On the Performance of Private Equity Investments: Does Market Timing matter?

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This paper investigates the market timing abilities of private equity fund managers using a unique set of detailed cash-flow data. We show that investment timing has an impact on the performance of venture capital funds. Surprisingly, divestment timing has no such impact on returns. For later-staged buyout funds our analysis reveals that fund performance is not driven by market timing but is significantly related to the experience of the individual fund manager. Thus, for successful investing into more mature portfolio companies, getting access to better deal flow and managing the investment affect the resulting success of these investments. Our results complement other recent findings on the performance of private equity funds.

JEL Classification: G23, G11.

Keywords: Private equity; Venture capital; Fund management; Market timing.

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"As with most things, *Timing Is Everything*. And if you can't control the timing, then what happens is very dependent on luck."

(Bob Johnson, Managing Partner, Founders Capital Partners, Timing is Everything: What's New in Venture Capital, *what matters, MIT alumni opinion column*, February 2002.)

1 Introduction

Private equity plays an essential role for financing innovative companies and business sectors in the economy. These funds not only constitute an important source of financial funding but also represent a key monitoring device for young growth companies. Although research interest in private equity has increased remarkably during the last years, little is still known about the performance characteristics of private equity as an asset class. This paper attempts to fill this gap.

For mutual funds and hedge funds it is common practice to break down portfolio performance into two components: security selection and market timing. For private equity funds, portfolio performance has not been split up into company selection and overall market timing so far. However, it is generally assumed that venture capitalists have the ability to time the market for taking their portfolio companies public, and early research by Barry et al. (1990) and Lerner (1994) seems to indicate this. Casual observation tells that during the years of the technology bubble many private equity funds destroyed money, because they invested too late, at unreasonable valuation levels, and were too slow to exit their investments.[1] In a recent study, Ljungqvist and Richardson (2003a) show that there is high variation in the speed, with which funds draw down committed capital, and invest it *deal by deal*.[2] Thus, although private equity funds do not invest into publicly traded assets and portfolio composition decisions are made less frequently, market timing supposedly plays an important role for overall fund performance.

The objective of this paper is to investigate the market timing abilities of private equity fund managers, using detailed cash flow information from a unique database of private equity

[1] Linda Himelstein, 'Crunchtime for VCs', *Business Week*, February 19, 2001.

[2] For an investment of 80% of the funds' committed capital, Ljungqvist and Richardson (2003, p. 11) show a time period starting from funds closing between one and ten years.

funds. With *timing ability* we mean deal-by-deal investment timing ability of individual fund managers - within the funds' lifetime - not entry timing of funds at the general industry level.[3]

Overall, our findings show that investment timing has an impact on the performance of venture capital (VC) funds, while divestment timing has no significant impact on returns. For later-staged buyout (MBO) funds our analysis reveals that fund performance is not driven by market timing but is significantly related to the experience of the individual fund manager. Thus, for successful investing into more mature portfolio companies, getting access to better deal flow and managing the investment affect the resulting success of these investments, rather than market timing. These results are consistent with other recent findings on the performance of private equity funds.

In the next section we present a brief overview of previous market timing studies on mutual funds and hedge funds. In section three we present an approach to answering the question whether there is a relationship between market timing ability of private equity fund managers and overall fund performance. In section four we describe our unique dataset of monthly cash flow information. The empirical analysis is presented in section five. In the last section we summarize the main results and draw some final conclusions.

2 Related Literature

2.1 Mutual fund performance literature

The investment performance of mutual funds has been the subject of extensive academic research. Evidence about the relative performance of individual funds is obviously of large interest to financial institutions with funds to allocate. In a seminal paper Jensen (1968) develops a one-parameter risk/return benchmark that facilitates a simple performance evaluation of mutual funds. The so-called *Jensen measure* was later refined by Black, Jensen,

[3] The time of raising a fund - the *entry timing* - is a function of the managers' ability to raise a fund. It is dependent on the willingness of investors to spend capital. This willingness can be assumed to be less driven by investors' rational assessment of the investment situation, but rather by emotional herd behavior. Both decisions, the one to raise a fund and the one to make actual portfolio investments, are based on different goals and are usually separated as much as possible allowed by the investment statutes.

and Scholes (1972). All these studies pay attention to security selection skills of fund managers, assuming the analyzed portfolios' risk levels to be constant though time.

Several authors, however, including Kon (1983), Kon and Jen (1979), Fabozzi and Francis (1979), Alexander and Stover (1980), and Miller and Gressis (1980), find at least some evidence that mutual funds do not maintain a constant risk structure over time. They conclude that market timing may be part of the fund managers' decision process.

Building on the standard CAPM framework, Treynor and Mazuy (1966) develop a first test of market timing for mutual funds. They add a quadratic term to the CAPM equation, and thereby change the notion of the model from a linear relation between a portfolio's return and the market return to a nonlinear one. According to them, an investment manager will hold a greater proportion of the market portfolio if he forecasts high market returns and a smaller proportion when he expects the market return to be low.

Fama (1972) and Jensen (1972) both highlight the empirical measurement problems when portfolios are assumed to not maintain a constant risk structure. In his model, Jensen (1972) assumes the market timer to predict the actual return on the market portfolio. Furthermore, the actual return on the market and the forecasted return are presumed to have a joint normal distribution. He illustrates that, under these assumptions, a market timers' forecasting ability can be determined by the correlation between the market timers' forecast and the return on the market. However, to separately illustrate the contribution of micro- and macroforecasting[4] one has to know the market timing forecast, the portfolio adjustment corresponding to that forecast, and the expected return on the market, for each period.

Merton (1981), Henriksson and Merton (1981) derive two new approaches to examine market timing abilities of fund managers: (i) a parametric test for the usual case of having access only to the time series of realized returns on a managed portfolio; and (ii) a non-parametric procedure for testing market-timing ability when the forecasts are directly observable. In their model, the portfolio manager allocates funds between cash and equities based on predictions of the future market return.

Overall, market timing studies find only limited evidence that fund managers possess superior market timing abilities. Treynor and Mazuy (1966) find significant timing ability in only one out of 57 funds in their sample, while Henriksson (1984) identifies only three out of

[4] Macroforecasting in this context refers to market timing.

116 funds that exhibit significant market timing ability. However, it has to be taken into consideration that these studies were performed using monthly or even annual data. According to a more recent study by Goetzmann, Ingersoll, and Ivkovich (2000), a monthly frequency might fail to capture the real contribution of market timing to fund performance, since portfolio composition decisions are made more frequently than once a month. Finally, Bollen and Busse (2001) prove empirically that the use of daily data increases the explanatory power of existing market timing models, evidenced by a significantly higher number of funds showing positive market timing abilities than previous studies exhibited. In sum, however, the evidence on market timing abilities of fund managers is mixed.

2.2 Related Literature on Private Equity

While earlier studies on private equity were based on aggregate data from public databases[5], there is now a set of recently published working papers, which examine the relation between risk and return of private equity investments more closely and with more detailed data.

Cochrane (2003) measures the risk and return characteristics of venture capital projects, correcting for selection bias in order to get robust results. He finds that the high volatility of VC returns drives high arithmetic returns and positive alphas.

Jones and Rhodes-Kropf (2003) analyze the role of idiosyncratic risk in VC and buyout fund returns. They show that VC investments have positive alphas while investors in VC funds earn no abnormal returns. Also, funds that have more idiosyncratic risk ex post will earn higher returns.

Kaplan and Schoar (2003) investigate individual fund returns and find that performance increases with experience and is persistent. They also show that better performing funds are more likely to raise follow-on funds.

However, neither of these studies explicitly incorporates market timing ability as a potential contributor to overall fund performance. The contribution of our paper is that we are the first to analyze the impact of deal-by-deal (within-funds) investment timing ability on performance.

Ljungqvist and Richardson (2003a) analyze the behavior of private equity fund managers. The dataset they use in two papers (2003a, 2003b) comes closest to our data in

[5] Such as Venture Economics or VentureExpert.

terms of detailed information on cash flows of individual investments. The authors show that fund managers time their investment and exit decisions in response to competitive conditions in the market for private equity. In particular, they find evidence that competition for deal flow with other private equity funds affects the investment timing.

In our paper, we aim to investigate whether fund managers can resist this external investment pressure, e.g. to overcome window dressing purposes or opportunities for quick fund raising, and stay rational enough to micro-time the market according to current valuation levels. In addition, we test for the impact of timing on fund performance. When valuation levels change, we implicitly assume changing investment opportunities with respect to the investment price. Ljungqvist and Richardson (2003a) furthermore show that improvements in investment opportunities increase performance. Since it is difficult to quantify the manager's access to high quality deal flow, we try to control for this effect by including proxy variables that capture the fund manager's experience.

3 Description of the Dataset

3.1 General Description

The general lack of in-depth quantitative research on private equity fund performance is most likely due to the *private* nature of the whole industry as opposed to the public character of mutual funds. While disclosure requirements force mutual funds to release information to the public (enabling their use for academic research), private equity companies are reluctant to disclose in-depth financial information. This is understandable, since information on returns is proprietary and full revelation is likely to result in a competitive disadvantage for the disclosing partnership. As a result, empirical research on the performance of private equity has been based solely on aggregate data until most recently.

The unique dataset used for this paper is derived from the records of CEPRES, The Center of Private Equity Research.[6] Although the database is completely anonymous, it provides high quality and in-depth data. The dataset is extraordinary with respect to the level of detail provided. It provides *gross cash flows*, i.e. not adjusted for management or success

[6] www.cepres.de

fees, on a monthly basis.[7] In some cases, additional information on *compensation* is given. The data can be obtained either on the fund level or for each portfolio company. Together with detailed cash flow data, the dataset also provides information with respect to the *investment manager*. Furthermore, the *sequence of the fund* - which denotes the number of funds a particular investment manager has raised up to date - is also supplied. Consequently, this information allows creating a track record for every investment manager with respect to fund performance and other criteria. The dataset contains both venture capital as well as private equity buyout (MBO) funds. As of September 13th, the dataset includes 64 investment managers, 203 funds, 4.913 investments, and 4.306 portfolio companies.[8]

In order to analyze the funds' real returns as well as investment (divestment) timing, we have to restrict the dataset to completely realized funds or those near to complete realization. Of course, all funds used for our study have finished the investment phase. Due to complete cash flow information on every funds' portfolio constituent, as well as net asset value information (if the single investment is not completely realized), we know exactly the overall fund realization stage. Assessing the funds on a deal-by-deal basis, we reduce the sample to 70 funds, managed by 36 different investment managers.[9] These funds are mature enough to determine the real final fund performance. Thus, following Lungquist and Richardson (2003a), we concentrate on the generation of mature funds. However, in contrast to their study, we do not generally cut off all funds raised after a certain date.[10] We analyze the funds' realization status individually on a deal-by-deal basis. To calculate the investment or divestment timing proxy as well as the fund performance, we utilize cash flows, which represent the amount of money flowing between company and limited partnership. If stocks from IPO exits are distributed, we measure their particular market value given at that date.

[7] Net cash flows lie in the range of around 55 percent of gross cash flows according to our calculations.

[8] The cut off date for this analysis was March 2003, i.e. funds that were added after March were not included in the analysis.

[9] 30 funds were realized completely, the other 40 funds were almost complete realized with no large distributions and performance changes expected. The general results are robust with respect to using the subset of fully realized funds.

[10] In their case the cutoff vintage year is 1993.

3.2 Descriptive Statistics

We analyze funds raised in vintage years between 1971 and 1998. Table 1 gives an overview of the funds' frequency distribution over the years. Of course, due to an increased deal flow, the number of analyzed funds is slightly higher in the 90ties. As presented in tables 2 to 2B, the very early funds from the 70ties are mainly consisting of buyout investments. Our sample includes venture capital funds starting from the 80ties. Consequently, our sample also includes older investment firms managing buyout portfolios. Nevertheless, on average there is no big difference between venture capital and buyout managers concerning their investment history. In terms of partnership age, we can observe a slightly longer investment history and a higher number of previously raised funds for buyout managers than for VC managers.

We calculated mean gross IRRs between 39.15% for buy out and 63.8% for venture funds. On average this corresponds to an overall IRR of 47.4%. All analyses are based on gross IRRs. A separate analysis of 80 (all CEPRES funds for which net and gross information were available) private equity funds, where we compared real net to gross IRRs - management fees, carry interest payments and other costs subtracted - , revealed on average an 45% depreciation on gross IRRs to get net values.[11]

For all subgroups - VC and buyout - more than half of the private equity investment firms are originated in the US (between 61% and 67%). This corresponds to the market volume of funds raised worldwide. The number of first time funds without investment history is around 35%, thus the sample is well balanced. Concerning these data characteristics we do not observe big differences between the sub samples.[12] A reduced sample set was providing size information. The mean fund size was 233 Mio €, strongly varying in a range between 12 and 2002 Mio €.

[11] The average or median IRRs are slightly higher than they are published in other studies which are based on VentureEconomics or VentureOne data. However, Kaplan/ Sensoy/ Strömberg (2002), p.17 reveal a tendency to exert a downward bias on returns if the those data are used compared to real life data.

[12] There might be a certain survivorship bias, because data are derived mainly from those private equity-managers which have had reported over the last years. We also gather data of those managers concerning their former funds. Unfortunately, we have no information fund-managers which had not been in business until the mid 90ties.

4 Problems with Measuring Market Timing of Private Equity Funds

4.1 Differences between Private Equity and other Asset Classes

Private Equity differs in many ways from other asset classes, such as mutual funds. The four main dissimilarities include: (i) different timing of cash inflows and cash outflows; (ii) lack of market prices and, consequently, difficult return measurement; (iii) illiquidity, which together with the contractual structure of private equity deals cause a long investment horizon; and (iv) different risk measurement standards.

Concerning the timing of cash flows, Ljungqvist and Richardson (2003a) find that "it takes six years for 90 percent of the committed capital to be invested". Table 3 shows an analysis of draw-downs for our dataset. The results are similar to the ones exhibited by them.[13] Furthermore, they conclude "the IRR of the average fund does not turn positive until the eighth year of the fund's life. Thus, once the adjustment for the cost of capital is made, it is only at the very end of a fund's life that excess returns are realized." Summarizing the results of the above analysis, we can conclude that the life of private equity funds consists of two distinct phases: an investment-dominated phase and a divestiture-dominated phase.

Secondly, as a result of the absence of a secondary market for private equity investments, there are no market prices to value portfolio companies. The internal rate of return[14] (IRR) is the most common performance measure for private equity funds. However, the IRR can only be computed for fully realized funds, based on the complete history of cash flows. It is standard practice to indicate a valuation for unrealized funds and calculate an interim IRR. Nonetheless, there are several concerns to be taken into consideration when employing the interim IRR concept. In contrast, mutual funds can evaluate their performance on a daily basis by generating holding period return series utilizing the market valuation of their portfolio investments.

Thirdly, private equity is characterized by a longer time to investment than mutual fund investments. The standard private equity investment process demonstrates the rationale: After performing a due diligence and evaluating the soundness of the deal, a fund manager ('general partner') draws down capital as needed to undertake investments into companies.

[13] However, Ljungqvist and Richardson (2003a) look at the ratio of draw-downs as a fraction of total commitments, while we look at cumulative draw-downs as a fraction of total draw-downs.

[14] IRR is the discount rate that makes the net present value of all cash flows equal to zero

The usual time horizon of the contract between the limited partner and the general partner is ten years. After the single investments were realized, capital gains are paid back deal by deal to the limited partner. Thus, private equity requires long investment horizons and can be considered a relatively illiquid asset compared to other investments.

Finally, the risk/return structure of portfolios composed of publicly traded securities can be analyzed through mean-variance approaches like CAPM. However, the standard deviation, which is an essential element of this analytical framework, is not an appropriate measure of risk for privately held assets. This is due to the unavailability of period-to-period market prices. Therefore, alternative measures of risk for private equity investments have to be applied.

4.2 Discrepancies in the examination of market timing

There are two main reasons why the market timing models used for mutual funds are not appropriate when analyzing private equity fund performance. First, the primary inputs for both models are monthly or daily return series for each of the sample funds. These returns are derived utilizing the holding-period yield formula on a period-to-period basis. However, private equity investments are relatively illiquid assets, in the sense that there is no active secondary market where they could be traded in. Consequently, there are no market prices available to determine a holding-period yield on a period-to-period basis. Even if a private equity partnership makes subjective valuations of its portfolio periodically, these valuations are not a reliable proxy for price changes to be used as inputs in a market model, since valuation standards are flexible and vary considerably.[15]

Secondly, portfolio decisions are made much less frequent in the private equity than in the mutual fund industry, where portfolio managers rearrange their cash-equity composition on a daily basis. Before a new private equity deal can be closed, the contractual details have to be negotiated, and this negotiation process takes up time. The situation is similar regarding the divestment of portfolio assets. Usually, portfolio companies are sold through a trade sale or by means of an IPO, both of which take time, since potential purchasers have to be found or a going public has to be arranged. Consequently, not the frequent decision making regarding the cash-equity composition, but the careful selection of

[15] Most portfolio companies are valuated at cost.

the moment, when an investment or a divestment is made, could constitute *successful market timing* in the field of private equity. Investments (divestments) should be undertaken during periods of relatively low (high) market valuations, respectively, *within in the funds' lifetime*.

Summarizing, market timing possibly constitutes an influential factor of private equity fund performance. Unfortunately, due to the structural dissimilarities between mutual funds and private equity funds, non of the existing market timing examination models can be used for our analysis. Consequently, a new approach has to be developed.

5 Empirical Analysis

The main objective of the empirical analysis is to answer the following two questions: (i) does the market valuation level affect investment or divestiture decisions of private equity fund managers? (ii) Does a positive correlation between market timing ability and fund performance provide evidence that market timing matters for overall fund performance?

Due to the reasons outlined above, market timing abilities have to be analyzed separately for the investment (*investment timing*) and for the divestment phase (*divestment timing*), respectively. Additionally, we develop a joint measure for *total market timing ability (total timing)* during both the investment as well as the divestment stage. Additionally, in order to measure joint influences of investment and divestment timing ability we include both timing proxies as explanatory variables in the regression analysis. Subsequently, we examine the relationship between 'positive' market timing ability and fund performance.

5.1 Market valuation index selection

Ideally, an empirical model of private equity fund performance should be based on the monthly valuation data of the global private equity industry. However, due to limited data availability[16], we use the NASDAQ Composite as main market valuation index for our analysis. This seems reasonable, given the high average and median correlation between the NASDAQ Composite and the relative valuation of the Private Equity industry of 0.846 and 0.815, respectively.

[16] Whereas the cash flow data on fund level goes back to 1971, the relative valuation of the private equity industry is only available staring in 1983.

5.2 A measure to evaluate relative market valuations

As mentioned before, private equity fund managers are unable to invest or divest immediately on short notice, due to the illiquid nature of the underlying assets. However, although fund managers cannot take advantage of daily market fluctuations, they can be assumed to regard the relative market valuation level on a quarterly or yearly time horizon. If they intend to *time the market*, they have to invest during periods of low market valuations and divest during phases of high market valuations.[17]

Due to the extraordinary devolopment of NASDAQ, we cannot straightforwardly compare actual cash inflows and outflows of a fund with the absolute monthly valuation level. Investments made before the bubble would obviously outperform investments carried out after 1998, most of the time, if compared that way. To identify the relative monthly valuation levels over the entire *life* time of NASDAQ, we divide the absolute monthly valuation index by a moving average over the same month. Applying moving averages (36 months), the relative market valuation level is displayed on a monthly basis, depending on the absolute valuation level (18 months) before and after the behold month. The following equation is used to compute the 36-month-moving averages:[18]

$$y^*_t = \frac{1}{2k} * \left[\frac{1}{2} y_{t-k} + \frac{1}{2} y_{t+k} + \sum_{\tau=t-(k-1)}^{t+(k-1)} y_\tau \right] \qquad \textbf{(1)}$$

with: y*=moving average of nasdaq index
t = date (month), k = 1,..18 month
y = nasdaq index level

Next, to determine the monthly valuation levels of NASDAQ, we divide the absolute monthly index by the computed moving average. Thereby, a measure for the *relative monthly valuation* level is created. The following equation illustrates the computation of the monthly valuation level measure:

[17] An example of perfect market timing would be an investment carried out in 1994/95 (before the Technology bubble) followed by a divestiture through IPO, right during the peak of the bubble in early 2000.

[18] This equation calculates the moving average only for an even number of months. k is computed by dividing the number of months of the moving average by two.

$$\mathrm{Re}lativeMarketValuation(t) = \frac{Index(t)}{y^*(t)} \qquad \textbf{(2)}$$

The 36-month time period, which is the basis of the *Relative Market Valuation* level calculation, can be seen as that time period within the investment manager is able to time the market. Figures 1 graph the monthly relative valuation level of NASDAQ from the early 1970s until the year 2002 depending on the moving average utilized.

5.3 Analysis of Market Timing Ability

To determine the relative monthly *investment activity level* of each fund, we use the following ratio:

$$I_t = \frac{negativeCashflow_t}{Tota\ln egativeCashflows} \qquad \textbf{(3)}$$

To examine market timing abilities *during the investment phase*, we compute the correlation between the relative market valuation level[19] and the investment activity ratio I_t on a monthly basis. Months without any investment activity are excluded from the analysis. A negative correlation is evidence in favor of fund manager's positive market timing ability, since his investments were mainly undertaken at low market valuations. The higher the negative correlation, the better is the timing ability of the fund manager. A correlation of minus one [-1] would imply that the fund manager has perfectly timed the market during the investment phase. A positive correlation, instead, illustrates that the fund manager has not carried out most of his investments at favorable market valuation conditions. To determine the number of funds that have timed the market during the investment phase, we add up all funds with a negative correlation. Although the individual level of market timing ability varies, a negative correlation generally implies that the fund manager was at least to some extent concerned with timing the market.

In a similar manner, we compute the following monthly ratio to scale each fund's activities during the realization / divestment period:

$$D_t = \frac{positveCashflow_t}{TotalpositiveCashflows} \qquad \textbf{(4)}$$

[19] Computed by dividing the absolute monthly valuation index by a moving average of the same month.

To evaluate the timing abilities of fund managers during the divestment period, we again examine the monthly correlation between the relative market valuation level and D_t. Months without any divestiture activity are excluded from the analysis. Since divestitures should be undertaken during periods of high market valuations, a positive correlation indicates positive market timing ability. Once more, a correlation of one [+1] would imply perfect market timing behavior of the fund manager. A negative correlation, in contrast, implies that the fund manager has not divested the majority of its investment at favorable market conditions. As before, we sum up the funds that have a positive correlation to get the absolute number of funds that have positively timed the market during the divestiture phase. In the following the correlation coefficient which indicates the extent of investment or divestment timing ability is named "investment timing" or "divestment timing", respectively.

In order to answer the second question whether there is a relationship between positive market timing ability and fund performance, we perform several OLS regressions, where *fund performance* (measured by gross IRR)[20] is used as dependent variable and *market timing ability (timing proxy)* is used as independent variable. The first set of regressions examines the relationship between market timing ability during the investment phase (*investment timing)* and overall fund performance (IRR). A second set of regressions examines the relationship between market timing ability during the divestiture (*divestment timing*) phase and overall fund performance (IRR). Finally, we look at the absolute market timing abilities of private equity fund managers. Total market timing ability (*total timing*) is derived from a distance analysis of the individual correlations with the value of perfect market timing, which is [–1] for the investment period and [+1] for the realization phase. Both distances are separately computed and subsequently added together to create one overall measure of market timing (analysis is presented in the last panels of tables 5, 6, and 7). Following the separate analysis of investment and divestment timing ability, we test for robustness by an inclusion of both timing proxies as explanatory variables in one regression

[20] Management fees and carried interest payments are changing between funds. The compensation payments are influenced by negotiations between the investors and the funds as well as their bargaining power. Ljungqvist and Richardson (2003), pp. 4, explain that the distribution of excess returns (who is earning the money – investor or fundmanager?) depend on the contractual arrangements between the private equity fund and the investor. We intend to show the influence of timing abilities on the real performance which is gross of fees.

(tables 5a, 6a, 7a). We, therefore, pay again attention to the joint influence of investment and divestment timing ability on fund performance.

As control variables we introduce experience proxies. We include the variables *age* of venture capital firm and track record (*number of previous funds raised, # funds*) in the regression model, in order to account for a possible impact of experience - and thereby access to deal flow. The rationale for this is that industry observers say it is easier for an experienced private equity manager to attract deals with high expected returns.

Following Ljungqvist and Richardson (2003a) we account for the influence of a high or low competition for deals on the funds performances. It is shown by Gompers and Lerner (2000) that in times with large commitments to private equity funds the high competition for deals lowers the average fund performances. By including the variable *log(real fund inflow_same vintage year)*, which describes the amount of investable capital in the market at date, in the analysis we further separate the influence of market timing ability on fund performance.

Finally, we split up the entire set of funds according to their investment characteristics in order to investigate smaller subsets and further verify the regression results obtained from the analysis before (tables 6 and 7). We identify a total of 24 VC funds and 46 MBO funds, which we examine through further regression analysis regarding their relationship between fund performance and market timing ability.

5.4 Results

As shown in table 4, the correlation results illustrate that private equity fund managers invest and divest to a limited extent in accordance with favourable market conditions. Applying the relative valuation level over the surrounding 36 months, we appreciate the fact that a private equity investment manager is only able to take advantage from valuation benefits within the investment or divestment period given by his statutes.

With respect to investment timing, 62.86 percent of the funds analyzed dispose a negative correlation, which indicates good investment timing.[21] However, the average and median correlation of all funds analysed are only minus 6.43 percent and minus 4.10 percent, respectively. Furthermore, on average, a correlation of minus 20 percent (when considering

[21] 38 funds have a negative correlation (out of 70 funds analyzed)

only funds with a negative correlation) demonstrates a quite high extent of positive market timing abilities - with respect to fund managers who are definitely timing the market. Only two out of all 70 funds analyzed show correlations lower than minus 0.5 during the investment phase. This confirms the fact that exact market timing is almost impossible due to the illiquidity of this asset class. Moreover, due to a lower elasticity of private equity investment valuations to market valuations, an exact timing (here indicated by a correlation of minus one) is not essential. A negative timing proxy is sufficient evidence for a particular manager being able to time the market (in the sense of macro-economical farsightedness). All results concerning the investment timing are shown in table 4. The exact distribution of the investment timing proxy is illustrated in figure 2.

Regarding the divestment phase, the correlations show a similar pattern (as illustrated in table 4). 55.07 percent of all funds show a positive correlation, which indicates positive divestment timing ability. The average and median for all funds is 4.99 and 2.86 per cent respectively. Thus, although the majority of fund managers time the market during the divestiture phase, the low correlations indicate that managers do not constantly accomplish to divest in a favourable market environment. A separated analysis of those fund managers, who are timing the divestment, shows a 21 percent correlation between the divestment and favourable exit valuation levels, on average. Figure 3 shows the exact distribution of the divestment timing ability (all correlations) for the complete set of funds. Even though lots of funds show relatively favourable investment timing, there are substantial differences regarding the funds' timing abilities. Pertaining to the investment phase, only two out of 70 funds dispose nearly perfect negative correlations[22]. For the divestiture phase, at least four out of 70 funds show very high correlations[23]. Table 4 also presents a separate analysis of VC and MBO funds' timing ability. On average, VC fund managers do better time the exit compared to MBO fund managers. This is in line with the results of Ljungqvist and Richardson (2003a).

To answer the second initial question whether 'good' market-timers perform better than 'bad' market timers, we carry out regression analyses. The relationship between timing ability - during both the investment and the divestiture phase - and fund performance was not

[22] Correlations below [-0.5]
[23] Correlations above [+0.5]

only scrutinized for the complete set of 70 funds but also for the subsets of 24 VC and 46 MBO funds.

In general, timing does matter! The regressions generate empirical evidence showing that timing ability is an important factor of overall fund performance. Table 5 presents the results of the OLS regression. The coefficients of investment timing indicate their positive effect on fund performance – if only at a 10 per cent significance level. To invest in times with favourable market valuations seems to improve fund performance. Surprisingly, the separate analysis of divestment timing does not show any significant influences on performance. Looking at the combined influence of investment and divestment timing (*total timing*, which can be interpreted as the ability to catch overall positive valuation changes) table 5 gives evidence of its influence on fund return. At a five per cent level of significance, fund performance is positively determined by total timing ability.

In table 5a we test the results for robustness by including all explanatory variables in one regression. The results confirm the findings of the former analysis. Investment timing ability is positively influencing fund performance, at 5 per cent level of significance. Due to differences in venture capital and MBO performance, we control for investment stage focus, and find that VC funds have significantly higher returns.

In this overall analysis we did not find any evidence that experience or the competition for deal flow has an impact on the funds performance. The coefficients of the control variables are not significantly different from zero.

Analyzing the two subsets (VC funds and MBO funds) separately, we find different results on the explanatory variables. In the case of venture capital, results outlined in table 6 show a significant influence of deal investment timing on fund performance. None of our control variables adds in all regressions power to explain variation in fund performance. VC-backed companies are very immature at the time of investment. Due to difficulties in determining the true business value, investment prices are often subject to market valuation levels. The elasticity of company valuation to variation in market prices can be assumed to be higher than those of more mature companies. On the other hand, private equity fund managers have it easier to value more mature businesses according to real operating profits, and thus more independently from current market valuations.

We thus interpret our findings in accordance with the following arguments: To time favourable market valuations is essential for investing venture capital into immature companies, due to high valuation elasticity to market prices. However, exit timing in accordance with high valuation levels is not as essential for performance. Exit prices are rather determined by real operating variables and individual quality of the business model. Of course, during the years of the technology bubble, selling VC-backed internet companies was pushing performance extraordinarily. In this situation, prices were not determined by real operating variables but on wrong future estimates of overoptimistic buyers. Nevertheless, one cannot claim this to be a common situation for private equity funds. In this paper we analyze data over a period of more than 20 years and test for *relative* valuation levels. Therefore, lots of ups and downs in market valuations are included in our sample. In table 6a, we test the results for robustness and confirm our former findings.

For later-staged buyout funds our analysis reveals that fund performance is not driven by market timing but is significantly related to the experience of the individual fund manager. Table 7 presents results of an OLS regression testing the impact of market timing and experience (proxied by age of the private equity firm (*age*) and the number of previously managed funds (*#fund*) on the performance of buyout funds. We find that more experienced fund managers, who have already raised some funds in their investment track record, perform better. This is confirmed on a 5 or 10 percent level of significance (table 7, panels 1-3). Thus, for successful investing into more mature portfolio companies, getting access to better deal flow and managing the investment seems to affect the success of these investments rather than timing the market. This is in line with our hypothesis, that market valuation is less important in determining the investment success of real operating mature companies. Buyout investments are mature by definition, and therefore, prices paid rather depend on the companies' quality, which is easier to evaluate than for start-ups. Moreover, in order to achieve high returns it seems to be the investment managers' task of selecting high quality companies. Summarizing, experience and access to deal flow are essential.

In accordance with Ljungqvist and Richardson (2003a) we identify two important factors which determine fund performance. To time the market is essential for VCs, who invest into immature companies without a long business history. Due to the lack of company information, valuations seem to be highly related on overall market valuations. For more

mature companies market valuations seem to play a minor role. Here, the real quality of the business is essential. Consequently, in the case of buyout financing, experience of dealing with those investments, as well as the right access to higher-quality deals is determining investment performance.

6 Summary and Conclusions

This paper contains the first examination of market timing ability of private equity fund managers, using a unique set of detailed cash-flow data. For mutual funds it is common practice to break down portfolio performance into two components: security selection and market timing. For private equity funds, portfolio performance has not been split up into the contribution of company selection and the contribution of market timing so far.

As an important step towards a more comprehensive understanding of all components that affect the overall fund performance of private equity funds, we analyze whether private equity funds time the market, and also, whether there is a relationship between positive *market timing ability* and overall fund performance. Due to the special characteristics of private equity, market timing abilities are separately analyzed for the investment and for the divestment phase.

Our results show that investment timing has an impact on the performance of venture capital funds. Surprisingly, divestment timing has on average no such impact on returns, even accounting for the bubble period of 1998-2000. For later-staged buyout funds, our analysis reveals that fund performance is not driven by market timing but rather significantly related to the experience of the individual fund manager. Thus, for successful investing into more mature portfolio companies, getting access to better deal flow and managing the investment affect the resulting success of these investments.

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Tables

Table 1: Sample overview by vintage year frequency

Vintage Year	Frequency	Percentage	Cumulative Percentage
1971	1	1.43	1.43
1981	1	1.43	2.86
1983	2	2.86	5.71
1984	2	2.86	8.57
1986	4	5.71	14.29
1987	3	4.29	18.57
1988	3	4.29	22.86
1989	6	8.57	31.43
1990	5	7.14	38.57
1991	3	4.29	42.86
1992	8	11.43	54.29
1993	5	7.14	61.43
1994	7	10.00	71.43
1995	3	4.29	75.71
1996	7	10.00	85.71
1997	7	10.00	95.71
1998	3	4.29	100.00
Total	70	100	

Table 2: Descriptive Statistics Full sample

All information is based on gross IRR data. The net IRRs (management fees, carry interest payments and other costs subtracted) are valued on average with 55% of gross values. This is based on a sample of 80 private equity funds. We have only fund size information for a reduced sample of 41 funds (41 out of 70).

Descriptive Statistics

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Annual (gross) IRR	1.00%	348.00%	47.38%	55.96%
Age of investment firm	0.00	44.00	7.69	10.58
Date of closing	15.11.1971	15.03.1999	26.11.1991	
# previous funds (track record)	0.00	20.00	2.87	3.78

# of fund	*absolute frequency*	*frequency*	*cumulated %*
1	29	41.43%	41.43%
2	18	25.71%	67.14%
3	10	14.29%	81.43%
4	4	5.71%	87.14%
5	4	5.71%	92.86%
6	1	1.43%	94.29%
More	4	5.71%	100.00%
Sum	70	.	

Sample fund characteristics

USA funds			65.15%	
Reduced sample of 41 Funds				
Fund size	€ Mio 11.18	€ Mio 2022	€ Mio 233.48	€ Mio 431.96

Table 2a: Descriptive Statistics MBO sample

Descriptive Statistics (only MBO Funds, N=46)

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Annual (gross) IRR	1.00%	203.00%	39.15%	38.71%
Age of investment firm	0.00	44.00	8.78	12.17
# previous funds (track record)	0.00	20.00	3.23	4.51
Date of closing	1971-11-15	1999-03-15	1991-02-20	
Sample fund characteristics				
USA funds			67.44%	
First time			36.96%	

Table 2b: Descriptive Statistics VC sample

Descriptive Statistics (only VC Funds, N=24)

	Minimum	Maximum	Mean	Std. Deviation
Annual (gross) IRR	1.00%	348.00%	63.83%	78.68%
Age of investment firm	0.00	21.00	5.58	6.20
# previous funds (track record)	0.00	5.00	2.166	1.46
Date of closing	1983-10-15	1998-10-01	1993-05-13	
Sample fund characteristics				
USA funds			60.87%	
First time			33.33%	

Table 3: Draw down analysis

The table below shows that the median of the funds has invested 97.56% of the total invested capital after six years and 99.87% after seven years respectively. The median of all funds is fully invested after eight years. Total observations are 30 for each year since only the set of fully realized funds was used for this analysis.

Years	cumulative negative cash flows / total negative cash flows	Relative change to previous year	Standard Deviation
1	23.61%		23.33%
2	47.16%	99.79%	25.73%
3	70.32%	49.11%	24.36%
4	86.58%	23.11%	18.35%
5	91.36%	5.53%	14.41%
6	97.56%	6.78%	12.30%
7	99.87%	2.37%	8.84%
8	100.00%	0.13%	6.02%
9	100.00%	0.00%	5.01%
10	100.00%	0.00%	3.03%

Table 4: Average and median investment and divestment timing ability

The table below shows the average and median correlations between relative market valuation (represented as the absolute index level divided by moving averages of the index level) and the investment activity ratio I_t. *The correlation coefficient which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively*. A negative value of the investment timing proxy (correlation) during the investment phase indicates positive market timing ability, whereas a positive value demonstrates negative market timing. For the divestment phase, the positive divestment timing proxy implies positive market timing ability, while a negative value represents negative market timing.The results illustrate that on average most private equity fund managers invest in accordance with favourable market conditions.

	All Funds (N=70)		VC Funds (N=24)		MBO Funds (N=46)	
	Investment timing	Divestment timing	Investment timing)	Divestment timing	Investment timing	Divestment timing
Average	-6.43%	4.99%	-3.33%	12.79%	-8.06%	0.82%
Median	-4.10%	2.86%	-7.26%	11.12%	-3.46%	-1.40%
Max	54.55%	75.81%	54.54%	75.81%	44.94%	75.77%
Min	-80.79%	-50.14%	-46.51%	-33.95%	-80.78%	-15.13%
St. Dev.	24.54%	24.95%	23.61%	27.97%	25.12%	22.40%
# neg.	44	31	15	8	28	24
# pos.	26	38	9	16	18	22
total	70	69	24	24	46	46
# neg. / total	62.86%	55.07%	62.25%	33.33%	60.86%	52.1%
mean proxy of good timers	-19.96%	21.00%	-16.09%	27.41%	-22.18%	16.60%

Table 5: Market timing and fund performance (full sample)

The table presents the results of the OLS regression; the dataset includes 70 private equity funds. The first row presents the dependent variables. The first column presents the independent variables. In the second to the sixth' column the coefficients of the OLS regression are illustrated. In italics below the ß estimates the p-value of the absolute heteroskedastic-consistent t-statistics is presented. One, two, and three asterisks indicate significance at the 10%, 5%, and 1% level, respectively. The last three rows present the r-squared, the adjusted r-squared, and the p-value of the F-test, that the set of coefficients is equal to zero.
The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. The influence of timing ability on performance is analyzed separately for the investment and divestment phase. The third panel shows results using a combined measure for investment timing (the regression variable which measures the overall timing ability is called "combined in-/divestment timing"). All OLS regressions satisfy the assumptions of the classical linear regression model. A negative beta estimate of the timing proxy during the investment phase indicates positive market timing ability, whereas a positive beta estimates demonstrates negative market timing. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing. For the regression of overall market timing ability of fund managers a negative beta estimate shows positive overall timing ability.

	Investment Timing			**Divestment Timing**			**Total Timing**		
	IRR	**IRR**		**IRR**	**IRR**		**IRR**	**IRR**	
		(test for multicollinearity)			(test for multicollinearity			(test for multicollinearity)	
Constant	-0.373	-0.238	0.417***	-0.385	-0.313	0.439***	0.537	0.621	1.352***
	0.515	*0.673*	*0.000*	*0.513*	*0.588*	*0.000*	*0.429*	*0.638*	*0.001*
Investment timing	-0.538*	-0.495*	-0.540*						
	0.053	*0.073*	*0.054*						
Divestment timing				0.313	0.307	0.297			
				0.263	*0.271*	*0.291*			
Combined In-/Divestment Timing							-0.479**	-0.452**	-0.470**
							0.020	*0.027*	*0.023*
Age	-0.0096		-0.007	-0.0068		-0.004	-0.00957		-0.007
	0.230		*0.372*	*0.449*		*0.637*	*0.224*		*0.379*
# funds	0.027	0.012	0.027	0.019	0.009	0.019	0.0225	0.0083	0.022
	0.165	*0.476*	*0.215*	*0.395*	*0.612*	*0.401*	*0.287*	*0.689*	*0.299*
Log(real fund inflows_ same vintage year)	0.184	0.146		0.192	0.170		0.193	0.155	
	0.165	*0.256*		*0.160*	*0.199*		*0.139*	*0.222*	
R squared	0.071	0.078	0.071	0.062	0.053	0.031	0.122	0.102	0.092
Adj. R squared	0.043	0.036	0.028	0.002	0.009	0.014	0.067	0.060	0.05
p-value (F-statistic)	0.148	0.148	0.184	0.397	0.32		0.076	0.071	0.098

Table 5a: Market timing and fund performance (full sample)

To test for robustness this table presents a combined analysis including both measures of timing ability in one regression analysis. Due to large differences in VC and buyout fund performances, we control additionally for the investment stage focus by implementing a dummy variable that controls for VC focus. The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. A negative beta estimate of the timing proxy during the investment phase shows positive market timing ability, whereas a positive beta estimate demonstrates negative market timing ability. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing ability.

	Timing	
	IRR	**IRR** (test for multicollinearity)
Constant	-0.281 *0.626*	-0.202 *0.721*
Investment Timing	-0.629** *0.025*	-0.617** *0.027*
Divestment Timing	0.272 *0.331*	0.259 *0.352*
Age	-0.0068 *0.438*	
# funds	0.026 *0.248*	0.016 *0.381*
Log(real fund inflows_ same vintage year)	0.139 *0.306*	0.115 *0.381*
Dummy VC	0.221 *0.147*	0.233 0.124
R squared	0.157	0.149
Adj. R squared	0.074	0.080
p-value (F-statistic)	0.096	0,069

Table 6: Market timing and fund performance (VC sample)

The table presents the results of the OLS regression; the dataset includes 23 venture capital funds. The first row presents the dependent variables. The first column presents the independent variables. In the second to the sixth' column the coefficients of the OLS regression are illustrated. In italics below the ß estimates the p-value of the absolute heteroskedastic-consistent t-statistics is presented. One, two, and three asterisks indicate significance at the 10%, 5%, and 1% level, respectively. The last three rows present the r-squared, the adjusted r-squared, and the p-value of the F-test, that the set of coefficients is equal to zero.
The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. The influence of timing ability on performance is analyzed separately for the investment and divestment phase. The third panel shows results using a combined measure for investment timing. All OLS regressions satisfy the assumptions of the classical linear regression model. A negative beta estimate of the timing proxy during the investment phase indicates positive market timing ability, whereas a positive beta estimates demonstrates negative market timing. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing. For the regression of overall market timing ability of fund managers a negative beta estimate shows positive overall timing ability.

	Investment Timing			**Deinvestment Timing**			**Total Timing**		
	IRR	**IRR** (test for multicollinearity)		**IRR**	**IRR** (test for multicollinearity)		**IRR**	**IRR** (test for multicollinearity)	
Constant	-2.099	-1.640	0.867***	-1.758	-1.431	1.031***	-0.949	-0.547	1.938*
	0.267	*0.338*	*0.009*	*0.395*	*0.440*	*0.006*	*0.647*	*0.781*	*0.052*
Investment timing	-1.290*	-1.250*	-1.236*						
	0.071	*0.074*	*0.094*						
Divestment timing				-0.0405	-0.0909	-0.101			
				0.947	*0.876*	*0.871*			
Combined In-/Divestment Timing							-0.624	-0.535	-0.546
							0.233	*0.284*	*0.309*
Age	-0.0258		-0.002	-0.0181		0.005	-0.0314		-0.006
	0.523		*0.956*	*0.686*		*0.914*	*0.471*		*0.881*
# funds	-0.093	-0.146	-0.11	-0.167	-0.219*	-0.184	-0.0898	-0.184	-0.113
	0.568	*0.146*	*0.517*	*0.352*	*0.077*	*0.317*	*0.613*	*0.132*	*0.538*
Log(real fund inflows_ same vintage year)	0.673	0.575		0.632	0.564		0.687	0.567	
	0.119	*0.143*		*0.179*	*0.186*		*0.613*	*0.171*	
R squared	0.325	0.310	0.225	0.188	0.180	0.1	0.251	0.229	0.147
Adj. R squared	0.179	0.201	0.103	0.008	0.051	0.042	0.085	0.107	0.013
p-value (F-statistic)	0.114	0.065	0.174	0.413	0.275	0.563	0.241	0.167	0.375

Table 6a: Market timing and fund performance (VC sample)

To test for robustness this table presents a combined analysis including both measures of timing ability in one regression analysis. Due to large differences in VC and buyout fund performances, we control additionally for the investment stage focus by implementing a dummy variable that controls for VC focus. The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. A negative beta estimate of the timing proxy during the investment phase shows positive market timing ability, whereas a positive beta estimate demonstrates negative market timing ability. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing ability.

	VC IRR
Constant	-2.198
	0.264
Investment Timing	-1.345*
	0.075
Divestment Timing	0.201
	0.123
Age	-0.0291
	0.495
# funds	-0.0771
	0.656
Log(real fund inflows_ same vintage year)	0.685
	0.123
R squared	0.330
Adj. R squared	0.133
p-value (F-statistic)	0.194

Table 7: Market timing and fund performance (MBO/LBO sample)

The table presents the results of the OLS regression; the dataset includes 45 buyout funds. The first row presents the dependent variables. The first column presents the independent variables. In the second to the sixth' column the coefficients of the OLS regression are illustrated. In italics below the ß estimates the p-value of the absolute heteroskedastic-consistent t-statistics is presented. One, two, and three asterisks indicate significance at the 10%, 5%, and 1% level, respectively. The last three rows present the r-squared, the adjusted r-squared, and the p-value of the F-test, that the set of coefficients is equal to zero.
The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. The influence of timing ability on performance is analyzed separately for the investment and divestment phase. The third panel shows results using a combined measure for investment timing. All OLS regressions satisfy the assumptions of the classical linear regression model. A negative beta estimate of the timing proxy during the investment phase indicates positive market timing ability, whereas a positive beta estimates demonstrates negative market timing. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing. For the regression of overall market timing ability of fund managers a negative beta estimate shows positive overall timing ability.

	Investment Timing			**Deinvestment Timing**			**Combined Timing**		
	IRR	**IRR** (test for multicollinearity)		**IRR**	**IRR** (test for multicollinearity)		**IRR**	**IRR** (test for multicollinearity)	
Constant	0.130	0.168	0.289***	0.0383	0.31***	0.31***	0.596	0.615**	0.803**
	0.772	*0.700*	*0.000*	*0.933*	*0.000*	*0.000*	*0.280*	*0.261*	*0.025*
Investment timing	-0.208	-0.192	-0.215	0.295	0.294	0.272	-0.257	-0.243	-0.254
	0.365	*0.394*	*0.345*	*0.275*	*0.271*	*0.305*	*0.147*	*0.162*	*0.148*
Divestment timing				0.295	0.294	0.272			
				0.275	*0.271*	*0.305*			
Combined in-/divestment timing							-0.257	-0.243	-0.254
							0.147	*0.162*	*0.148*
Age	-0.00277		-0.002	0.00073		0.000	-0.00319		-0.003
	0.634		*0.682*	*0.910*		*0.999*	*0.577*		*0.647*
# funds	0.0327**	0.0284**	0.03249**	0.0252	0.0242*	0.026*	0.0294*	0.02516**	0.02957**
	0.037	*0.028*	*0.034*	*0.118*	*0.07*	*0.10*	*0.052*	*0.051*	*0.049*
Log(real fund inflows_ same vintage year)	0.038	0.02677		0.0647	0.0624		0.0507	0.0368	
	0.717	*0.792*		*0.544*	*0.546*		*0.623*	*0.711*	
R squared	0.137	0.132	0.134	0.148	0.148	0.14	0.164	0.158	0.159
Adj. R squared	0.053	0.07	0.072	0.063	0.085	0.077	0.082	0.097	0.099
p-value (F-statistic)	0.186	0.110	0.106	0.161	0.085	0.1	0.111	0.063	0.025

Table 7a: Market timing and fund performance (MBO/LBO sample)

To test for robustness this table presents a combined analysis including both measures of timing ability in one regression analysis. Due to large differences in VC and buyout fund performances, we control additionally for the investment stage focus by implementing a dummy variable that controls for VC focus. The correlation coefficient (table 4) which indicates investment or divestment timing is named "Investment timing" or "Divestment timing", respectively. A negative beta estimate of the timing proxy during the investment phase shows positive market timing ability, whereas a positive beta estimate demonstrates negative market timing ability. For the divestment phase, a positive beta estimate implies positive market timing ability, while a negative beta estimate represents negative market timing ability.

	MBO IRR
Constant	0.0499
	0.912
Investment timing	*-0.237*
	0.310
Divestment timing	0.306
	0.258
Age	-0.00012
	0.845
# funds	0.02631*
	0.10
Log(real fund inflows_ same vintage year)	0.0581
	0.585
R squared	0.171
Adj. R squared	0.064
p-value (F-statistic)	0.182

Figure 1: Relative monthly market valuation level of the NASDAQ (employing a 36-months moving average)

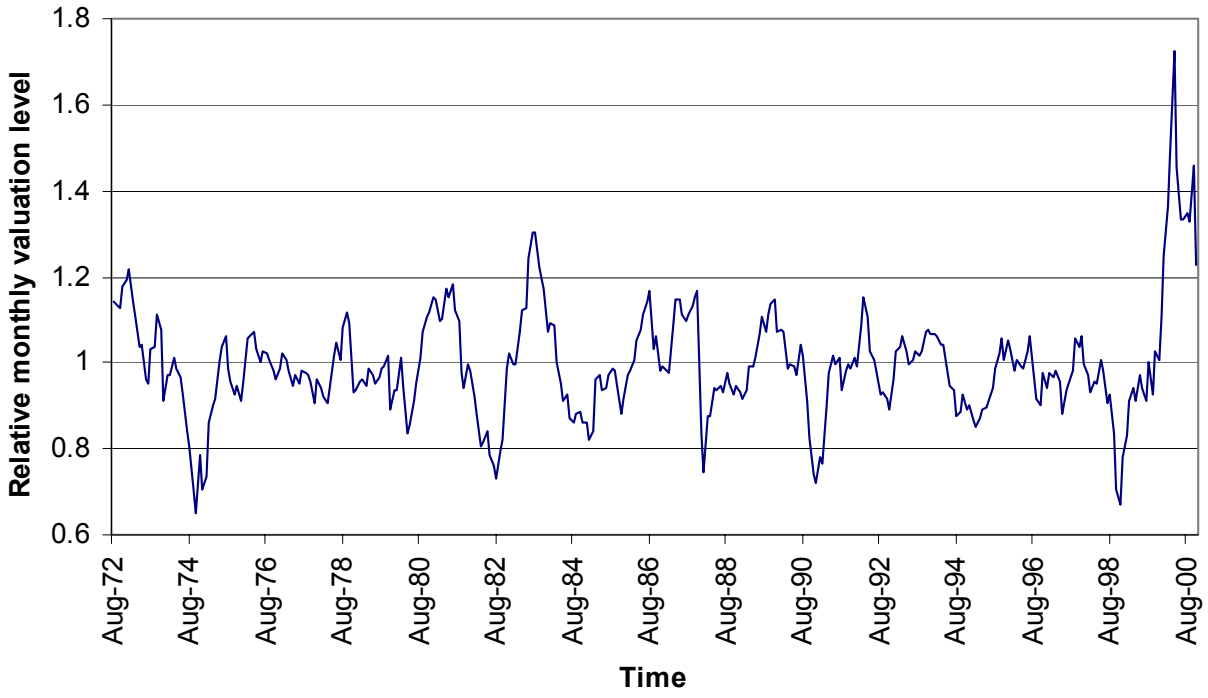

Figure 2: Distribution of correlations between relative valuation levels based on 36-months moving average and investment activity ratio I_t for the complete set of funds = distribution of investment timing ability

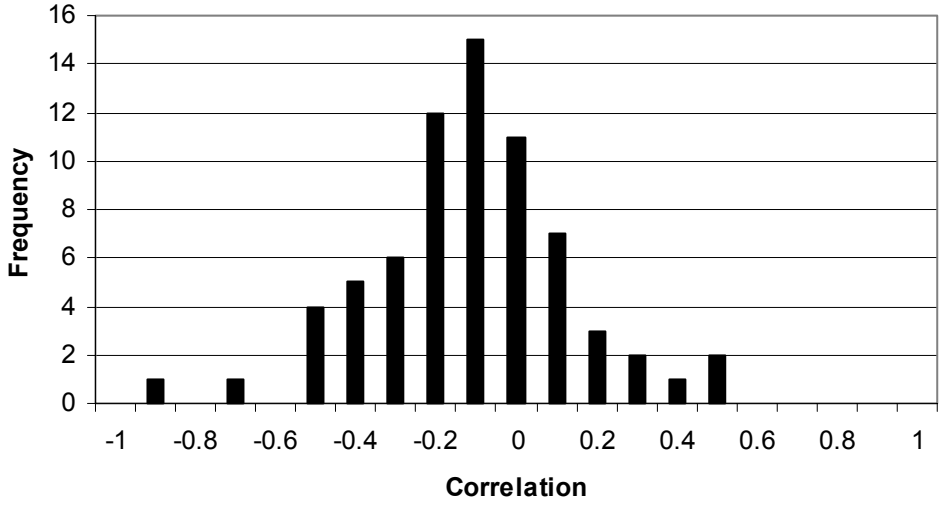

Figure 3: Distribution of correlations between relative valuation levels based on 36-months moving average and divestment activity ratio D_t for the complete set of funds = = distribution of divestment timing ability