0.272*** (-3.01)
Demand for buyout capital			
M&A volume	+	0.157** (2.14)	0.121* (1.68)
Tobin-Q	+	0.076*** (3.50)	0.083*** (4.16)
Time trend	-	-0.295** (-2.10)	
Control variables			
New economy		-0.044 (-1.01)	0.002 (0.06)
Fund size		-0.030 (-0.82)	-0.029 (-0.81)
Buyout size		0.005 (0.08)	0.007 (0.11)
Holding period		-0.010 (-0.11)	-0.020 (-0.22)
First fund year		0.055 (1.44)	0.056 (1.48)
Buyout year			
1990 and before		0.135* (1.72)	0.018 (0.33)
1995 and later		0.049 (0.59)	0.153** (2.42)
<hr/>			
N		608	608
R ²		6.5%	5.9%
Adjusted R ²		4.8%	4.3%
F		7.02***	7.76***
Durbin-Watson d statistics		1.748	1.750
Bera-Jarque test (Chi ² -value)		841.6***	860.7***
Shapiro-Wilk test (z-value)		7.961***	8.009***
Akaike information criterium		2.808	2.811
Schwarz information criterium		29.372	26.994
Maximal VIF		13.72	3.44
Average VIF		3.53	1.84

References

- Berg A and Gottschalg O. Understanding Value Generation in Buyouts. *Journal of Restructuring Finance* 2005;2; 9-37.
- Black BS and Gilson RJ. Venture Capital and the Structure of Capital Markets: Banks versus Stock Markets. *Journal of Financial Economics* 1998;47; 243-277.
- Black F. Noise. *Journal of Finance* 1986;41; 529-543.
- Brainard WC and Tobin J. Pitfalls in financial model building. *American Economic Review* 1968;58; 99-122.
- Chung KH and Pruitt SW. A simple approximation of Tobin's q. *Financial Management* 1994;23; 70-74.
- Cohen J, West SG, Aiken LA and Cohen P. *Applied regression/correlation analysis for the behavioral sciences*. Lawrence Erlbaum Associates: Mahwah, New Jersey; 2002.
- Cotter JF and Peck SW. The Structure of Debt and Active Equity Investors: The Case of the Buyout Specialist. *Journal of Financial Economics* 2001;59; 10-147.
- Dammon RM, Dunn KB and Spatt CS. The Relative Pricing of High-Yield Debt: The Case of RJR Nabisco Holdings Capital Corporation. *American Economic Review* 1993;83; 1090-1111.
- Dann LY. Common Stock Repurchases. *Journal of Financial Economics* 1981;9; 113-138.
- Dann LY, Mayers D and Rafts RJ. Trading Rules, Large Blocks and the Speed of Price Adjustment. *Journal of Financial Economics* 1977;4; 3-22.
- Davidson III WN and Chhachhi I. A test for price pressure effects in tender offer stock repurchases. *Financial Review* 1996;31; 25-49.
- Davidson III WN and Garrison SH. The Stock Market Reaction to Significant Tender Offer Repurchases of Stock: Size and Purpose Perspective. *Financial Review* 1989;24; 93-107.
- Desbrières P and Schatt A. The Impacts of LBOs on the Performance of Acquired Firms: The French Case. *Journal of Business Finance & Accounting* 2002;29; 695-729.
- Dhillon U and Johnson H. Changes in the Standard and Poor's 500 list. *Journal of Business* 1991;64; 11-16.
- Diller C and Kaserer C. What drives Private Equity Returns? - Fund Inflows, skilled GPs, and/or Risk? Working Paper 2005.
- Durand D. The Cost of Capital, Corporation Finance, and the Theory of Investment: Comment. *American Economic Review* 1959;49; 639-655.
- Fama EF. Efficient capital markets: a review of theory and empirical work. *Journal of Finance* 1970;25; 383-417.
- Fama EF. Efficient Capital Markets: II. *Journal of Finance* 1991;46; 1575-1617.

- Goetzmann WN. Does Delisting from the S&P 500 Affect Stock Price? *Financial Analysts Journal* 1986;42; 64-69.
- Gompers P and Lerner J. An analysis of compensation in the U.S. venture capital partnership. *Journal of Financial Economics* 1999;51; 3-44.
- Gompers P and Lerner J. Money chasing deals? The impact of fund inflows on private equity valuations. *Journal of Financial Economics* 2000;55; 281-325.
- Gompers P and Lerner J. *The Venture Capital Cycle*. MIT Press: Boston; 2004.
- Gompers PA. Grandstanding in the venture capital industry. *Journal of Financial Economics* 1996;42; 133-156.
- Gottschalg O and Groh A. The Risk-Adjusted Performance of US-Buyouts. INSEAD Working Paper 2006.
- Gottschalg O, Phalippou L and Zollo MG. Performance of Private Equity Funds: Another Puzzle? INSEAD Working Paper 2004.
- Hall P 1994. Methodology and Theory for the Bootstrap. In: Engle RF and McFadden DL (Eds), *Handbook of Econometrics*, vol. 4. Elsevier: Amsterdam; 1994. p.
- Harris L and Gurel E. Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence Existence of Price Pressures. *Journal of Finance* 1986;41; 815-819.
- Huber PJ. *Robust Statistics*. John Wiley & Sons: New York; 1981.
- Jensen MC. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review* 1986;76; 323-329.
- Jensen MC. Active Investors, LBOs and the Privatization of Bankruptcy. *Journal of Applied Corporate Finance* 1989a;2; 35-44.
- Jensen MC. Eclipse of the Public Corporation. *Harvard Business Review* 1989b;67; 61-74.
- Kaplan SN. The Effects of Management Buy-outs on Operating Performance and Value. *Journal of Financial Economics* 1989a;24; 217-254.
- Kaplan SN. Management Buyouts: Evidence on Taxes as a Source of Value. *Journal of Finance* 1989b;44; 611-632.
- Kaplan SN. The Staying Power of Leveraged Buyouts. *Journal of Financial Economics* 1991;29; 287-314.
- Kaplan SN and Schoar A. Private Equity Performance: Returns, Persistence and Capital. *Journal of Finance* 2005;60; 1791-1823.
- Kaplan SN and Stein JC. The Evolution of Buyout Pricing and Financial Structure in the 1980s. *Quarterly Journal of Economics* 1993;108; 313-57.
- Kraus A and Stoll HR. Price Impacts of Block Trading on the New York Stock Exchange. *Journal of Finance* 1972;27; 569-588.

- Lichtenberg F and Siegel DS. The Effects of Leveraged Buyouts on Productivity and Related Aspects of Firm Behavior. *Journal of Financial Economics* 1990;165-194.
- Lindenberg EB and Ross SA. Tobin's q Ratio and Industrial Organization. *Journal of Business* 1981;54; 1-32.
- Ljungqvist A and Richardson MP. The Investment Behaviour of Private Equity Fund Managers. RICAFAE Working Paper 2003.
- Lowenstein L. Management Buyouts. *Columbia Law Review* 1985;85; 730-784.
- Lynch AW and Mendenhall RR. New evidence on stock price effects associated with changes in the S&P 500 index. *Journal of Business* 1997;70; 351-383.
- Masulis RW. Stock Repurchase by Tender Offer: An Analysis of the Causes of Common Stock Price Changes. *Journal of Finance* 1980;35; 305-319.
- Miller MH and Modigliani F. Dividend Policy, Growth, and the Valuation of Shares. *The Journal of Business* 1961;34; 411-433.
- Modigliani F and Miller MH. The Cost of Capital, Corporation Finance and the Theory of Investment. *American Economic Review* 1958;48; 261-297.
- Opler TC and Titman S. The Determinants of Leveraged Buyout Activity: Free Cash Flow vs. Financial Distress Costs. *Journal of Finance* 1993;48; 1985-1999.
- Sahlman WA. The structure and governance of venture-capital organizations. *Journal of Financial Economics* 1990;27; 473-521.
- Sahlman WA and Stevenson HH. Capital Market Myopia. *Journal of Business Venturing* 1985;1; 7-30.
- Scholes MS. The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices. *Journal of Business* 1972;45; 179-211.
- Shleifer A. Do Demand Curves for Stocks Slope Down? *Journal of Finance* 1986;41; 579-590.
- Shleifer A. *Inefficient Markets*. Oxford University Press: 2000.
- Smith CWJ. Investment Banking and the Capital Acquisition Process. *Journal of Financial Economics* 1986;15; 3-29.
- Tobin J. A General Equilibrium Approach To Monetary Theory. *Journal of Money, Credit & Banking* 1969;1; 15-29.
- Tobin J. Monetary Policies and the Economy: The Transmission Mechanism. *Southern Economic Journal* 1978;44; 421-431.
- Vermaelen T. Common Stock Repurchases and Market Signalling. *Journal of Financial Economics* 1981;9; 139-181.
- Warther VA. Aggregate mutual fund flows and security returns. *Journal of Financial Economics* 1995;39; 209-235.

Wermers R. Mutual fund herding and the impact on stock prices. *Journal of Finance* 1999;54; 581-622.

Wright M and Coyne J. *Management Buy-outs*. Croom-Helm: London, U.K.; 1985.

Wright M and Robbie K. Venture capital and private equity: A review and synthesis. *Journal of Business Finance & Accounting* 1998;25; 521-570.

Wurgler J and Zhuravskaya E. Does Arbitrage Flatten Demand Curves for Stocks? *Journal of Business* 2002;75; 583-608.