# Real Estate Fund Flows and the Flow-Performance Relationship

David H. Downs

*Virginia Commonwealth University*

Steffen Sebastian

*University of Regensburg*

Christian Weistroffer

*Goethe University Frankfurt*

René-Ojas Woltering

*University of Regensburg*

**Abstract**

This paper examines the flow-performance relationship for direct real estate investment funds. Combining a unique data set with a VAR model framework, we find evidence that investors chase past returns at the aggregate level. However, we find against a market timing hypothesis - real estate fund flows do not seem to predict subsequent returns. Additional findings indicate aggregate flows into direct real estate funds are serially correlated and negatively related to changes in the risk free rate. Our analysis of individual fund flows is motivated by a growing body of literature that addresses the flow-performance relationship and the effect of illiquid assets. Overall, we find the flow-performance relationship for direct real estate investment funds is convex. This finding is consistent with studies based on funds with more liquid underlying assets such as equity funds. More importantly, we find that the flow-performance shape varies with fund-level liquidity. Individual fund flows are less sensitive to poor performance as liquidity increases. The flow-performance sensitivity is higher for high performing funds as liquidity increases. Together these results imply that fund liquidity increases the flow-performance convexity of real estate funds. The implications are that investors are more sensitive to fund-level underperformance (i.e., more likely to sell), when there is increased liquidity risk.

*JEL classification*: G11, G14, G24

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# 1 Introduction

The mutual fund literature provides clear evidence that investors buy those funds with the highest past returns (Ippolito, 1992; Sirri and Tufano, 1998; Guercio and Tkac, 2002). The literature also reports that investors do not withdraw money from the worst performing funds to the same degree. Consequently, the relationship between fund flows and performance of individual funds is described as convex. Most studies on the relationship between fund flows and performance are limited to funds which invest in liquid asset classes such as stocks and bonds. As a result of the underlying asset liquidity, these funds are generally considered liquid funds. Chen, Goldstein, and Jiang (2010) analyze the flow-performance relationship while differentiating among the liquidity of stocks held by mutual funds. They document that funds investing in less liquid stocks exhibit a stronger sensitivity of outflows to poor past performance than funds with liquid assets. They argue an investor's tendency to withdraw increases when there is a concern for the damaging effect of other investor's redemptions. This rationale follows as outflows in illiquid funds result in more damage to future performance due to higher trading costs. The results of Chen et al. (2010) suggest that the degree of liquidity of the underlying asset may have an effect on investor behavior. This raises the question how fund investors behave if the underlying asset is completely illiquid as in the case of direct real estate investments.

The literature on the flow-performance relationship in the context of real estate is sparse. In this case, data limitations restrict the scope of research questions addressed. Fisher, Ling, and Naranjo (2009) and Ling, Marcato, and McAllister (2009) derive capital flows of institutional investors from their transactions in the US and UK property markets in order to analyze whether the transactions of these investors cause price pressure at the aggregate level. This is problematic as each transaction also has a counterparty. Thus it remains unclear why the transactions of one sub-segment of investors (here, institutional investors) would cause price pressure while those of the other sub-segment of investors would have to cause the opposite. These authors also analyze whether investors chase past returns. In that context, their measure of flows and returns has another challenge. Flow data that are derived from transactions do not precisely reflect the point of time when the decision to invest in real estate has actually been made. The time lag until property transactions are finally closed is often a substantial and time-varying. Thus, their flow measure might be attributed to performance chasing behavior (or not), although market conditions may have been completely different when the actual investment decision took place.

Another strand of real estate studies on the flow-performance relationship is based on REIT mutual funds. Ling and Naranjo (2006) analyze the relationship between aggregate flows into REIT mutual funds and aggregate REIT returns. Chou and Hardin (2013) study the flow-performance relationship at the level of individual REIT mutual funds. However, the REITs held by REIT mutual funds are publicly traded, liquid securities. Thus, investments into REIT mutual funds may not be affected by illiquidity considerations that play a role in the context of direct real estate investments. Furthermore, flows into REIT mutual funds may only have an effect on REIT prices. As fund flows do not cause transactions in the direct property market the effect on the underlying asset seems only remotely possible. Finally, Ling and Naranjo (2003) examine total capital flows into REITs (i.e. equity issuances and net debt changes), but their flow data is based on financing decisions of the REIT management and hence not suited to analyze investor behavior in the tradition of the mutual fund literature.

The aim of this study is to address these limitations by investigating the flow-performance relationship of direct real estate investment funds. Our analysis is based on a unique dataset of German mutual funds. Germany is one of the few places worldwide where investors have the opportunity to invest in direct real estate investment funds with an open-ended structure. Unlike REIT mutual funds, which invest in liquid, publicly traded REITs, German open-end real estate funds invest directly in real property. In order to be able to absorb negative cash flow shocks without immediately having to engage in costly transactions, real estate funds hold high cash reserves which serve as a liquidity insurance. Up to 50% of their assets under management (AuM) are invested in cash, which is substantially higher than the 4-5% typically reported for equity mutual funds. When the liquidity ratio falls below 5%, the fund is legally required to stop the redemption of shares until liquidity is restored.

This setting provides several advantages to study investor behavior when the underlying asset is particularly illiquid. First, our flow data is a high-quality, contemporaneous measure of fund investor decisions to invest in real estate. Thus, we measure precisely how investors react to performance and do not have to rely on transaction data which are a lagged measure of real estate investment decisions. Compared to flows into REIT mutual funds, our flow data enables us to analyze the link between the direct property market and public security markets as the returns of real estate funds are based on appraisals and property transactions, and not on public security returns. Furthermore flows into real estate funds are ultimately invested into (or divested from) the direct property market, while REIT mutual fund flows merely affect REIT prices.

Our initial analysis focuses on the flow-performance relationship at the aggregate level. Here, we follow the approach of Fisher et al. (2009) and use Vector Autoregression (VAR) analysis to capture the dynamic relationship between flows and returns, while controlling for exogenous factors that may affect investor behavior. We empirically test whether investors chase past returns at the aggregate level. We find aggregate flows into real estate funds are positively related to prior fund returns which is consistent with return chasing behavior of real estate fund investors. This results stands in contrast to the findings of Warther (1995) who finds no evidence of return chasing of behavior of equity fund investors at the aggregate level.

We also examine whether aggregate flows have an effect on subsequent returns. As we do not observe flows and returns in sub-markets by property type but only flows and returns of the fund as a whole, we cannot test the price pressure hypothesis. Instead, our data set enables us to examine whether investors possess market timing ability on an aggregate level in the context of real estate funds. More specifically, we test whether investors move into real estate funds prior to future outperformance, and out of real estate funds before they underperform. However, we find no evidence supporting the market timing hypothesis for real estate funds on an aggregate basis.

Additional analysis shows that aggregate flows and returns are serially correlated. Aggregate flows are negatively related to lagged changes in the risk free rate, which is consistent with investors viewing real estate funds as a low risk investment substitute for cash. Furthermore, we find aggregate real estate returns are positively related to the level of the risk free rate in the previous period. The analysis is complemented by impulse response functions in which we examine this dynamic relation over a longer horizon.

Next, we examine the flow-performance relationship for individual real estate funds. This analysis enables us to determine whether the return-chasing behavior of investors observed at the aggregate level is also evident as investors choose among different funds. In addition, we address the question whether the flow-performance relationship is affected by fund liquidity. We follow the approach of Sirri and Tufano (1998) and model investor choice between real estate funds using a piecewise linear approach with fund- and time fixed effects. We find that investors respond to past performance when selecting individual funds. The flow-performance relationship for real estate funds is convex. Top-performing funds receive disproportionally large inflows in the following period. While the underlying assets of real estate funds are illiquid, we find no evidence that investors punish poor performance. This result contradicts the prediction of Chen et al. (2010) that funds with less liquid assets show a stronger response of flows to poor performance.

In additional analysis we model the effect of fund liquidity on the flow-performance relationship by interacting past performance with the liquidity ratio of the fund. We find that fund liquidity affects the shape of the flow-performance relationship. Fund liquidity increases the flow-performance sensitivity for strong performing funds while it decreases the sensitivity for poorly performing funds. This result suggests investors chase past performance less and flee poor performance more aggressively when the fund liquidity is a constraint. Our findings contribute to the literature by highlighting direct real estate investment funds and the role of fund liquidity for the flow-performance relationship.

The remainder of this paper is organized as follows. Section 2 introduces the related literature and our hypotheses. The dataset and descriptive statistics are introduced in Section 3. Section 4 contains our research methodology and the empirical results for the aggregate analysis. Section 5 provides the research methodology and results for the fund level analysis. Section 6 provides our conclusions.

# 2 Related Literature and Hypotheses

### Performance Chasing

Chasing past performance can be rational if past performance contains information about future performance. In the public stock markets, past performance is generally not a good indicator of future performance. Hence, it is not surprising that Warther (1995) finds no evidence that aggregate fund flows into equity mutual funds are positively related to past returns. The REIT literature provides some evidence that the returns of REITs are more predictable than those of common stocks (e.g. Nelling and Gyourko (1998) or Ling, Naranjo, and Ryngaert (2000)). Thus, the finding of Ling and Naranjo (2006) that aggregate flows into REIT mutual funds are positively related to prior aggregate REIT returns could be interpreted as a case of rational investor behavior. Return chasing might be even more of an issue in the private real estate markets, where the autocorrelation of direct real estate returns is well documented. However, the *extant* literature provides mixed evidence regarding whether or not investors chase past performance in the private real estate market. While Ling et al. (2009) find support for return chasing behavior of institutional investors UK data, Fisher et al. (2009) come to the opposite conclusion with institutional transaction data from the US.

Our data of direct real estate investment funds provides a unique setting to study whether or not real estate investors chase past returns. As the returns of real estate funds are predominantly based on appraisal values and rental income, they should show patterns similar to those documented for return indices of private real estate markets. Consequently, at least in the short term, investors of real estate funds may successfully predict future performance from past fund returns and invest their money accordingly. Thus, we formulate our hypothesis of return chasing behavior at the aggregate level as follows:

**Hypothesis 1:** *Investors chase past performance (i.e., aggregate net flows into real estate funds are positively related to prior performance).*

**Market Timing**

If investors simultaneously invest in or withdraw money from several mutual funds within the same investment category, the returns of the underlying assets may be affected. Warther (1995) finds evidence of price pressure through aggregate mutual fund flows. He reports that aggregate flows into equity mutual funds are positively related to contemporaneous stock returns, while he finds no relationship between returns and lagged flows. Coval and Stafford (2007) find evidence of price pressure across a common set of securities held by distressed funds. Funds experiencing large outflows tend to decrease existing positions, while funds experiencing large inflows tend to expand existing positions. Using aggregate flows into REIT mutual funds, Ling and Naranjo (2006) also only document a contemporaneous relationship between REIT returns and aggregate REIT mutual fund flows, but they do not find that flows predict returns. In the private real estate market, Fisher et al. (2009) find that US-based capital flows predict subsequent returns, whereas Ling et al. (2009) find no support for the price pressure hypothesis in the UK.

In contrast to prior studies, our data set enables us to examine whether investors possess market timing ability on an aggregate level. Unlike the prior work, we do not claim to test the price pressure hypothesis as our measure of returns is based on the aggregate performance of the real estate funds in the sample as opposed to underlying asset prices. More specifically, we test whether investors move into real estate funds prior to future outperformance, and out of real estate funds before they underperform. Bhargava, Bose, and Dubofsky (1998) identify a short-term trading strategy for open-end mutual funds where investors can exploit international correlations of stock markets by buying mutual funds whose NAVs do not yet reflect information released during the US trading day. A similar, yet longer-term investment strategy might be profitable for real estate funds. The returns of real estate funds are predominantly based on annual appraisals which are periodically updated for the whole portfolio of the fund. Investors might trade on anticipated swings in the real estate market before they are reflected in the new appraisals and hence in the net asset values (NAVs) of the funds. For example, investors might foresee a significant revaluation of fund assets in the near future. This leads us to our market timing hypothesis:

**Hypothesis 2a:** *Aggregate flows into real estate funds predict future performance (i.e., investors of real estate funds exploit anticipated return swings).*[1,2]

However, even if inflows and outflows occur due to rational expectations about future performance, the fund flows themselves may have a negative impact on fund performance. In the short term, high inflows increase a fund's share of lower yielding cash holdings. Therefore, potentially successful market timing may be masked by the dilution effect of fund flows on returns. Greene and Hodges (2002) find that daily fund flows into equity mutual funds have a dilution effect of annualized 0.48%. This effect may be even stronger for real estate funds, because the high liquidity ratios persist until additional property acquisitions are completed, which takes substantially longer compared to equity funds. Furthermore, it is well known from other asset classes such as equity mutual funds (Chen, Hong, Huang, and Kubik, 2004), private equity funds (Lopez-de Silanes, Phalippou, and Gottschalg, 2013), and hedge funds (Fung, Hsieh, Naik, and Ramadorai, 2008), that capacity constraints are associated with the lower returns of larger funds. In the medium to longer term, higher liquidity ratios will ultimately transmit into property transactions. This may force the fund management to engage in less profitable property transactions, providing another reason why fund flows might have a negative impact on subsequent returns. The two contradicting effects are reflected in our alternative hypothesis about the relationship between fund flows and subsequent performance:

**Hypothesis 2b:** *Aggregate flows into real estate funds dilute fund performance due to capacity constraints and by increasing a fund's share of lower yielding cash holdings.*

[1]We acknowledge the 5% front-end load fee for real estate funds is a hurdle that makes market timing less profitable for investors that buy into the market. However, as each investor has to pay this fee, it is still better to buy into the market when it is perceived to be relatively cheap than in fairly-priced or overvalued periods. In contrast, there is no redemption fee when investors redeem shares, thus, there are no barriers to exiting an expensive market.

[2]In July 2013, a new law came into force which introduced a minimum holding period of 24 months as well as a notice period of 12 months. These regulatory changes can be seen as further hurdles for market timing, though they became effective after the end of our sample period.

### Flow-Performance Convexity

There are numerous studies in the mutual fund literature that find a strong relationship between past performance and subsequent flows into individual mutual fund flows (Ippolito, 1992; Sirri and Tufano, 1998; Guercio and Tkac, 2002). Most of these studies find that investors tend to respond more positively to good performance relative to poor performance, i.e. winners are bought more intensely than losers are sold. This phenomenon results in a convex shape of the flow-performance relationship. The shape of the flow-performance relationship can have important implications for various market participants. For example, Chevalier and Ellison (1997) argue that fund managers are encouraged to take more risk if outperformance is associated with significant inflows while investor reaction to poor performance is more muted. The flow-performance relationship may also have an effect on the performance persistence of mutual funds. Chen et al. (2004) find that fund size is negatively related with fund performance. The flow-performance relationship determines to what extent large funds will be affected by these diseconomies of scale, as it determines to what extent past performance results in excessive inflows (Berk and Green, 2004).

More recent research by Chen et al. (2010) finds the flow-performance relationship depends on a mutual fund's underlying asset liquidity. The authors document that funds investing in less liquid stocks exhibit a stronger sensitivity of outflows to bad past performance than funds with liquid assets. The hypothesized rationale behind this is that investors fear the damaging effect of other investor's redemptions which lead to further underperformance due to high transaction costs which are caused by the outflows – a problem that is likely to apply to real estate funds, as well. To our knowledge, our study is the first to address the shape of the flow-performance relationship in the context of the illiquidity of direct real estate. While somewhat related, Chou and Hardin (2013) analyze the flow-performance relationship for REIT mutual funds that invest in liquid securities.

The illiquidity of direct real estate is manifest in high property transaction costs and long transaction periods. In the short term, high cash reserves protect real estate funds from costly fire sales, when a large amount of investors redeem their shares. Still and at least in the medium term, real estate funds have to react to outflows by selling properties if they want to maintain their target liquidity ratios. As in the case of mutual funds that hold illiquid stocks, these transactions may have adverse effects on fund performance. Compared to equity mutual funds that invest in liquid stocks, the financial fragility that is caused by illiquid underlying asses is not an issue as long as investors have no reason to redeem their shares. This situation may change if investors anticipate that other investors will redeem their shares which would result in costly underperformance. Chen et al. (2010) argue that fundamental events may have an amplifying effect if they increase an investor's incentive to take action in the expectation that other investors will take the same action. A real estate fund's underperformance relative to its peers might be such a coordinating event that triggers substantial outflows as a result of the anticipation of other investor redemptions. This scenario is the basis of our third hypothesis, that real estate fund flows are sensitive to poor performance and hence, the flow-performance relationship is not convex, but linear.

**Hypothesis 3:** *The flow-performance relationship for real estate funds is linear (i.e. fund flows are sensitive to both, strong and poor performance).*

### Fund Liquidity

Hypothesis 3 addresses the role of the illiquidity of the underlying assets, not the liquidity of the fund itself. The liquidity of the fund may however have a direct impact on fund flows and hence the flow-performance relationship.

A real estate fund is either liquid or not. Investors may redeem their shares directly to the fund family at NAV, which is calculated on a daily basis. If, however, the liquidity ratio of the fund falls below 5%, real estate funds are legally obligated to stop the redemption of shares. In this event, the fund is âœclosedâ for a period of up to 24 months. During this time, the fund tries to build sufficient cash reserves either by selling properties or by attracting new inflows. If the fund fails to build sufficient cash reserves, it may close for a second time. After three unsuccessful re-openings, the fund finally has to be liquidated and pay out the proceeds to the investors. Until the fund reopens, investors have no access to their money, unless they decide to sell their shares on a secondary market often for a substantial discount to NAV.

From the investor's point of view, the temporary closing of a real estate fund implies that the fund becomes illiquid from one day to another. It is the fund's liquidity ratio that determines the likelihood of this unpleasant scenario. High liquidity ratios provide insurance for the fund and its investors. In contrast, low liquidity ratios increase the probability of fund illiquidity and may incentivize investors to redeem their shares before it is too late. We argue that the flow-performance relationship for real estate funds is conditional on the liquidity of the fund. Investors base their investment decision on past performance as long as the fund is liquid. However the risk of illiquidity may dominate other factors when the funds' liquidity ratio is low. Hence, the impact of past performance should be less pronounced in such circumstances. We formulate our hypothesis of fund liquidity as follows:

**Hypothesis 4:** *The flow-performance relationship for real estate funds is conditional on the liquidity of the fund (i.e. only liquid real estate funds are sensitive to past performance).*

# 3 Data and Descriptive Statistics

### Data Sources, Sample Description and Definitions

Our empirical study is based on a survivorship bias-free sample of German open-end real estate funds for the September 1990 to December 2010 period. We obtain monthly information about absolute net flows, i.e., actual purchases minus redemptions,[3] and the size of the funds (i.e., AuM) from the German Investment and Asset Management Association (BVI). The BVI Investment Statistics report is the core overview of portfolios and inflows in the German investment industry. The BVI collects information about net flows and AuM directly from its members which represent approximately 99 percent of the German mutual fund industry AuM. Monthly fund

[3] Our measure of fund flows is based on actual buying and selling decisions of investors, whereas most studies covering the US or UK market approximate net flows by the following formula: Flow(t)=(Fund size(t)-Fund size(t-1)*(1+Fund return(t)))/Fund size(t-1). This approximation formula assumes that all flows occur at the end of the period. Furthermore, dividend payments are treated as outflows, although they do not reflect investor decisions. In contrast, our flow data treats dividend reinvestments as an inflow as investors might be more willing to reinvest their dividends into the fund if they are satisfied with the performance.

returns are obtained from Morningstar and Datastream. The risk free rate (Germany 3-month treasury bill rate) and the three Fama-French risk factors for Germany are from Stefano Marmi's web site.[4]

The final sample is comprised of 25 German open-end real estate funds. We exclude semi-institutional funds from the sample as they are primarily intended for institutional investors.[5] At the beginning of our sample period in September 1990, we observe 10 real estate funds. Fifteen real estate funds were opened over the sample period. Two funds were discontinued, with fund volume partly shifting to other funds. By the end of 2010, 24 funds existed in total. Twelve of these funds were "frozen" or "in liquidation" as they were hit by the global financial crisis. A frozen fund no longer redeems shares, but it continues to sell new shares. As a result, their net flows are either positive or zero. Our analysis addresses the behavior of all fund investors, i.e., we are also interested in the factors that cause investors to redeem their shares and this is no longer possible when a fund is frozen. Consequently, only observations for non-frozen funds are used in the sample, though we include the outflows for the month in which the fund moves to a frozen status. When a fund reopens, we typically observe high outflows as investors regain the opportunity to redeem their shares. Therefore we wait for one month after the reopening for a fund to return to the sample. In additional analysis, we also use data on the liquidity ratios of the funds. We hand-collect data on the cash holdings of the real estate funds from their annual and semi-annual reports.

We analyze the flow-performance relationship at, both, the aggregate level and the level of individual real estate funds. Our key variable of interest is the percentage net flow, or the growth rate of new money, which is defined as the absolute net flow, normalized by the size of the fund at the end of the previous period:

$$Flow_{i,t} = \frac{AbsoluteNetFlow_{i,t}}{FundSize_{i,t-1}} \tag{1}$$

At the aggregate level we are also interested in the effect of flows on returns.

[4] http://homepage.sns.it/marmi/DataLibrary.html

[5] Legally, semi-institutional funds are retail funds. The similarity stops there. The minimum investment for semi-institutional funds starts at half a million Euros. We identify 13 semi-institutional fund openings in our sample.

Here, we follow the literature and use quarterly data. This seems plausible given that returns are affected by a time lag until flows transmit into property transactions. Thus, we use the total net flows into all real estate funds over the quarter relative to the total size of all real estate funds at the end of the previous quarter. Aggregate returns are defined as the value-weighted return of all real estate funds over the quarter.

At the fund level, we focus on fund flows. Thus, we conduct the fund level analysis with monthly data in order to make use of the highest data frequency available. The liquidity ratio of a fund is a key explanatory variable used in the fund-level analysis. The liquidity ratio is defined as the total fund holdings of liquid securities (cash and short-term investments) relative to the size of the fund:

$$Liquidity_{i,t} = \frac{CashReserves_{i,t}}{FundSize_{i,t}} \tag{2}$$

Note that real estate funds also use leverage of up to 50% of the total assets. Thus, the liquidity ratio refers to the equity portion or NAV of the fund and does not reflect the share of total assets invested cash. For example, all else being equal, a liquidity ratio of 20% implies that the fund is able to redeem 15% of all outstanding shares before the critical liquidity ratio of 5% is reached. As we only observe half-yearly updates of a fund's cash holdings, the liquidity ratio only changes every six months.

To ensure our results at the level of individual real estate funds are not driven by outliers, we winsorize flows at the bottom and top 1% of the distribution. At the aggregate level, there is no need to winsorize, as the potential effect of outliers disappears by aggregating the data.

### Descriptive Statistics

Table I presents the descriptive statistics for flows and returns at the aggregate level and at the level of individual funds over the 1990:3 to 2010:4 period. Furthermore, Table I contains the descriptive statistics of the employed control variables. The first four columns show the mean, standard deviation, minimum, and maximum for the quarterly aggregate level variables. The next four columns show the same metrics for the monthly fund level variables. Note that fund level returns and their standard deviations refer to monthly measures of the total return over the previous twelve months, while all other variables refer to monthly data.

We first focus on the aggregate level statistics in the first four columns of Table I. On average, real estate funds experienced positive growth rates of 2.91% per quarter, in excess of the growth in AuM that is caused by positive returns. The standard deviation associated with these growth rates is 4.63%. The minimum net flow reveals a maximum loss of 8.26% of AuM in a single quarter, while the maximum value equates to a quarterly inflow of 23.49%. Over the same period, the average value-weighted quarterly return of all real estate funds is 1.21%, which equates to an annualized total return of 4.84%. Thus, the average return of real estate funds in excess of the risk free rate is 0.8% per year and, thus, substantially lower than the annualized excess return of the German stock market (2.76%). The standard deviation of quarterly returns of 0.53% indicates real estate funds are a low risk investment. The risk-return profile that should appeal to more risk-averse investors is complemented by a minimum quarterly return that is still positive (0.44%). In Figure 1, we plot aggregate flows and returns over the sample period. Flows are measured on the left vertical axis, returns are measured on the right vertical axis. Consistent with the correlation coefficients, the co-movement indicates that investors tend to invest more during times of high returns and less during periods of low returns.

Next, we turn to the descriptive statistics at the individual fund level. As expected, the fund level numbers show a wider distribution compared to the aggregate level. Even after winsorizing, we observe monthly outflows of up to -7.02% and maximum inflows into individual funds of more than 25% of AuM. The average monthly net flow into individual real estate funds is 1.2%, and thus higher than at the monthly equivalent at the aggregate level. This suggests that smaller funds experience stronger growth relative to large funds.

At the disaggregated level, real estate funds also appear slightly more risky. The average 12-month return of the real estate funds in our sample (measured at a quarterly frequency) is 4.73% with a standard deviation of 2.35% and extreme values of -6.50% and 16.63%. The average real estate fund has a size of 3.23 billion Euros. The standard deviation of fund size is 2.68 billion Euros. The largest fund in our sample has a size of 11.90 billion Euros, which compares to a minimum fund size of only 37 million Euros.

We observe substantial heterogeneity in the liquidity ratios of the funds in our sample. The average liquidity ratio is 32.75% with a standard deviation of 14.24%. The lowest liquidity ratio is 5.00% and therefore just above the critical value of 5%. The maximum liquidity ratio is 99.55%. Liquidity ratios near 100% may occur for young funds which have already raised money, but not yet closed any property transactions, so their assets only consist of cash holdings. Figure 2 graphs the mean and minimum liquidity ratio for the funds in our sample over the September 1990 to December 2010 period.

Panel A of Table II contains the contemporaneous correlations for the aggregate variables. A star indicates that the correlation is statistically significant at the 5% level. The first column in Panel A reveals a positive and statistically significant correlation between aggregate flows and returns ($\rho$=0.42). The respective correlation coefficient between flows and lagged returns is even stronger ($\rho$=0.53). This suggests fund flows may follow returns. The second column of Panel B contains the correlation coefficients between returns and lagged flows. Returns are positively correlated with past flows ($\rho$=0.23), which is consistent with the market timing hypothesis.

The strong and statistically significant correlation between flows and lagged flows ($\rho$=0.50) in the first column of Panel B and, likewise, the positive correlation between returns and lagged returns ($\rho$=0.71) in the second column of Table B indicate that our main variables of interest are autocorrelated and may follow a unit root process. However, our tests reject the null hypothesis that these time series contain a unit root, so we include these variables without modifications.

Fund flows are positively correlated with both, the contemporaneous ($\rho$=0.35) and the lagged level ($\rho$=0.47) of the risk free rate. This suggest investors tend to buy real estate funds during times of high interest rates. However, this positive relationship may also be driven by the fact that periods of high real estate returns coincide with high levels of the risk free rate ($\rho$=0.84). In contrast, aggregate flows into real estate funds are negatively correlated with contemporaneous ($\rho$=-0.41) and lagged ($\rho$=-0.42) changes in the risk free rate. The correlations between returns and changes of the risk free rates (i.e., contemporaneous as well as lagged), are not statistically significant.

# 4 Aggregate Flows and Returns

### Vector Autoregression (VAR) Methodology

In this section, we empirically test whether investors chase past returns (Hypothesis 1) and whether they possess market timing ability (Hypothesis 2a) or whether aggregate flows have a performance diluting effect (Hypothesis 2b). We employ VAR methodology to examine the dynamic relationship between aggregate flows and returns of real estate funds. A VAR model is a system of simultaneous equations where the dependent variables are expressed as linear functions of their own and each other's lagged values and exogenous variables. Several specifications of the following VAR model are estimated:

$$Flow_t = \alpha_1 + \sum_{i=1}^{T} \beta_i Flow_{t-i} + \sum_{i=1}^{T} \gamma_i Return_{t-i} + \sum \omega_s Control_{s,t-1} + \varepsilon_{1,t} \tag{3}$$

$$Return_t = \alpha_2 + \sum_{i=1}^{T} \beta_i Flow_{t-i} + \sum_{i=1}^{T} \gamma_i Return_{t-i} + \sum \omega_s Control_{s,t-1} + \varepsilon_{2,t} \tag{4}$$

$Flow_t$ is the net absolute flow into all real estate funds divided by the total fund volume of the previous period. $Return_t$ is the value-weighted return of all real estate funds.

Our set of exogenous control variables includes the lagged change in the risk free rate. All else being equal, we expect that interest rate increases reduce flows into real estate funds. The reasons are two-fold. First, given the risk-return characteristics of real estate funds are relatively similar to those of the risk free rate, the two investments may be seen as alternatives by investors seeking diversification. An increase in the risk free rate would decrease the relative attractiveness of real estate funds. Second, interest rate increases usually have a negative impact on direct property prices. This might be anticipated by real estate fund investors and, hence, provides an incentive to withdraw their money from real estate funds. We also control for the level of the risk free rate as it has an effect on the performance of real estate funds due to their large cash holdings. Finally, we control for capital market factors that may have an effect on returns and investor behavior by including the three Fama-French risk factors (*Market excess return, SMB, HML*). $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ are innovations that may be contemporaneously correlated with each other, but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

The unconstrained VAR system is estimated with quarterly data for the 1992q1 to 2010q4 period. We sequentially estimate models with up to six lags and use Akaike information criterion, Schwarz information criterion, and Hannan-Quinn information criterion as model selection criteria. We find four lags satisfies the criteria.

**VAR Results**

Table III summarizes our results from the VAR analysis. We estimate five different specifications. Model (i) is our base case, where the analysis is restricted to the endogenous variables only. In model (ii), we add the lagged change of the risk free rate as an exogenous control variable and in model (iii), we use the absolute level of the risk free rate at the end of the previous quarter. In model (iv), we simultaneously control for measures of the risk free rate. In model (v) we built up on model (iv) by including the three country-specific, Fama-French risk factors. The first column of each model refers to the flow equation, while the second column refers to the return equation of the VAR.

We first turn to the flow equations of the five models in order to examine whether investors chase past returns (Hypothesis 1). The results in the first columns of model (i) reveal the returns of real estate funds predict aggregate real estate fund flows beyond past flows. Although, none of the four lagged coefficients is individually significant, a joint test of the lagged returns on flows is positive and statistically different from zero. The sum of the four lagged coefficients on return is 5.09 with a z-statistic of 4.60. This effect remains robust even after including the various exogenous control variables in models (ii) to (v). Thus, our results are consistent with return chasing behavior of real estate fund investors at the aggregate level.

The graphical analysis of impulse response functions provides further insights about the short- and long term relationship between flows and returns. Figure 3 plots the response of quarterly aggregate fund flows to a one standard deviation return shock. The graph shows a strong reaction of flows in the quarter that follows the shock. The effect of the return shock is persistent, yet partially reduced after the second quarter until the effect finally dissipates after 6 quarters. The results are based on model (v).

Our results also indicate aggregate flows are serially correlated. In model (i), the estimated coefficient of flows on flows in the previous quarter is positive and statistically different from zero, suggesting that aggregate flows are autocorrelated in the short term. The second and third lag are insignificant, but flows are also autocorrelated with their fourth lag. The sum of the four lagged coefficients on flow is 0.33 and statistically significant at the 5% level. Overall, a simple, bivariate model (i) explains 51.6% of the variation of aggregate flows. The joint significance of the four lagged flow coefficients disappears in models (ii) to (iv), where we control for the risk free rate, but is significant again in model (v), where we additionally control for the Fama-French risk factors.

The results of the flow equation in model (ii) show strong evidence that aggregate flows are negatively related to lagged changes in the risk free rate. This effect is robust to the inclusion of further control variables in models (iv) and (v) and supports the view that real estate funds are less attractive for investors when interest rates rise. This may either be the case because substitute investments, such as money market funds, become more attractive or because of the negative effect of interest rate increases on property prices and, hence, on anticipated returns of real estate funds. We find no significant relationship between aggregate flows and the level of the risk free rate. Furthermore, aggregate flows are negatively related to the SMB-factor, but positively related to the HML-factor. Thus, flows into real estate funds are higher when large stocks do better than small stocks and when stocks with a high book-to-market ratio outperform stocks with a low book-to-market ratio. Finally, the R-squared of model (v) is 63%.

Next, we turn to the return equations in order to test our second hypothesis, by answering the question whether aggregate flows are predictive of aggregate returns. Overall, our results do not support the market timing hypothesis (Hypothesis 2a).

There is a positive effect of the third lag of flows on returns and this effect is robust across all five models. This could be interpreted as successful market timing on behalf of investors if the fourth lag of flows did not completely reverse this effect. The sum of the four lagged coefficients on flow is not positive in any of the models. Thus, on average, real estate fund investors do not seem to be able to anticipate future returns.[6,7] We mentioned previously that flows might also dilute returns by increasing a fund's low-yield cash holdings (Hypothesis 2b). In models (i) and (ii), the overall effect of flow on return is negative and statistically different from zero, which is consistent with a performance diluting effect of flows on returns. However, this effect is no longer statistically significant in models (iii) to (v), as additional exogenous control variables are introduced.

Based on model (v), we plots the response of quarterly aggregate fund returns to a one standard deviation flow shock. The results are shown in Figure 4. The graph shows a slightly negative initial reaction, consistent with short term return dilution. The effect is strongly reversed in the following quarter, but becomes negative again after four quarters. After six quarters, the effect dissipates to zero.

We find strong evidence that aggregate returns are serially correlated. In model (i), the sum of the four lagged return coefficients is 0.99 with a z-statistic of 10.33. The magnitude of the overall effect is reduced by more than 50%, but remains significant in models (iii) to (v). This suggests that the level of the risk free rate is an important determinant of aggregate real estate fund returns. In model (iii), the level of the lagged risk free rate has a coefficient of 0.51 and is statistically different from zero. This result reflects that the large cash holdings of real estate funds are an important determinant of their performance. Furthermore we find that aggregate real estate returns are positively related to lagged changes in the risk free rate and the lagged

[6] In untabulated results, we examine the market timing hypothesis at the level of individual funds using a fixed-effects panel VAR. The fund-level results are consistent with the aggregate level. In other words, we do not find evidence of market timing at the level of individual real estate funds.

[7] The international portfolio allocation of the funds may be an obstacle for market timing as one market might be overvalued while appraisals for the other market are fairly valued. In untabulated results, we conducted additional regression analysis with funds that only invest in Germany to test whether our results are more supportive of market timing when the international portfolio allocation issue does not exist. Interestingly, the results based on only German funds are consistent with the full sample results (i.e., we do not find support for the market timing hypothesis)

stock market excess return, and negatively related to the lagged SMB factor (i.e., the returns of real estate funds are higher when large caps outperform small cap stocks).

# 5 Individual Fund Flows and Returns

**Piecewise Linear Regression Methodology**

In this section, we analyze the flow-performance relationship for individual real estate funds in order to test Hypotheses 3 and 4. We follow Sirri and Tufano (1998) and examine the shape of the flow-performance relationship using a piecewise linear regression methodology. This approach allows for different flow-performance sensitivities for different levels of performance. In each month, we rank all real estate funds by their performance over the previous 12 months from zero (worst performance) to one (best performance), where the ranks correspond to the fund's performance percentile. Based on their performance percentile, funds are classified into low, medium and high performance using the following decomposition:[8]

$$\begin{aligned} Low_{i,t} &= min(0.2, Rank_{i,t}) \\ Mid_{i,t} &= min(0.6, Rank_{i,t} - Low_{i,t}) \\ High_{i,t} &= Rank_{i,t} - (Low_{i,t} + Mid_{i,t}) \end{aligned} \tag{5}$$

$Low_{i,t}$ represents the performance rank for funds in the bottom 20% of the distribution. $Mid_{i,t}$ represents the performance rank of funds whose performance percentile falls into the range of 20% to 80%, and $High_{i,t}$ represents the performance rank for the 20% of funds with the best performance. We then regress monthly fund flows on the first lags of these fractional rank variables, where their coefficients represent the slope of the flow-performance relationship over their range of sensitivity. In particular, we are interested whether real estate fund investors are equally sensitive to strong and poor performance, which would result in a linear flow-performance relationship. Several specifications of the following regression model are estimated using

[8] In untabulated results, we obtain consistent results using a more conservative approach for the performance decomposition.

cross-sectional and time-period fixed effects:

$$\begin{aligned} Flow_{i,t} = \alpha_1 &+ \beta_1 Low_{i,t-1} + \beta_2 Mid_{i,t-1} + \beta_3 High_{i,t-1} \\ &+ \beta_4 Flow_{i,t-1} + \beta_5 Std.dev.of returns_{i,t-1} \\ &+ \beta_6 LogFundsize_{i,t-1} + \beta_7 LogAge_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{6}$$

Previous studies document that fund flows are also affected by non-performance related variables. Beyond past performance, the fund's riskiness, lagged flows into the fund, the size of the fund and fund age all help to determine which mutual funds investors prefer (Patel, Zeckhauser, and Hendricks, 1991; Jain and Wu, 2000; Kempf and Ruenzi, 2008). We include the lagged risk of the fund, measured by the standard deviation of the fund's monthly total returns over the previous twelve months ($Std.dev.of returns_{i,t-1}$), the natural logarithm of the size of the fund at the end of the previous month ($LogFundsize_{i,t-1}$), and the natural logarithm of the age of fund($LogAge_{i,t-1}$). Furthermore, we control for possible autocorrelation in the dependent variable by including lagged flows ($Flow_{i,t-1}$).

**Flow-Performance Convexity for Real Estate Funds**

Figure 5 shows the relationship between relative returns and flows. For each month from September 1990 to December 2010, funds are ranked by their performance over the previous twelve months and divided into five equal groups. For each of these five groups, the mean net flow into the funds in the following month is calculated. Figure 5 shows that the reaction of real estate fund investors to past performance is relatively convex. Fund flows are relatively insensitive to poor performance while top performance is associated with strong inflows in the following month. The results are in line with most studies in the equity mutual fund literature and do not support our third hypothesis. However, so far the analysis does not control for further factors that may have an impact on fund flows.

Table IV contains the regression results on the flow-performance relationship for individual real estate funds over the September 1990 to December 2010 period. Six different specifications are estimated. In model (i), we estimate the flow-performance relationship for real estate funds without control variables. In models (ii) to (v), we sequentially introduce our control variables ($Flow_{i,t-1}$, $Std.dev.ofreturns_{i,t-1}$, $LogFundsize_{i,t-1}$, and $LogFundsize_{i,t-1}$) to determine their impact on the flow-performance relationship. The control variables are all lagged by one month. In model (vi), the four control variables are included simultaneously.

The results in model (i) of Table IV confirm the intuition that was provided by Figure 5. The flow-performance relationship for real estate funds is convex. For top-performing funds, performance is associated with statistically and economically significant inflows. For example, an improvement in the performance ranking in a given month from the 70th to the 90th percentile is associated with an increase in fund flows of 2.02% ($= 0.101 * 0.2$). In contrast, for funds with median performance a similar increase in performance (say, from the 40th to the 60th percentile) is only associated inflows of 0.04% and for low performing funds, there is virtually no improvement in fund flows associated with a performance improvement in the same range. The convexity of the flow-performance relationship is robust across all models, although slightly less pronounced in model (vi), where we simultaneously include all control variables. We find no evidence consistent with the conjecture that the illiquidity of the underlying assets of real estate funds trigger a stronger response to poor performance, than observed for equity funds. Thus, we do not find evidence in support of Hypothesis 3.

The regression results for the control variables are consistent with the literature. The coefficient on lagged flows shows the importance of controlling for autocorrelation in fund flows. Net flows are smaller if the fund's performance was volatile over the previous twelve months, although this effect is not statistically different from zero. Larger and older funds grow at lower rates. These interpretations are intuitive and the inclusion of the control variables improves the explanatory power of the model.

### Fund Liquidity and the Flow-Performance Relationship

Investors may be more concerned about the liquidity of a real estate fund, itself than about the liquidity of the underlying assets. As long as the liquidity ratio of the fund is sufficiently high, real estate funds provide adequate liquidity transformation.

However, as the liquidity ratio falls the probability of a fund closure and, potentially, costly asset fire sales becomes more likely. Thus, investor reaction to past performance may be conditional on the liquidity of the fund.

Figure 6, analogous to Figure 5, shows the flow-performance relationship for (relatively) liquid and illiquid real estate funds. Liquid real estate funds are defined as the 30% of funds with the highest liquidity ratios in a given month and illiquid funds are the 30% of funds with the lowest liquidity ratios. The graph, Figure 6, indicates liquidity increases the flow-performance sensitivity at the high performance range. In contrast, liquidity lessens the sensitivity at the low performance range. Overall, liquidity appears to raise the convexity of the flow-performance relationship. This suggests fund liquidity may play an important role for the flow performance sensitivity and, as such,deserves more rigorous examination.

To examine the impact of fund liquidity on the shape of the flow-performance relationship (Hypothesis 4), we interact performance with the liquidity ratio of the fund as shown in the following regression:

$$\begin{aligned} Flow_{i,t} = \alpha_1 &+ \beta_1 Liquidity_{i,t-1} \\ &+ \beta_2 Low_{i,t-1} + \beta_3 Low_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_4 Mid_{i,t-1} + \beta_5 Mid_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_6 High_{i,t-1} + \beta_7 High_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_8 Flow_{i,t-1} + \beta_9 Std.dev.ofreturns_{i,t-1} \\ &+ \beta_6 LogFundsize_{i,t-1} + \beta_7 LogAge_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{7}$$

Without modifications, the coefficient on the fractional performance variables would correspond to the partial derivative of flows with respect to the performance variable when the liquidity ratio of the fund is zero. Of course, a liquidity ratio of zero is implausible. De-meaning the interacted variables ensures the interpretation of the coefficient on the explanatory variable is the same as it would be without the interaction (Balli and Sorensen, 2013). Thus, we de-mean the interacted variables across time to preserve the interpretability of the slope coefficients.

Table V contains the regression results of the effect of fund liquidity on the shape of the flow-performance relationship for individual real estate funds over the September 1991 to December 2010 period. Five different specifications are estimated. Model (i) is estimated with fund liquidity as an explanatory variable and no interaction terms. In models (ii) to (iv), we sequentially include interaction terms of the fractional rank variable and the liquidity ratio of the fund. In model (v), each rank variable is interacted simultaneously. All models are estimated using cross-sectional and time-period fixed effects.

Our main interest in Table V concerns the coefficients on the interaction terms between liquidity and the fractional performance ranks. The coefficient on the interaction term between $Low_{i,t-1}$ and $Liquidity_{i,t-1}$ in model (ii) reveals that fund liquidity reduces the flow-performance sensitivity for poorly performing funds. The higher the fund liquidity, the smaller the sensitivity of flows to past performance. Conversely, lower fund liquidity ratios are associated with an increased flow performance sensitivity for poorly performing funds.

By contrast, fund liquidity increases the flow-performance sensitivity of mid and high-performing funds (models (iii) and (iv)). All else being equal, given two funds have the same degree of strong performance (e.g. 90th performance percentile), the fund with the higher liquidity ratio will have higher flow-performance sensitivity and, thus, higher inflows should the positive performance be persistent. The effects of fund liquidity on low and high performance remain robust even after simultaneously introducing interaction terms for all performance fractiles. The difference in the signs for low and high performance speaks to the shape of the flow-performance relationship as liquidity increases convexity. Overall, the results are consistent with Hypothesis 4 which states the flow-performance relationship is conditional on fund liquidity.[9]

[9] Our measure for fund liquidity is based on the cash reserves or "liquid assets" of the funds. Alternative liquidity measures might consider the debt capacity of real estate funds as another dimension of liquidity. Real estate funds are allowed to use leverage of up to 50% of asset value. For example, a fund with a leverage ratio of 30% might raise an additional 20 % of cash by borrowing against its properties until the 50% limit is reached. A law introduced in 2007 restricts the amount of leverage that a fund may use in order to finance redemptions to 10% of a fund's size. In untabulated results we use a measure for fund liquidity that accounts for the debt capacity. We find our results are robust to this alternative measure for fund liquidity. Additionally, when we include fund leverage as a control variable and the results do not change.

### Economic Implications of Low Fund Liquidity

The economic implications of the Table V results are not straightforward to interpret. In additional tests, we interact performance with a low liquidity indicator variable. This approach allows for a more direct interpretation of the fund-liquidity effect on the flow performance relationship. Specifically, the interaction term coefficient represents the change in the flow-performance sensitivity when fund liquidity is low. We use a liquidity ratio of 20 percent as the treshold that separates funds with low liquidity from funds with sufficient liquidity. The rationale for focusing our economic implications on low fund liquidity is due to the increased probability or risk that a low-liquidity fund becomes illiquid (i.e. suspends the redemption of shares) in the near future.

Table VI reports the regression results for the effect of low fund liquidity on the flow-performance relationship. Flows into liquid funds are not sensitive to poor past performance, whereas flows into mid- and top-performing funds are increasingly more sensitive to past performance. Thus, for sufficiently liquid funds, the flow-performance relationship is convex, as shown in Table V. However, flows are significantly more sensitive to poor past performance if the fund is less liquid. This follows as the coefficients on the interaction term between $Low_{i,t-1}$ and $Lowliquidity_{i,t-1}$ in model (ii) and (v) are positive and statistically significant. The combined effect of the coefficients on the base term and the interaction term is also positive and significant. This result for less liquid funds is consistent with hypothesis 3 as it suggests that investors flee poor performance if the fund is at risk of becoming illiquid.

While low fund liquidity does not have a significant impact on flows into funds with medium performance, the results in models (iv) and (v) show that fund liquidity matters for the flow-performance sensitivity of the top performing funds. The interaction term between $High_{i,t-1}$ and $Lowliquidity_{i,t-1}$ is negative and statistically significant. The combined effect of base and interaction coefficients is not statistically different from zero, which implies that investors do not chase past winners if they are at risk of becoming illiquid.

Overall, our analysis of the flow-performance relationship at the individual fund level is consistent with and complements the aggregate level analysis. In both cases, we find real estate fund investors chase performance. Furthermore, the best performing funds attract a disproportionate share of fund flows relative to their peers with average fund performance. Although the liquidity of the underlying real assets may have an effect on fund performance, we do not find fund flows are sensitive to poor performance. Interestingly, however, we find that fund liquidity impacts flow-performance sensitivity. Investors seem to flee poor performance if the fund is less liquid. Furthermore, the flow-performance relationship for strongly performing funds is less pronounced if fund liquidity is low. As such, illiquidity at the fund level results in a less convex flow-performance relationship.

# 6 Conclusion

This study addresses a gap in the real estate literature. We analyze the flow-performance relationship for open-end funds that invest directly in private-market real estate assets. The combination of the open-end mutual fund structure and the illiquidity of the underlying assets provides a unique setting to study the decisions of investors.

Our empirical strategy is two-pronged. First, we study the dynamic relationship between aggregate flows and returns using VAR methodology. Next, we examine the flow-performance relationship at the level of individual funds using a piecewise linear regression approach. There are three main findings. First, real estate fund investors chase past returns. Periods of high aggregate returns are associated with significantly higher fund flows in the following quarters. Second, the flow-performance relationship for individual real estate funds is convex. Top performing funds benefit disproportionately from large inflows, whereas flows into poorly-performing funds are insensitive to past performance. Third, the shape of the flow-performance relationship depends on the liquidity of the fund. While fund liquidity increases the flow-performance sensitivity for strong performing funds, the flow-performance sensitivity of poorly performing funds decreases with fund liquidity. This implies the convexity in the flow-performance relationship of direct real estate investment funds increases with liquidity.

Three important conclusions emerge from these findings: (i) investors in open-ended, direct real estate funds seem to capitalize on the return autocorrelation of real estate funds as return chasing behavior can be beneficial when returns are persistent, (ii) the illiquidity of the underlying assets of real estate funds does not seem to effect the flow-performance relationship relative to other asset classes, however (iii) investors seem to appreciate the risk associated with fund-level liquidity as seen in the reduced convexity of low liquidity funds. This implies that direct real estate fund investors recognize and respond to the joint influence of fund-level performance and liquidity on subsequent flows.

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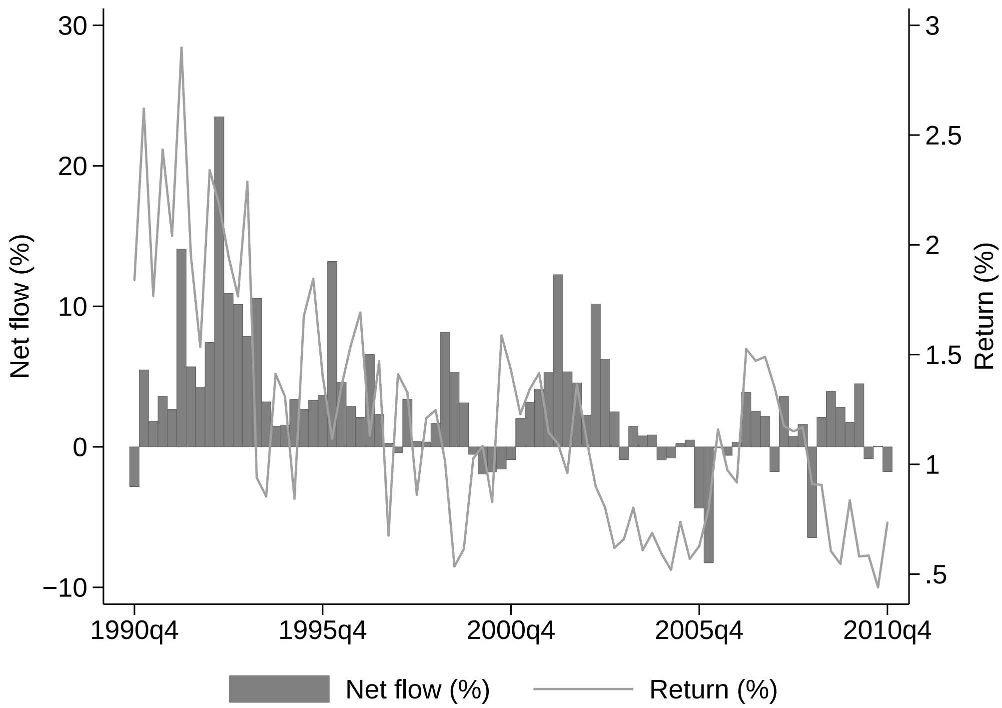


**Figure 1:** This figure shows the time series of aggregate fund flows and returns of all real estate funds between September 1990 and December 2010.

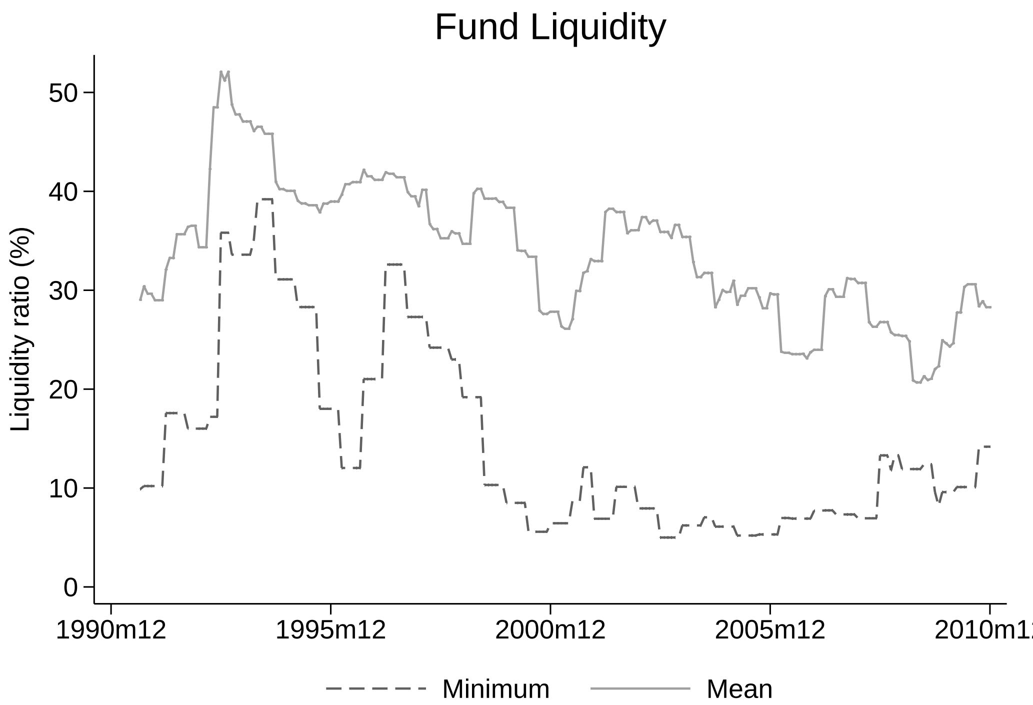


**Figure 2:** This figure shows the mean and minimum liquidity ratios.

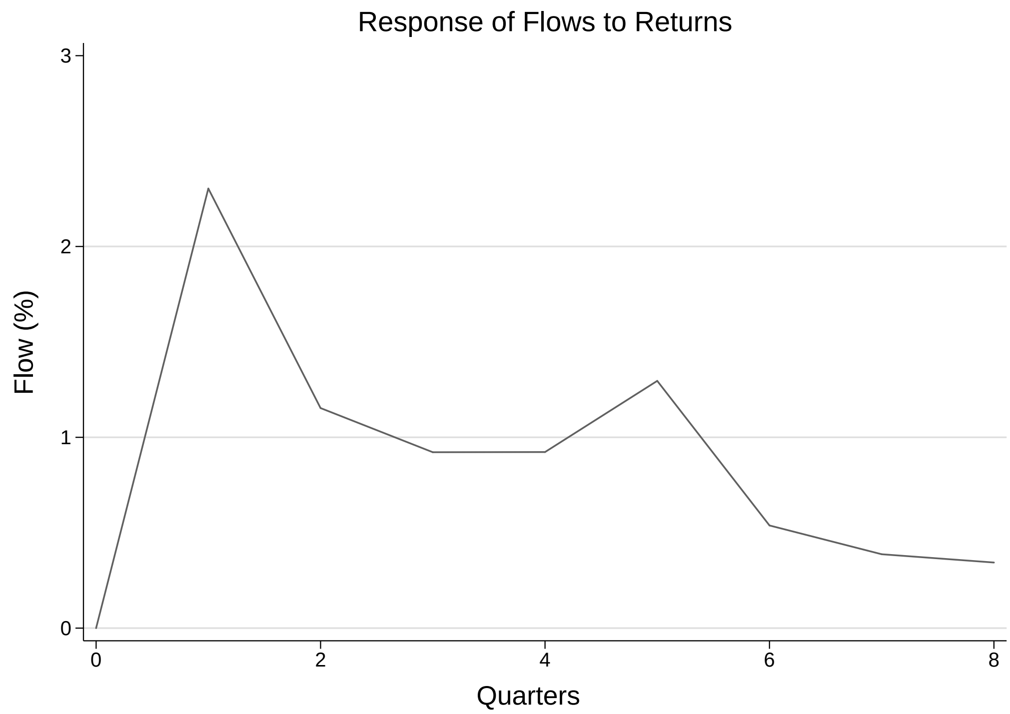


**Figure 3:** This figure shows the response of aggregate real estate fund flows to returns based on model (v) of Table III.

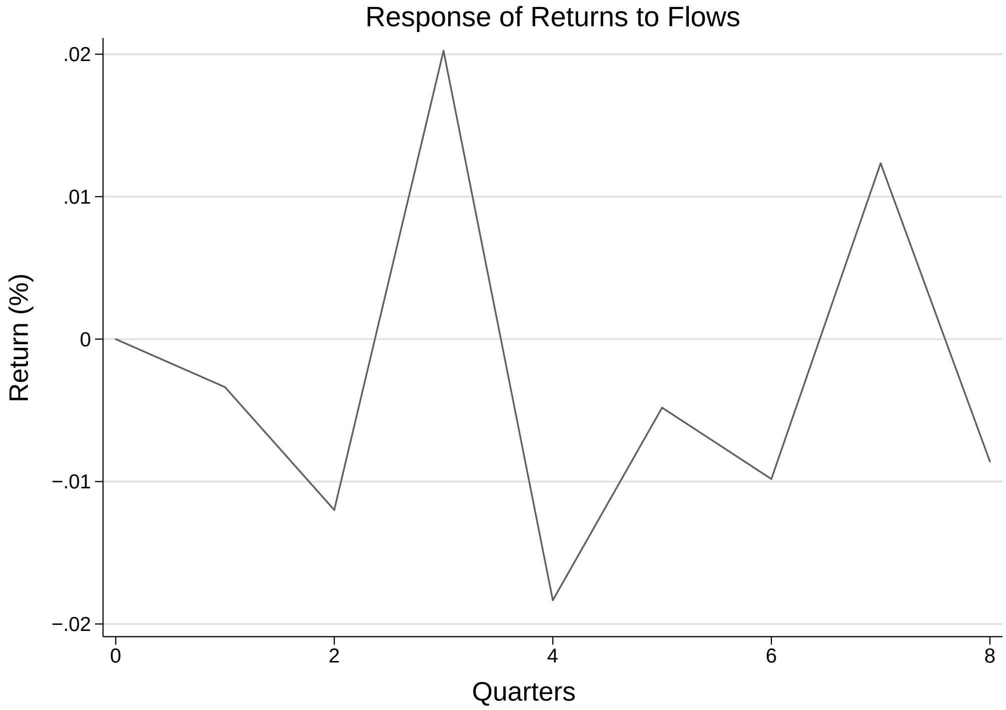


**Figure 4:** This figure shows responses of real estate fund returns to aggregate net flows based on model (v) of Table III.

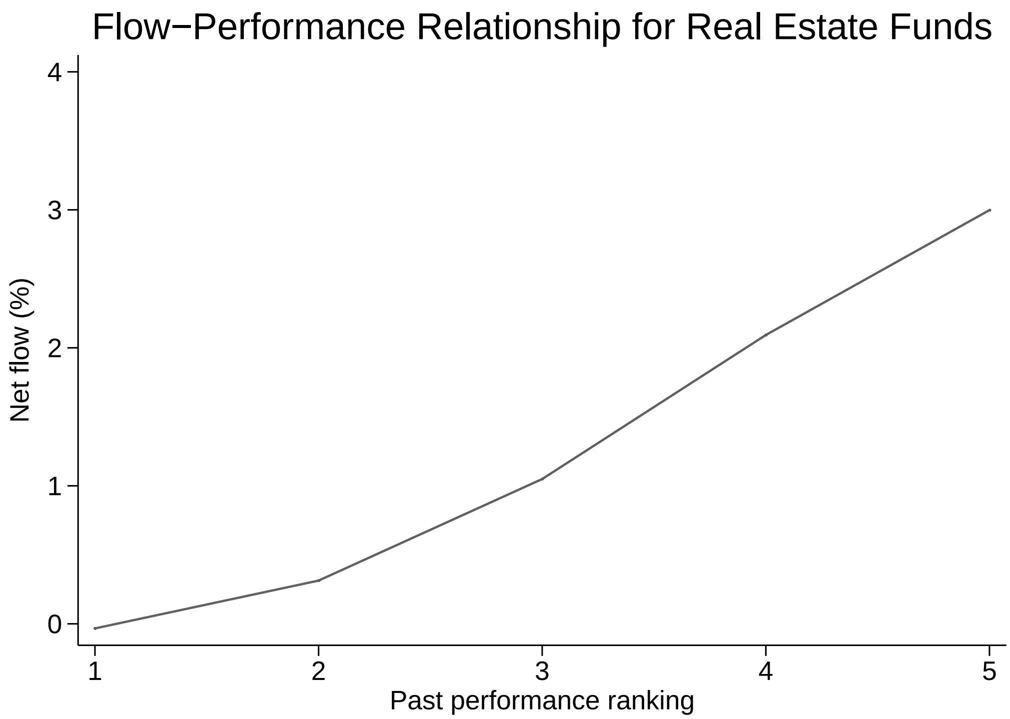


**Figure 5:** This figure shows average monthly net flows as a function of performance over the previous 12 months. For each month, funds are ranked by their performance over the previous twelve months and divided into five equal groups. For each of these five groups, the mean net flow into the funds in the following month is calculated.

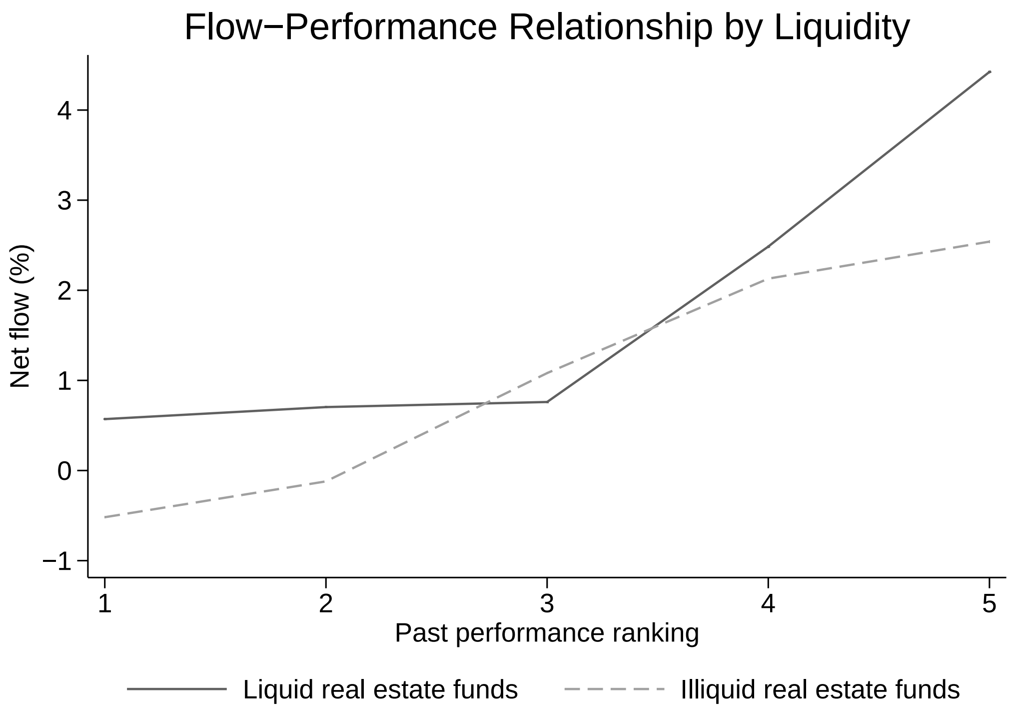


**Figure 6:** This figure shows the flow-performance relationship for liquid and illiquid real estate funds. In each month, funds are sorted by liquidity. Illiquid funds are defined as the 30 percent of funds with the lowest liquidity ratios. Liquid funds are defined as the 30 percent of funds with the highest liquidity ratios.

**Table I:** Descriptive statistics for aggregate and fund level variables

| Variables | Aggregate level | | | | Fund level | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. dev. | Min. | Max. | Mean | Std. dev. | Min. | Max. |
| Flow | 2.91 | 4.63 | -8.26 | 23.49 | 1.20 | 3.54 | -7.02 | 25.30 |
| Return | 1.21 | 0.53 | 0.44 | 2.90 | 4.73 | 2.35 | -6.50 | 16.63 |
| *Aggregate level control variables* | | | | | | | | |
| Risk free rate | 1.01 | 0.56 | 0.12 | 2.33 | - | - | - | - |
| Change in risk free rate | -0.02 | 0.10 | -0.53 | 0.18 | - | - | - | - |
| Excess market return | 0.69 | 7.95 | -18.61 | 29.91 | - | - | - | - |
| SMB | -1.88 | 6.35 | -17.24 | 18.34 | - | - | - | - |
| HML | 2.70 | 6.75 | -15.19 | 31.00 | - | - | - | - |
| *Fund level control variables* | | | | | | | | |
| Std. of returns | - | - | - | - | 0.27 | 0.24 | 0.04 | 1.79 |
| Fund size | - | - | - | - | 3.23 | 2.68 | 0.037 | 11.90 |
| Age | - | - | - | - | 225.80 | 160.06 | 14 | 556 |
| Liquidity | - | - | - | - | 32.75 | 14.24 | 5.00 | 99.55 |

This table contains the descriptive statistics for the aggregate and fund level variables used throughout the analysis over the September 1990 to December 2010 period. Aggregate level flow (%) = total absolute net flow of the quarter into all real estate funds divided by the total size of all real estate funds at the end of the previous quarter; Fund level flow (%) = absolute net flow of the month into the fund divided by fund size at the end of the previous month; Aggregate level return (%) = value-weighted return of the quarter of all real estate funds; Fund level return (%) = fund return of the past 12 months; Risk free rate = Germany 3-month treasury bill rate in EUR; Change in risk free rate (%) = change in the Germany 3-month treasury bill rate in EUR; Excess market return (%) = Germany stock market return in excess of the risk free rate in EUR; SMB (%) = Germany small-firm minus big firm return factor in EUR; HML (%) = Germany high book-to-market minus low book-to-market return factor in EUR; Std. of returns (%) = fund return volatility of the past 12 months; Fund size (billions of EUR) = fund size at the end of the month; Age = fund age in months; Liquidity (%) = cash holdings of the fund divided by fund size.

**Table II:** Contemporaneous and lagged correlations for aggregate variables

| | Flow | Return | RF | DRF | MKTRF | SMB | HML |
|---|---|---|---|---|---|---|---|
| *Panel A: Contemporaneous correlations* | | | | | | | |
| Flow | 1 | - | - | - | - | - | - |
| Return | 0.42* | 1 | - | - | - | - | - |
| Risk free rate (RF) | 0.35* | 0.84* | 1 | - | - | - | - |
| Change in risk free rate (DRF) | -0.41* | -0.00 | 0.01 | 1 | - | - | - |
| Excess market return (MKTRF) | 0.06 | -0.15 | -0.27* | 0.06 | 1 | - | - |
| SMB | 0.07 | -0.15 | -0.09 | -0.14 | 0.36* | 1 | - |
| HML | -0.12 | -0.10 | -0.10 | 0.10 | -0.04 | -0.26* | 1 |
| *Panel B: Lagged correlations* | | | | | | | |
| $\text{Flow}_{t-1}$ | 0.50* | 0.23* | 0.31* | -0.23* | 0.08 | 0.01 | -0.13 |
| $\text{Return}_{t-1}$ | 0.53* | 0.71* | 0.83* | -0.13 | -0.17 | -0.06 | 0.02 |
| Risk free rate $(\text{RF})_{t-1}$ | 0.47* | 0.82* | 0.98* | -0.17 | -0.29* | -0.07 | -0.09 |
| Change in risk free rate $(\text{DRF})_{t-1}$ | -0.42* | 0.09 | 0.13 | 0.57* | -0.25* | -0.09 | 0.02 |
| Excess market return $(\text{MKTRF})_{t-1}$ | -0.09 | -0.19 | -0.22 | 0.25* | 0.18 | 0.28* | -0.01 |
| $\text{SMB}_{t-1}$ | -0.19 | -0.24* | -0.07 | 0.13 | 0.17 | 0.27* | -0.01 |
| $\text{HML}_{t-1}$ | 0.03 | -0.06 | -0.10 | -0.03 | -0.12 | -0.05 | -0.16 |

Flow (%) = total absolute net flow of the quarter into all real estate funds divided by the total size of all real estate funds at the end of the previous quarter; Return (%) = value-weighted return of the quarter of all real estate funds; Risk free rate (RF) (%) = Germany 3-month treasury bill rate in EUR; Change in risk free rate (%) = change in the Germany 3-month treasury bill rate in EUR; Excess market return (%) = Germany stock market return in excess of the risk free rate in EUR; SMB (%) = Germany small-firm minus big firm return factor in EUR; HML (%) = Germany high book-to-market minus low book-to-market return factor in EUR. * denotes significance at the 5% level.

**Table III:** Vector autoregression results for aggregate flows and returns

| | (i) | | (ii) | | (iii) | | (iv) | | (v) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $Flow_t$ | $Return_t$ | $Flow_t$ | $Return_t$ | $Flow_t$ | $Return_t$ | $Flow_t$ | $Return_t$ | $Flow_t$ | $Return_t$ |
| $Flow_{t-1}$ | 0.239** | -0.018** | 0.096 | -0.008 | 0.200* | -0.009 | 0.093 | -0.004 | 0.136 | -0.003 |
| | (2.28) | (-1.98) | (0.92) | (-0.82) | (1.85) | (-1.05) | (0.88) | (-0.41) | (1.32) | (-0.38) |
| $Flow_{t-2}$ | -0.023 | -0.009 | 0.023 | -0.012 | -0.038 | -0.005 | 0.020 | -0.008 | 0.024 | -0.011 |
| | (-0.21) | (-0.91) | (0.22) | (-1.32) | (-0.35) | (-0.59) | (0.19) | (-0.95) | (0.24) | (-1.31) |
| $Flow_{t-3}$ | -0.193* | 0.019** | -0.201** | 0.020** | -0.197* | 0.020** | -0.201** | 0.021** | -0.218** | 0.023*** |
| | (-1.78) | (2.05) | (-2.00) | (2.23) | (-1.84) | (2.32) | (-2.00) | (2.40) | (-2.22) | (2.76) |
| $Flow_{t-4}$ | 0.302*** | -0.027*** | 0.277*** | -0.025*** | 0.293*** | -0.025*** | 0.276*** | -0.024*** | 0.311*** | -0.024*** |
| | (3.12) | (-3.24) | (3.08) | (-3.18) | (3.05) | (-3.21) | (3.07) | (-3.18) | (3.61) | (-3.23) |
| $Return_{t-1}$ | 1.400 | 0.391*** | 2.633** | 0.301*** | 2.223 | 0.204* | 2.727** | 0.178 | 2.304* | 0.107 |
| | (1.19) | (3.81) | (2.30) | (2.95) | (1.64) | (1.84) | (2.14) | (1.63) | (1.86) | (1.01) |
| $Return_{t-2}$ | 0.907 | 0.150 | 1.172 | 0.131 | 1.680 | -0.025 | 1.274 | -0.004 | 0.593 | -0.011 |
| | (0.74) | (1.40) | (1.03) | (1.29) | (1.22) | (-0.22) | (0.99) | (-0.03) | (0.47) | (-0.10) |
| $Return_{t-3}$ | 0.894 | 0.203* | 0.299 | 0.246** | 1.556 | 0.053 | 0.399 | 0.114 | 0.662 | 0.110 |
| | (0.75) | (1.95) | (0.27) | (2.47) | (1.19) | (0.49) | (0.31) | (1.05) | (0.55) | (1.07) |
| $Return_{t-4}$ | 1.892 | 0.250** | 1.133 | 0.305*** | 2.359* | 0.144 | 1.209 | 0.205** | 1.023 | 0.173* |
| | (1.58) | (2.40) | (1.00) | (3.03) | (1.89) | (1.41) | (0.99) | (1.97) | (0.88) | (1.74) |
| Change in risk free $rate_{t-1}$ | - | - | -14.287*** | 1.038*** | - | - | -14.061*** | 0.739** | -15.267*** | 0.533 |
| | - | - | (-3.56) | (2.91) | - | - | (-3.33) | (2.05) | (-3.72) | (1.52) |
| Risk free $rate_{t-1}$ | - | - | - | - | -2.264 | 0.514*** | -0.311 | 0.411*** | 0.206 | 0.503*** |
| | - | - | - | - | (-1.21) | (3.35) | (-0.17) | (2.61) | (0.11) | (3.23) |
| Market Excess $Return_{t-1}$ | - | - | - | - | - | - | - | - | 0.015 | 0.007* |
| | - | - | - | - | - | - | - | - | (0.30) | (1.69) |
| $SMB_{t-1}$ | - | - | - | - | - | - | - | - | -0.125** | -0.015*** |
| | - | - | - | - | - | - | - | - | (-2.11) | (-2.91) |
| $HML_{t-1}$ | - | - | - | - | - | - | - | - | 0.078 | -0.002 |
| | - | - | - | - | - | - | - | - | (1.49) | (-0.42) |
| Constant | -0.042*** | 0.001 | -0.043*** | 0.001 | -0.051*** | 0.003** | -0.044*** | 0.002** | -0.044*** | 0.002** |
| | (-3.58) | (0.61) | (-3.94) | (0.70) | (-3.70) | (2.35) | (-3.38) | (2.06) | (-3.50) | (2.24) |
| Observations | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| R-squared | 51.6 | 66.9 | 58.4 | 70.21 | 52.5 | 71.1 | 58.4 | 72.6 | 63.0 | 75.1 |
| Sum of Flow | 0.325** | -0.035*** | 0.195 | -0.025** | 0.258* | -0.020 | 0.188 | -0.016 | 0.254* | -0.015 |
| | (2.21) | (-2.71) | (1.39) | (-2.01) | (1.66) | (-1.53) | (1.28) | (-1.26) | (1.78) | (-1.25) |
| Sum of Return | 5.094*** | 0.994*** | 5.237*** | 0.984*** | 7.82*** | 0.376* | 5.609** | 0.492** | 4.583* | 0.380* |
| | (4.60) | (10.33) | (5.10) | (10.77) | (3.12) | (1.83) | (2.30) | (2.37) | (1.96) | (1.89) |

This table contains the vector autoregression (VAR) results for the 1992q1 - 2010q4 period with the endogenous variables net flow (%) and return (%), while all other variables enter the equation as exogenous controls. Net flow (%) is the total money flow into all real estate funds divided by total assets under management of all real estate funds lagged by one quarter. Return (%) is the value-weighted total return of all real estate funds. Change in risk free rate (%) is the quarterly change in the Germany 3-month treasury bill rate in EUR. The risk free rate is the Germany 3-month treasury bill rate in EUR. Excess market return (%) is the Germany stock market return in excess of the risk free rate in EUR. SMB (%) is the Germany small-firm minus big firm return factor in EUR. HML (%) is the Germany high book-to-market minus low book-to-market return factor in EUR. T-statistics are in parentheses. Coefficients marked with ***,** and * are significant at the 1%, 5%, and 10% level, respectively.

**Table IV:** Effect of relative performance on individual real estate fund flows

| | (i) | (ii) | (iii) | (iv) | (v) | (vi) |
|---|---|---|---|---|---|---|
| $\text{Low}_{t-1}$ | -0.007 | -0.010 | -0.004 | 0.015 | 0.018 | 0.007 |
| | (-0.66) | (-1.00) | (-0.32) | (1.34) | (1.61) | (0.62) |
| $\text{Mid}_{t-1}$ | 0.021*** | 0.014*** | 0.021*** | 0.023*** | 0.023*** | 0.016*** |
| | (6.87) | (5.01) | (6.88) | (7.35) | (7.75) | (5.75) |
| $\text{High}_{t-1}$ | 0.101*** | 0.056*** | 0.094*** | 0.072*** | 0.052*** | 0.033** |
| | (6.49) | (3.95) | (5.69) | (4.57) | (3.34) | (2.20) |
| $\text{Flow}_{t-1}$ | - | 0.407*** | - | - | - | 0.376*** |
| | - | (26.65) | - | - | - | (24.12) |
| Std. dev. of $\text{returns}_{t-1}$ | - | - | 0.364 | - | - | -0.337 |
| | - | - | (1.40) | - | - | (-1.35) |
| Log fund $\text{size}_{t-1}$ | - | - | - | -0.008*** | - | -0.003** |
| | - | - | - | (-8.77) | - | (-2.58) |
| Log $\text{age}_{t-1}$ | - | - | - | - | -0.025*** | -0.012*** |
| | - | - | - | - | (-13.66) | (-5.60) |
| Constant | 0.013 | 0.009 | 0.011 | 0.108*** | 0.113*** | 0.092*** |
| | (1.45) | (1.06) | (1.16) | (7.68) | (9.83) | (6.53) |
| Observations | 3612 | 3612 | 3612 | 3612 | 3612 | 3612 |
| R-squared | 0.342 | 0.457 | 0.342 | 0.357 | 0.377 | 0.469 |

This table contains the regression results of the flow-performance relationship of 25 real estate funds for the September 1990 to December 2010 period. The dependent variable is the monthly net flow. The sensitivity of flows to past performance is measured using a piecewise linear regression model. In each month, funds are ranked by their performance over the previous twelve months. The rank variable is then decomposed into the following fractiles. *Low* is defined as Min (*Rank*, 0.2); *Mid* is defined as Min (0.6,*Rank*-*Low*; *High* is defined as (*Rank*-(*Low*+*Mid*)). Thus, the coefficients on the piecewise decompositions of the fractional rank represent the slope of the flow-performance relationship over their range of sensitivity. Control variables include the net flow into the fund in the previous month, the 12-month-return volatility of the fund, the natural logarithm of the fund's size at the end of the previous month, and the natural logarithm of the fund's age. The model is estimated using cross-sectional and time period fixed effects. t-statistics are in parentheses. Coefficients marked with ***,** and * are significant at the 1%, 5%, and 10% level, respectively.

**Table V:** Effect of liquidity on the flow-performance relationship

| | (i) | (ii) | (iii) | (iv) | (v) |
|---|---|---|---|---|---|
| $\text{Low}_{t-1}$ | 0.006 | -0.006 | 0.008 | 0.007 | -0.009 |
| | (0.53) | (-0.49) | (0.78) | (0.63) | (-0.80) |
| $\text{Low}_{t-1} * \textit{Liquidity}_{t-1}$ | - | -0.164** | - | - | -0.257*** |
| | - | (-2.54) | - | - | (-3.38) |
| $\text{Mid}_{t-1}$ | 0.016*** | 0.017*** | 0.015*** | 0.016*** | 0.018*** |
| | (5.65) | (5.98) | (5.48) | (5.73) | (6.20) |
| $\text{Mid}_{t-1} * \textit{Liquidity}_{t-1}$ | - | - | 0.031* | - | 0.019 |
| | - | - | (1.80) | - | (0.76) |
| $\text{High}_{t-1}$ | 0.034** | 0.034** | 0.031** | 0.019 | 0.018 |
| | (2.25) | (2.29) | (2.05) | (1.24) | (1.16) |
| $\text{High}_{t-1} * \textit{Liquidity}_{t-1}$ | - | - | - | 0.413*** | 0.423*** |
| | - | - | - | (4.38) | (3.51) |
| $\text{Liquidity}_{t-1}$ | 0.005 | 0.003 | 0.006 | 0.004 | 0.002 |
| | (1.08) | (0.72) | (1.28) | (0.94) | (0.50) |
| $\text{Flow}_{t-1}$ | 0.376*** | 0.376*** | 0.373*** | 0.368*** | 0.366*** |
| | (24.09) | (24.11) | (23.80) | (23.53) | (23.40) |
| Std. dev. of $\text{returns}_{t-1}$ | -0.353 | -0.428* | -0.298 | -0.362 | -0.446* |
| | (-1.41) | (-1.70) | (-1.18) | (-1.46) | (-1.77) |
| Log fund $\text{size}_{t-1}$ | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** |
| | (-2.79) | (-2.86) | (-2.61) | (-2.70) | (-2.68) |
| Log $\text{age}_{t-1}$ | -0.011*** | -0.011*** | -0.011*** | -0.010*** | -0.011*** |
| | (-4.78) | (-4.93) | (-4.78) | (-4.54) | (-4.77) |
| Constant | 0.091*** | 0.096*** | 0.088*** | 0.089*** | 0.095*** |
| | (6.51) | (6.79) | (6.24) | (6.36) | (6.69) |
| Observations | 3612 | 3612 | 3612 | 3612 | 3612 |
| R-squared | 0.470 | 0.471 | 0.470 | 0.473 | 0.475 |

This table contains the regression results of the flow-performance relationship of 25 real estate funds for the September 1990 to December 2010 period. The dependent variable is the monthly net flow. The sensitivity of flows to past performance is measured using a piecewise linear regression model. In each month, funds are ranked by their performance over the previous twelve months. The rank variable is then decomposed into the following fractiles. *Low* is defined as Min (*Rank*, 0.2); *Mid* is defined as Min (0.6,*Rank*-*Low*; *High* is defined as (*Rank*-(*Low*+*Mid*)). Thus, the coefficients on the piecewise decompositions of the fractional rank represent the slope of the flow-performance relationship over their range of sensitivity. Low, Mid, and High are interacted with fund liquidity to investigate whether the flow-performance relationship depends on fund liquidity. The interacted variables are de-meaned to preserve the interpretability of the actual level coefficients. Control variables include fund liquidity, the net flow into the fund in the previous month, the 12-month-return volatility of the fund, the natural logarithm of the fund's size at the end of the previous month, and the natural logarithm of the fund's age. The model is estimated using cross-sectional and time period fixed effects. t-statistics are in parentheses. Coefficients marked with ***,** and * are significant at the 1%, 5%, and 10% level, respectively.

**Table VI:** Effect of low liquidity on the flow-performance relationship

| | (i) | (ii) | (iii) | (iv) | (v) |
|---|---|---|---|---|---|
| $\text{Low}_{t-1}$ | 0.006 | -0.009 | 0.006 | 0.007 | -0.011 |
| | (0.55) | (-0.70) | (0.53) | (0.63) | (-0.78) |
| $\text{Low}_{t-1} * Lowliquidity_{t-1}$ | - | 0.035* | - | - | 0.038* |
| | - | (1.93) | - | - | (1.79) |
| $\text{Mid}_{t-1}$ | 0.016*** | 0.017*** | 0.016*** | 0.016*** | 0.017*** |
| | (5.57) | (5.83) | (5.41) | (5.62) | (5.40) |
| $\text{Mid}_{t-1} * Lowliquidity_{t-1}$ | - | - | 0.001 | - | 0.003 |
| | - | - | (0.12) | - | (0.44) |
| $\text{High}_{t-1}$ | 0.033** | 0.033** | 0.033** | 0.041*** | 0.043*** |
| | (2.22) | (2.18) | (2.22) | (2.65) | (2.73) |
| $\text{High}_{t-1} * Lowliquidity_{t-1}$ | - | - | - | -0.075** | -0.100** |
| | - | - | - | (-2.02) | (-2.22) |
| Low $\text{liquidity}_{t-1}$ | -0.001 | -0.007** | -0.001 | -0.001 | -0.007** |
| | (-0.98) | (-2.16) | (-0.84) | (-0.35) | (-2.13) |
| $\text{Flow}_{t-1}$ | 0.376*** | 0.376*** | 0.376*** | 0.373*** | 0.373*** |
| | (24.07) | (24.08) | (24.04) | (23.87) | (23.85) |
| Std. dev. of $\text{returns}_{t-1}$ | -0.340 | -0.376 | -0.343 | -0.327 | -0.374 |
| | (-1.37) | (-1.51) | (-1.37) | (-1.31) | (-1.50) |
| Log fund $\text{size}_{t-1}$ | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** |
| | (-2.74) | (-2.88) | (-2.73) | (-2.63) | (-2.81) |
| Log $\text{age}_{t-1}$ | -0.012*** | -0.012*** | -0.011*** | -0.012*** | -0.012*** |
| | (-5.45) | (-5.48) | (-5.43) | (-5.49) | (-5.45) |
| Constant | 0.094*** | 0.099*** | 0.095*** | 0.094*** | 0.099*** |
| | (6.60) | (6.83) | (6.58) | (6.56) | (6.85) |
| Observations | 3612 | 3612 | 3612 | 3612 | 3612 |
| R-squared | 0.470 | 0.470 | 0.470 | 0.470 | 0.471 |

This table contains the regression results of the flow-performance relationship of 25 real estate funds for the September 1990 to December 2010 period. The dependent variable is the monthly net flow. The sensitivity of flows to past performance is measured using a piecewise linear regression model. In each month, funds are ranked by their performance over the previous twelve months. The rank variable is then decomposed into the following fractiles. *Low* is defined as Min (*Rank*, 0.2); *Mid* is defined as Min (0.6,*Rank-Low*; *High* is defined as (*Rank-*(*Low*+*Mid*)). Thus, the coefficients on the piecewise decompositions of the fractional rank represent the slope of the flow-performance relationship over their range of sensitivity. To investigate whether the flow-performance relationship is affected by low fund liquidity, Low, Mid, and High are interacted with an indicator variable that equals one if the fund's liquidity ratio is smaller than 20 percent and zero otherwise. Control variables include fund liquidity, the net flow into the fund in the previous month, the 12-month-return volatility of the fund, the natural logarithm of the fund's size at the end of the previous month, and the natural logarithm of the fund's age. The model is estimated using cross-sectional and time period fixed effects. t-statistics are in parentheses. Coefficients marked with ***,** and * are significant at the 1%, 5%, and 10% level, respectively.