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René-Ojas Woltering

Real Estate Investment Vehicles: The Tension between Asset and Fund Liquidity

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Chapter 1

Introduction

The question of *whether* to invest in real estate is easily answered by numerous asset allocation studies that have found real estate should play a significant role in optimal multi-asset portfolios.[1] The benefits of real estate as an asset class are often attributed to a favorable risk-return profile due to relatively stable rental income and a low correlation with other asset classes such as stocks and bonds. Furthermore, as a real asset, it is typically assumed to possess significant inflation-hedging capabilities. There are, however, challenges that need to be addressed when a real estate investment is considered. First of all, a direct investment in physical real estate is inherently illiquid as transaction costs are high and transaction periods can be substantial. Second, the private real estate market is rather opaque, due to the heterogeneity of each property and the lack of a central marketplace. Thus, information costs tend to be high. Third, the indivisibility of direct property results in high minimum investment requirements, which is a challenge to the construction of well-diversified property portfolios.

As a result, direct property investments are often an option only for large institutional investors with 1) long investment horizons that can attenuate illiquidity issues, 2) the necessary expertise to solve information problems, and 3) sufficient capital to facilitate the construction of well-diversified portfolios. For all other investors, the question of *how* to gain exposure to real estate as an asset class is a non-trivial one.

[1] See Seiler et al. (1999) for a review of the early academic literature on optimal allocations to real estate. Suggested allocations typically range from 15% to 20%. More recent research by MacKinnon and Al Zaman (2009) considers the effect of the investment horizon. The authors find that, for medium- to long-term investors, optimal allocations to real estate can increase to as high as 23%-31% due to the decreasing correlation of real estate with stocks and bonds.

The hurdles in obtaining the desirable risk-return characteristics of real estate provide a rationale for the existence of real estate investment vehicles as a form of financial intermediation. However, it is important to keep in mind that although financial intermediation can reduce the problems of direct real estate investments, the problems themselves do not cease to exist (Sebastian, 2003). This dissertation is concerned with the tensions that can arise when an inherently illiquid asset such as direct real estate is transformed into an investment vehicle that is traded on a day-to-day basis.

In general, real estate investment vehicles can be classified into open-end and closed-end funds. The key difference (which is central to this dissertation) is the way liquidity is provided. In the case of open-end funds, liquidity is created by the fund (or the sponsor of the fund), which regularly sells new shares and redeems existing shares. Importantly, it is the fund that calculates the price per unit, which depends primarily on regularly appraised property values and is hence tightly linked to the value of the underlying assets. In contrast, the paid-in capital of closed-end funds is constant. Once the initial capital is collected, the fund is closed, and the shares trade on public exchanges where the price results from supply and demand, and is not always on par with the value of the underlying assets.

In summary, open-end funds create liquidity through a *variable number of shares* at a *fixed price* (at least in the short term), whereas closed-end funds create liquidity through a *variable share price*, whereby the *number of shares is fixed*. In both cases, the investment vehicle ends up being more liquid than the underlying asset, which may lead to the following tensions between the liquidity of the fund and the liquidity of the underlying assets.

Open-end funds respond to the time-varying demand of investors for the vehicle by adjusting the number of shares. Tensions may arise when investors attempt to redeem shares at a faster rate than the fund is able to liquidate its underlying assets. To mitigate this problem, open-end real estate funds tend to hold high cash reserves. However, the cash reserves are limited and ultimately, open-end funds may have to suspend share redemptions until enough properties are sold to pay the exiting investors. In this event, the funds will temporarily cease to provide liquidity transformation.

In the case of closed-end funds, the time-varying demand of investors for the vehicle is matched through a variable share price on public exchanges. Here, tension may arise when the price for the investment vehicle changes at a faster rate faster rate than justified by changes in the value of the underlying assets. Ultimately, price and fundamental value may deviate from each other to an extent that the return dynamics no longer justify the high optimal allocation to real estate found in numerous multi-asset portfolio studies. In summary, the liquidity-providing mechanism is also the Achilles heel of both types of investment vehicles.

This dissertation examines three key issues related to the tension between asset and fund liquidity of real estate investment vehicles. The first part addresses real estate fund flows, which are at the core of the liquidity-providing mechanism of open-end real estate funds. When the number of newly issued shares exceeds the number of redeemed shares, a positive fund flow is measured. In contrast, when more investors exit their investments, open-end funds experience outflows, and the fund's cash reserves are reduced. When the cash reserves of the fund are low, or if the outflows are particularly high, the fund is at risk of becoming illiquid. To rebuild cash reserves (or to reopen the fund if it has temporarily suspended share redemptions), the fund may be forced to sell properties, which is time-consuming and involves high transaction costs.

Hence, understanding what drives real estate fund flows is of central importance in the case of open-end real estate funds. The general mutual fund literature finds that fund flows into equity mutual funds, where underlying asset illiquidity is not a concern, depend predominantly on a fund's past performance. As investors tend to disproportionately chase the best past performers, while poorly performing funds are merely sold, the flow-performance relationship is found to be convex (Sirri and Tufano, 1998).

Using a piecewise linear regression framework, this dissertation confirms the convexity of the flow-performance relationship for a sample of 25 German open-end real estate funds over the September 1990 to December 2010 period. However, the shape is also found to vary with fund-level liquidity (i.e., cash reserves relative to fund size). Investors are more sensitive to poor past performance when fund liquidity is low. Also, the best-performing funds tend to be chased less as their risk of becoming illiquid increases. Overall, the results suggest that open-end real estate fund investors are aware of the risk associated with low fund-level liquidity.

The second part of this dissertation examines the determinants of fund openings, particularly whether the decision to open a new open-end real estate fund is different from other asset classes such as stocks or bonds, where there is no discrepancy between asset and fund liquidity. The decision to launch a new mutual fund is essentially a cost-benefit trade-off. This dissertation finds that this trade-off generally tends to favor fund openings in liquid asset classes such as stocks or bonds. In the case of real estate, this trade-off is significantly influenced by the liquidity risk of open-end funds.

The dataset used here consists of 2,127 fund openings in 12 investment objectives for 76 fund families within the German mutual fund industry over the 1992-2010 period. A substantial cannibalization effect across the existing real estate funds of a family following a fund opening is documented. Due to the illiquid nature of the underlying assets, this cannibalization effect is a threat for the existing real estate funds of a family. An analysis of the determinants of fund openings using probit regression techniques reveals high inflows into the existing real estate funds of a family are the key to overcoming the cannibalization barrier. This factor is far less important for fund openings in other asset classes, where liquidity issues do not play a role.

Additional findings reveal that, in contrast to other asset classes, real estate fund openings are not sensitive to proxies for economies of scale or scope at a fund family level. This finding is consistent with strong fund-level economies of scale that provide an incentive to allow existing real estate funds to grow large. Overall, the results suggest that the determinants of real estate fund openings cannot be subsumed under a general fund opening framework because of differences in specific features of the underlying assets.

The third part of this dissertation is related to the tension between asset and fund liquidity of closed-end real estate funds. Publicly traded real estate stocks are the most prominent representative of closed-end real estate funds in many countries. Because they are traded daily on public exchanges, the liquidity of the investment vehicle is often higher than the liquidity of the underlying assets, and hence stock prices may change more rapidly than justified by changes in the values of the underlying properties. In other words, the prices of publicly traded real estate stocks may be too variable relative to value changes of the underlying assets. To investigate whether price and fundamental values have deviated too far, this dissertation tests whether an investment strategy that is long in real estate stocks with the most attractive ratios of price-to-fundamental value can produce significant excess returns.

The true fundamental value of real estate funds is unobservable. However, the net asset value (NAV) of publicly traded real estate stocks in fair value-based accounting regimes provides a relatively robust approximation. This is especially true when compared to the common book value of equity for general stocks that is used as a proxy for fundamental value in many asset pricing studies. Therefore, the analysis in the third part of this dissertation is based on a sample of 255 listed property holding companies in 11 countries with fair value based-accounting regimes over the 2005-2014 period. The key variable of interest is the ratio of price-to-NAV, or the NAV spread, which measures discrepancies between price and value. The results provide strong evidence in favor of the theory that market prices of real estate stocks can deviate too far from fundamental values. Investing in a global portfolio of the most underpriced real estate stocks relative to the average ratio of price to fundamental value in a country provides annualized excess returns of 8.0%. Even after controlling for common risk factors, risk-adjusted returns remain statistically significant. The implication is that stock price variability on public exchanges does not always reflect changes in fundamental values. Hence, the liquidity transformation of closed-end real estate funds may result in a loss of the risk-return characteristics of the underlying assets.

Chapter 2

Real Estate Fund Flows and the Flow-Performance Relationship

This paper is the result of a joint project with *David H. Downs*, *Steffen Sebastian*, and *Christian Weistroffer*.

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.

2.1 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 et al. (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 et al. (2009) and Ling et al. (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 dataset of German mutual funds over the September 1990 to December 2010 period. 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 methodological approach of Fisher et al. (2009), Ling et al. (2009) and Sebastian and Weistroffer (2010), 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.[1] 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 2.2 introduces the related literature and our hypotheses. The dataset and descriptive statistics are introduced in Section 2.3. Section 2.4 contains our research methodology and the empirical results for the aggregate analysis. Section 2.5 provides the research methodology and results for the fund level analysis. Section 2.6 provides our conclusions.

[1] Sebastian and Weistroffer (2010) examine the flow-performance relationship for 18 German real estate funds from 1990-2008. However, they do not control for liquidity. In contrast to our results, they find a linear relationship between flows and returns.

2.2 Related Literature and Hypotheses

2.2.1 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 et al. (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).*

2.2.2 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 et al. (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).*[2,3]

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 et al., 2004), private equity funds (Lopez-de Silanes et al., 2013), and hedge funds (Fung et al., 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.*

2.2.3 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

[2] 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.

[3] 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.

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.

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).*

2.2.4 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 "closed" 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).*

2.3 Data and Descriptive Statistics

2.3.1 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,[4] 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 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.[5]

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.[6] At the beginning of our sample period in September 1990, we

[4] 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.

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

[6] 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.

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:

$$Flow_{i,t} = \frac{AbsoluteNetFlow_{i,t}}{FundSize_{i,t-1}} \tag{2.1}$$

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

$$Liquidity_{i,t} = \frac{CashReserves_{i,t}}{FundSize_{i,t}} \quad (2.2)$$

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.

2.3.2 Descriptive Statistics

Table 2.1 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 2.1 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 2.1. 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

Table 2.1: 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.

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 2.1, 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.

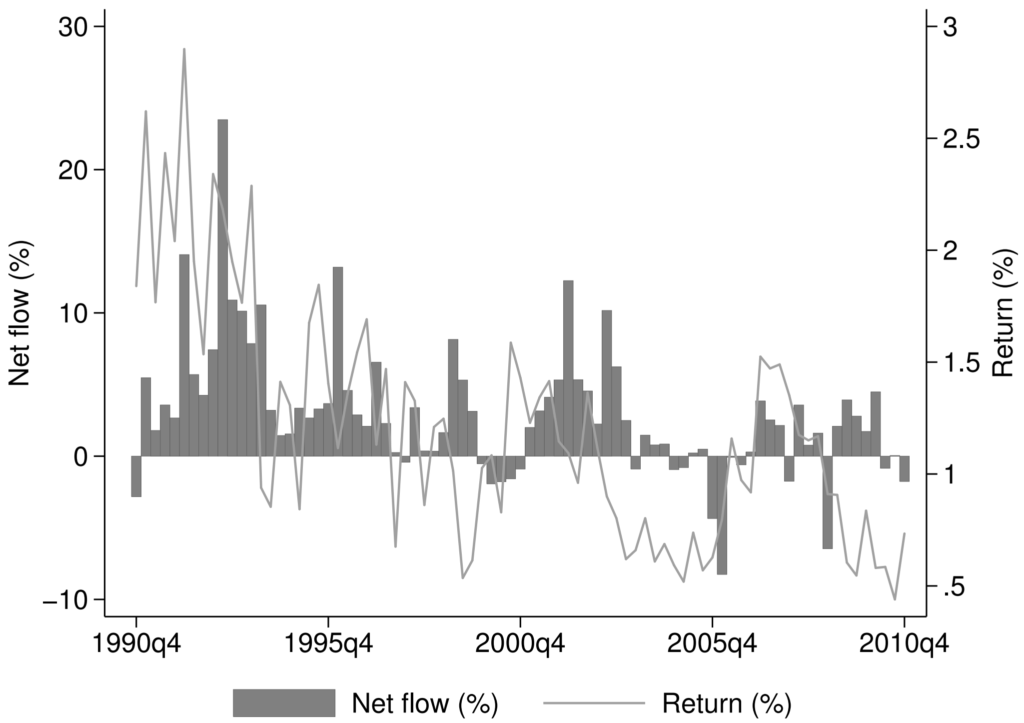


Figure 2.1: This figure shows the time series of aggregate fund flows and returns of all real estate funds between September 1990 and December 2010.

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 2.2 graphs the mean and minimum liquidity ratio for the funds in our sample over the September 1990 to December 2010 period.

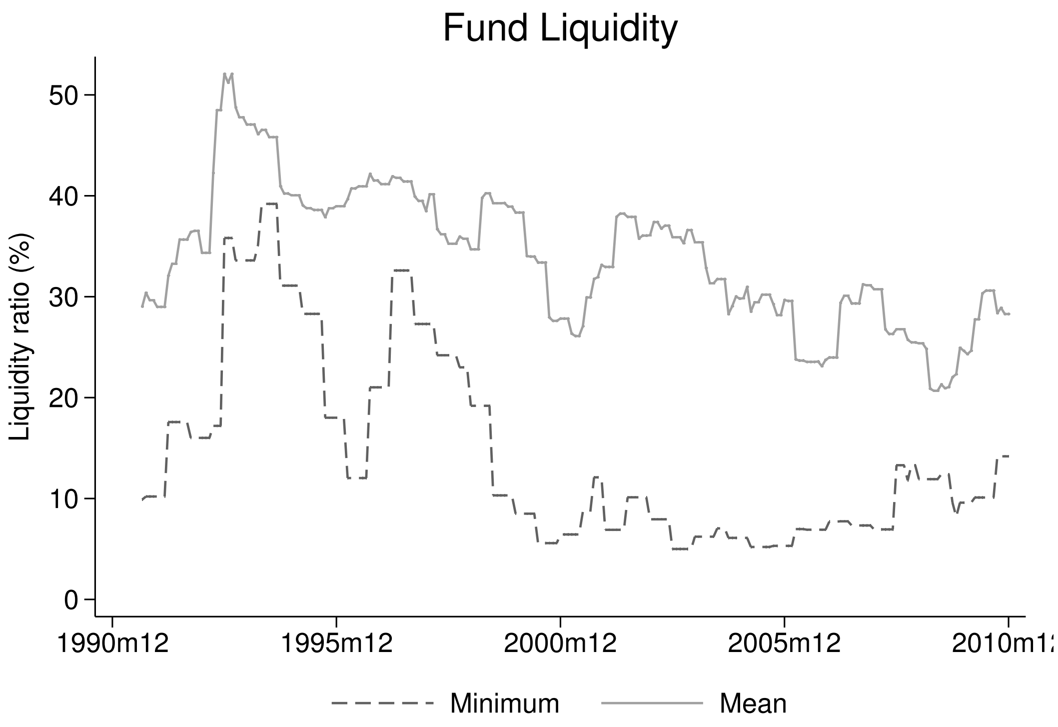


Figure 2.2: This figure shows the mean and minimum liquidity ratios between September 1990 and December 2010.

Panel A of Table 2.2 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 (ρ=0.42). The respective correlation coefficient between flows and lagged returns is even stronger (ρ=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 (ρ=0.23), which is consistent with the market timing hypothesis.

The strong and statistically significant correlation between flows and lagged flows (ρ=0.50) in the first column of Panel B and, likewise, the positive correlation between returns and lagged returns (ρ=0.71) in the second column of Panel 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.

Table 2.2: 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							
Flow$_{t-1}$	0.50*	0.23*	0.31*	-0.23*	0.08	0.01	-0.13
Return$_{t-1}$	0.53*	0.71*	0.83*	-0.13	-0.17	-0.06	0.02
Risk free rate (RF)$_{t-1}$	0.47*	0.82*	0.98*	-0.17	-0.29*	-0.07	-0.09
Change in risk free rate (DRF)$_{t-1}$	-0.42*	0.09	0.13	0.57*	-0.25*	-0.09	0.02
Excess market return (MKTRF)$_{t-1}$	-0.09	-0.19	-0.22	0.25*	0.18	0.28*	-0.01
SMB$_{t-1}$	-0.19	-0.24*	-0.07	0.13	0.17	0.27*	-0.01
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.

Fund flows are positively correlated with both, the contemporaneous (ρ=0.35) and the lagged level (ρ=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 (ρ=0.84). In contrast, aggregate flows into real estate funds are negatively correlated with contemporaneous (ρ=-0.41) and lagged (ρ=-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.

2.4 Aggregate Flows and Returns

2.4.1 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:

$$Flow_t = \alpha_1 + \sum_{i=1}^{T} \beta_i Flow_{t-i} + \sum_{i=1}^{T} \gamma_i Return_{t-i} + \sum \omega_s Control_{s,t-1} + \varepsilon_{1,t} \tag{2.3}$$

$$Return_t = \alpha_2 + \sum_{i=1}^{T} \beta_i Flow_{t-i} + \sum_{i=1}^{T} \gamma_i Return_{t-i} + \sum \omega_s Control_{s,t-1} + \varepsilon_{2,t} \tag{2.4}$$

$Flow_t$ 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.

2.4.2 VAR Results

Table 2.3 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 2.3 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) ex-

Table 2.3: 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.

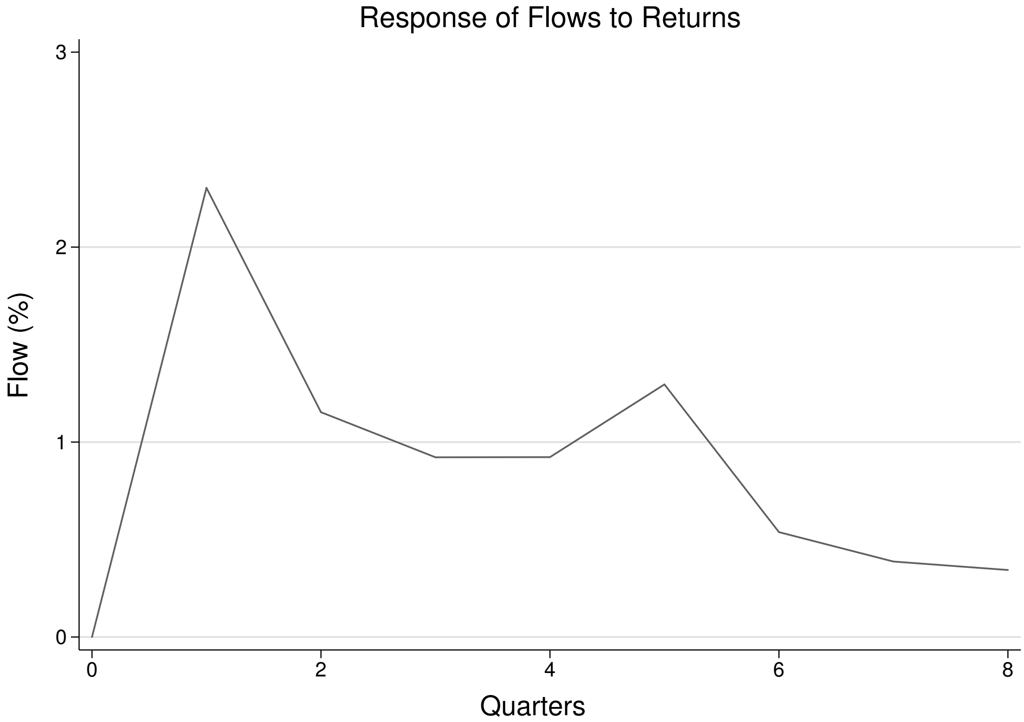


Figure 2.3: This figure shows the response of aggregate real estate fund flows to returns based on model (v) of Table 2.3.

plains 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.[7,8] 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 2.4. 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

[7] 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.

[8] 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)

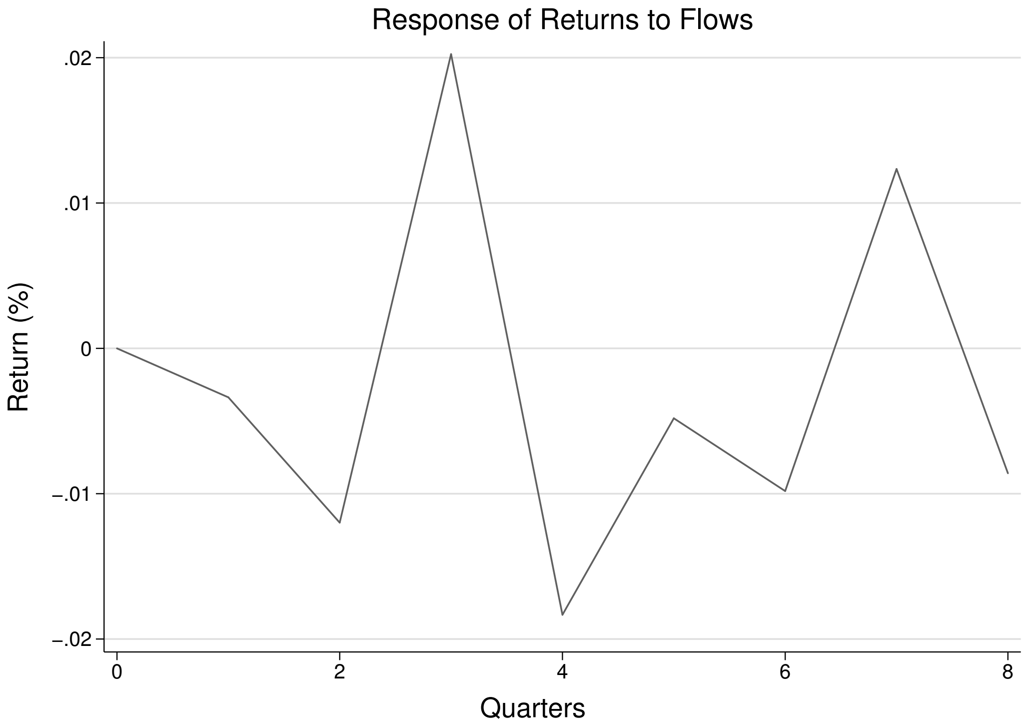


Figure 2.4: This figure shows responses of real estate fund returns to aggregate net flows based on model (v) of Table 2.3.

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 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).

2.5 Individual Fund Flows and Returns

2.5.1 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:[9]

$$\begin{aligned} Low_{i,t} &= min(0.2, Rank_{i,t}) \\ Mid_{i,t} &= min(0.6, Rank_{i,t} - Low_{i,t}) \\ High_{i,t} &= Rank_{i,t} - (Low_{i,t} + Mid_{i,t}) \end{aligned} \tag{2.5}$$

$Low_{i,t}$ 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 cross-sectional and time-period fixed effects:

$$\begin{aligned} Flow_{i,t} = \alpha_1 &+ \beta_1 Low_{i,t-1} + \beta_2 Mid_{i,t-1} + \beta_3 High_{i,t-1} \\ &+ \beta_4 Flow_{i,t-1} + \beta_5 Std.dev.of returns_{i,t-1} \\ &+ \beta_6 LogFundsize_{i,t-1} + \beta_7 LogAge_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{2.6}$$

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 et al., 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

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

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 ($Flow_{i,t-1}$).

2.5.2 Flow-Performance Convexity for Real Estate Funds

Figure 2.5 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 2.5 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 2.4 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 2.4 confirm the intuition that was provided by Figure 2.5. 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

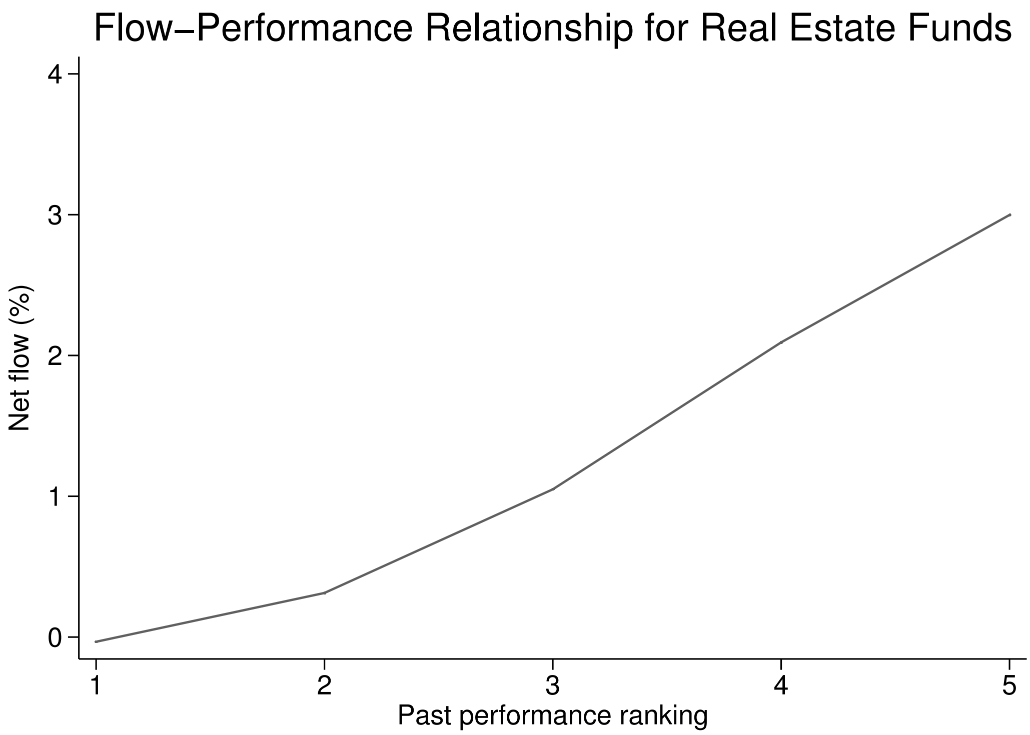


Figure 2.5: This figure shows average monthly net flows as a function of performance over the previous 12 months. For each month, funds are ranked by their performance over the previous twelve months and divided into five equal groups. For each of these five groups, the mean net flow into the funds in the following month is calculated.

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.

Table 2.4: Effect of relative performance on individual real estate fund flows

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
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)
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)
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)
Flow$_{t-1}$	-	0.407***	-	-	-	0.376***
	-	(26.65)	-	-	-	(24.12)
Std. dev. of returns$_{t-1}$	-	-	0.364	-	-	-0.337
	-	-	(1.40)	-	-	(-1.35)
Log fund size$_{t-1}$	-	-	-	-0.008***	-	-0.003**
	-	-	-	(-8.77)	-	(-2.58)
Log 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.

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.

2.5.3 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 2.6, analogous to Figure 2.5, 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 2.6, 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.

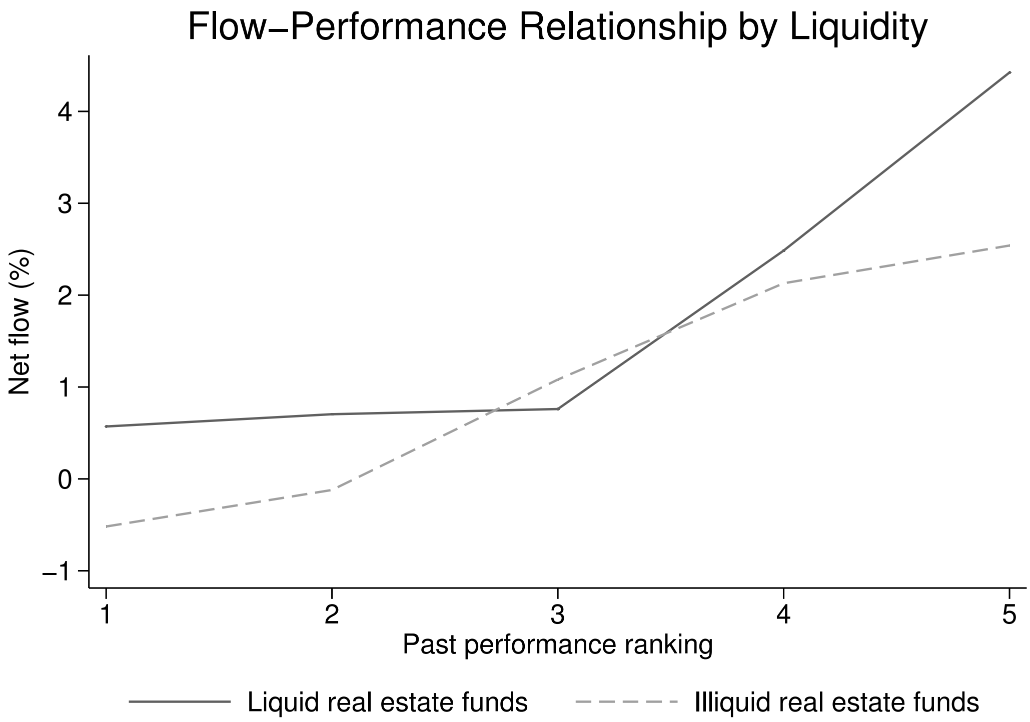


Figure 2.6: This figure shows the flow-performance relationship for liquid and illiquid real estate funds. In each month, funds are sorted by liquidity. Illiquid funds are defined as the 30 percent of funds with the lowest liquidity ratios. Liquid funds are defined as the 30 percent of funds with the highest liquidity ratios.

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:

$$\begin{aligned} Flow_{i,t} = \alpha_1 &+ \beta_1 Liquidity_{i,t-1} \\ &+ \beta_2 Low_{i,t-1} + \beta_3 Low_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_4 Mid_{i,t-1} + \beta_5 Mid_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_6 High_{i,t-1} + \beta_7 High_{i,t-1} * Liquidity_{i,t-1} \\ &+ \beta_8 Flow_{i,t-1} + \beta_9 Std.dev.ofreturns_{i,t-1} \\ &+ \beta_6 LogFundsize_{i,t-1} + \beta_7 LogAge_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{2.7}$$

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 2.5 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 2.5 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.

Table 2.5: Effect of liquidity on the flow-performance relationship

	(i)	(ii)	(iii)	(iv)	(v)
Low$_{t-1}$	0.006	-0.006	0.008	0.007	-0.009
	(0.53)	(-0.49)	(0.78)	(0.63)	(-0.80)
Low$_{t-1} * Liquidity_{t-1}$	-	-0.164**	-	-	-0.257***
	-	(-2.54)	-	-	(-3.38)
Mid$_{t-1}$	0.016***	0.017***	0.015***	0.016***	0.018***
	(5.65)	(5.98)	(5.48)	(5.73)	(6.20)
Mid$_{t-1} * Liquidity_{t-1}$	-	-	0.031*	-	0.019
	-	-	(1.80)	-	(0.76)
High$_{t-1}$	0.034**	0.034**	0.031**	0.019	0.018
	(2.25)	(2.29)	(2.05)	(1.24)	(1.16)
High$_{t-1} * Liquidity_{t-1}$	-	-	-	0.413***	0.423***
	-	-	-	(4.38)	(3.51)
Liquidity$_{t-1}$	0.005	0.003	0.006	0.004	0.002
	(1.08)	(0.72)	(1.28)	(0.94)	(0.50)
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 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 size$_{t-1}$	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-2.79)	(-2.86)	(-2.61)	(-2.70)	(-2.68)
Log 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.

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.[10]

2.5.4 Economic Implications of Low Fund Liquidity

The economic implications of the Table 2.5 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 2.6 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 2.5. However, flows are signif-

[10] 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.

icantly 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.

2.6 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.

Table 2.6: Effect of low liquidity on the flow-performance relationship

	(i)	(ii)	(iii)	(iv)	(v)
Low$_{t-1}$	0.006	-0.009	0.006	0.007	-0.011
	(0.55)	(-0.70)	(0.53)	(0.63)	(-0.78)
Low$_{t-1} * Lowliquidity_{t-1}$	-	0.035*	-	-	0.038*
	-	(1.93)	-	-	(1.79)
Mid$_{t-1}$	0.016***	0.017***	0.016***	0.016***	0.017***
	(5.57)	(5.83)	(5.41)	(5.62)	(5.40)
Mid$_{t-1} * Lowliquidity_{t-1}$	-	-	0.001	-	0.003
	-	-	(0.12)	-	(0.44)
High$_{t-1}$	0.033**	0.033**	0.033**	0.041***	0.043***
	(2.22)	(2.18)	(2.22)	(2.65)	(2.73)
High$_{t-1} * Lowliquidity_{t-1}$	-	-	-	-0.075**	-0.100**
	-	-	-	(-2.02)	(-2.22)
Low liquidity$_{t-1}$	-0.001	-0.007**	-0.001	-0.001	-0.007**
	(-0.98)	(-2.16)	(-0.84)	(-0.35)	(-2.13)
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 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 size$_{t-1}$	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-2.74)	(-2.88)	(-2.73)	(-2.63)	(-2.81)
Log 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.

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.

Chapter 3

Real Estate Fund Openings and Cannibalization

This paper is the result of a joint project with *David H. Downs* and *Steffen Sebastian*.

Abstract

This paper examines the trade-offs in launching new real estate funds, specifically open-end, direct-property funds. This investment vehicle, which is designed to provide the risk-return benefits of private market real estate, is available to retail investors in a number of countries. At the same time, these funds are also subject to liquidity risk, because they hold an inherently illiquid asset in an open-end structure. This format presents fund-family managers with unique challenges, particularly with the decision to opening new funds. The data consists of 2,127 German fund openings across 76 fund families in 12 asset classes over the 1992-2010 period. Including a wide range of asset classes allows for a comparison of real estate and other investment objectives. We find a substantial cannibalization effect across the existing real estate funds of a family, while we note the opposite effect – i.e., flows into existing funds increase following a fund opening within the same objective – for all other asset classes. Our analysis of fund opening determinants shows that inflows mitigate the cannibalization risk for new real estate funds. Additional evidence highlights the role of scale and scope economies in real estate fund openings. Overall, the results provide

new insights into the relatively large size and small number of real estate funds when compared to mutual funds dedicated to other investment objectives.

3.1 Introduction

Mutual fund families compete based on performance and breadth of fund offerings. Opening a new fund can affect both of these dimensions at the same time. Each fund opening increases the likelihood that one of a family's funds will exhibit superior investment performance while it also leads to an expansion of the product line. Another advantage of fund openings is documented by Khorana and Servaes (1999), who find that fund families recognize economies of scale and scope by opening new funds. Empirical support for the profitability of fund openings comes from Khorana and Servaes (2012), who find that fund openings lead to higher market share. Given these advantages, the frequent use of fund openings is not surprising. Evans (2010) documents that fund families even incubate mutual funds, that is, they open several funds privately, and at the end of the incubation period offer only the best performing funds to the public. The resulting large number of mutual funds in the industry has been described by some scholars as excessive (Massa, 2000). In this paper, we examine these issues for open-end, direct-property funds – a specific type of mutual fund which may face much different challenges than typical mutual funds.

Considering the trade-offs, openings may also lead to fund flow cannibalization when the growth of new funds comes at the cost of a family's existing funds. While the positive effect of fund openings on the market share of the family implies that the inflows achieved through fund openings outweigh a potential cannibalization effect, the mutual fund literature lacks a systematic analysis of how fund flows into existing funds are affected by new fund openings of the family. The risk of self-inflicted liquidations of portfolio positions is particularly relevant for funds investing in illiquid asset classes such as real estate. Here, disinvestments can be characterized by high costs and long transaction periods. However, funds focused on less liquid stocks or bonds may also be negatively affected by fund openings. Ultimately, the potential cost of cannibalization must be considered for fund openings within specific investment objectives.

The goal of this paper is to study the trade-offs associated with opening new real estate funds. Germany ranks as the largest and most developed real estate fund industry for individual investors; hence, we concentrate our analysis on German mutual fund data. The notion of a direct-property, open-end mutual fund (hereinafter referred to as a real estate fund), intended for individual investors, may be somewhat foreign to some readers and even real estate investment scholars, because that fund type is not available in the U.S.[1] [2]

German real estate funds can be understood as a compromise between direct investment in private real estate and listed real estate (e.g., publicly traded REITs), the latter of which offers liquidity. The underlying assets of German real estate funds – and their counterparts globally – are direct-property investments.[3] Given the relative illiquidity of real estate as an underlying asset in an open-end fund format, fund-level liquidity is of particular interest. To maintain daily liquidity (i.e., offer daily share redemptions), German real estate funds typically hold high cash reserves. Real estate fund returns are derived from the fund's NAV per share, which is reported on a daily basis and depends predominantly on appraisal-based property values. The NAV-based pricing scheme results in a risk-return profile that is comparable to appraisal-based, private-market real estate indices (such as NPI, the NCREIF Property Index). Diversification and low volatility are a primary appeal of this investment vehicle, and have contributed to its continuing popularity in many countries.[4]

Despite the benefits, however, the financial intermediation offered through open-end, direct-property funds is not perfect. For example, if a fund runs low on cash reserves, share redemptions may be temporarily suspended, and the fund may be-

[1] Retail investors in the U.S. and many other countries typically gain exposure to real estate by investing in REITs or REIT mutual funds. U.S.-domiciled REIT mutual funds are only similar to German real estate funds in that both investment vehicles share an open-end format. U.S. REIT mutual funds are known for investing in securities such as mortgage-backed bonds or REIT shares. Similarly to German real estate funds, Equity REITs – which are not open-end funds but are more analogous to closed-end funds – invest in direct property. For some retail investors, direct real estate may be accessed through non-traded REITs, but these are closed-end vehicles that are not comparable to the German experience.

[2] The U.S. real estate investment vehicle that comes closest to German open-end real estate funds is a "commingled" real estate fund. Those included in the NFI-OE (the NCREIF Fund Index – Open-End Equity), for example, invest in direct property and have an open-end fund structure. However, these funds are operated for and are restricted to institutional investors. U.S. retail investors can only gain exposure through defined contribution plans or other sponsor-type relationships. They are not available to the general public.

[3] See the Appendix for a list of countries in which open-end, direct-property funds are available to retail investors.

[4] For example, recent global evidence finds that optimal multi-asset portfolios devote large shares to direct real estate (e.g. Rehring, 2012). MacKinnon and Al Zaman (2009) find that REITs are a redundant asset class for investors with access to direct real estate. Schweizer et al. (2011) compare REITs and German real estate funds in a multi-asset portfolio context, and show that real estate funds have a diversification advantage over REITs in low-risk portfolios.

come illiquid.[5] We thus caution readers to interpret our results with these caveats in mind. The following section analyzes how the tension between fund-level liquidity and the underlying asset liquidity affects the real estate fund opening decision. The Appendix provides additional background and some institutional details on the global mutual fund market, open-end real estate funds, and, specifically, the German real estate fund industry.

Our objective is to examine 1) the implications of fund flow cannibalization, and 2) the determinants of fund openings, both with a focus on real estate funds. Our analysis is motivated by the fact that open-end, direct-property funds are typically allowed to grow much larger and are started less frequently than funds dedicated to other investment objectives. Thus far, the fund opening literature has focused on investment objectives defined by liquid asset classes (e.g., stocks and bonds). To our knowledge, this is the first study that addresses real estate fund openings. Including other asset classes in the analysis enables us to compare real estate and alternative investment objectives. Our sample consists of a panel of 76 fund families that could potentially open funds in 12 asset classes over the 1992-2010 period. Overall, we observe 2,127 German fund openings across all investment objectives.

The first part of our study proposes a novel and direct test of cannibalization by analyzing whether and to what extent fund flows into existing funds in the same family within an investment objective are affected by new fund openings. To isolate the cannibalization effect, we control for further variables that may affect fund flows within the family-objective level. These include the lagged returns of the family's funds within the investment objective, aggregate fund flows into the family within the investment objective, size of the fund family, percentage of family assets invested in the investment objective, and total number of fund openings within the investment objective. To determine whether cannibalization is a real estate-specific effect, we interact the number of funds opened by the family with a dichotomous variable for real estate funds. The parameters are estimated using a generalized method of moments (GMM) approach.

The empirical analysis reveals a substantial cannibalization effect subsequent to a real estate fund opening. The opening of a new real estate fund is, on average,

[5] See, e.g., Weistroffer and Sebastian (2014) for a description of the German experience.

associated with a reduction of 438 million Euros of fund flows into existing real estate funds of the family. In contrast, fund openings have a moderately positive effect on fund flows into existing funds in all other investment objectives, suggesting that cannibalization is a real estate-specific phenomenon.

The second part of our study analyzes the determinants of fund openings, again with an emphasis on real estate-specific determinants. Several characteristics of direct real estate investments suggest that these determinants may differ from those of other asset classes. For example, the combination of cannibalization risk and the illiquidity of the asset class may lead to a more pronounced role of liquidity in fund family decisions. Furthermore, the fact that direct real estate is indivisible may hinder the construction of diversified portfolios. Prior to opening a new real estate fund, there may thus be an incentive to allow existing real estate funds to grow large relative to other asset class funds. The heterogeneity of real estate investments – relative to other asset classes – may also prevent the fund family from benefiting from economies of scale and scope through real estate fund openings.

We use probit regression techniques to examine the determinants of real estate fund openings and how they differ from fund openings in all other investment objectives. Our probit regression models have standard errors clustered at the level of the fund family, and time fixed effects. The dependent variable is binary, and indicates whether or not a fund family has opened a new fund within a specific investment objective.

The set of explanatory variables consists of fund flows into existing funds of the family within an investment objective in order to test whether fund openings are liquidity-driven. We examine the role of economies of scale and scope in fund openings through the variables family size, fraction of family assets invested in an investment objective, and number of funds opened by the family in the prior year. We use the excess return of the funds in a family's investment objective to test whether fund openings are driven by return considerations. We also include industry-level control variables. To test our real estate-specific hypotheses, we interact the respective explanatory variable with a dichotomous variable. This variable indicates whether the fund opening (or non-opening) occurs within the real estate investment objective.

We find evidence that real estate fund openings are liquidity-driven. When the real estate funds of the family experience high outflows, the real estate fund opening probability goes to zero. In contrast, high inflows into the existing real estate funds of the family strongly increase the real estate fund opening probability. This flow dependence is much weaker for fund openings in all other investment objectives, which suggests that fund families are only willing to bear the risk of cannibalization if high inflows compensate for expected outflows. Furthermore, the proxies for economies of scale and scope in fund openings indicate they play only a minor role in real estate fund openings. However, they are strong drivers of fund openings in all other asset classes.

Overall, our results suggest that the determinants of real estate fund openings cannot be subsumed under a general fund opening framework. To the contrary, the economic principles underlying the real estate fund opening decision are asset class-specific. This paper is therefore the first to document this finding, as well as the fundamental influence that cannibalization plays in real estate fund openings.

The remainder of this paper is organized as follows. The next section reviews the related literature, and develops testable implications of the effects and determinants of real estate fund openings. Afterward, we introduce the data and methodology. The empirical results section follows. The final section offers our conclusions. The Appendix provides additional background on open-end, direct-property funds, as well as on the German mutual fund industry.

3.2 Related Literature and Hypotheses

3.2.1 Fund Openings – Benefits and Costs

As profit-oriented companies, fund families strive to increase their firm value. The principal driver of fund family value is an increase in assets under management (AuM). The mutual fund literature finds that fund families strategically compete in their marketplace through fund performance and the breadth of their offerings. Fund openings play an important role in this context, because fund families can affect both dimensions at the same time by opening a new fund.

Top-performing mutual funds not only attract disproportionately high inflows for themselves (Sirri and Tufano, 1998), but also for the other funds of the family (Nanda et al., 2004). Accordingly, it makes sense for fund families to increase their chances of having a highly ranked fund by opening new funds. Goetzmann and Ibbotson (1993) hypothesize that this probability is maximized when the fund family opens many funds simultaneously with a low correlation between the investment strategies. Nanda, Wang, and Zheng (2004) confirm that families with a higher variation in investment strategies across funds are more likely to generate star performers.

The widespread implementation of this practical strategy is documented by Evans (2010), who finds that fund families incubate mutual funds. He finds that fund families tend to open several funds privately, and, at the end of the incubation period, offer only the best-performing funds to the public. Fund families may also open new funds as a way to window-dress the poor performance of existing funds. Berzins (2005) finds that low-skill families, which fail to attract new money due to prior poor performance, can successfully regain cash flows by opening new funds.

Fund families also aim to increase their product line and thereby appeal to a broader range of investors by opening new funds. Massa (2000) argues that fund families exploit the heterogeneity of investors by offering various funds in diverse investment categories. Massa (2003) goes on to find that fund openings enable fund families to compete less on performance when they are able to differentiate themselves along non-performance-related fund characteristics.

When a new fund is opened, it either represents a new investment style, or it follows current industry trends. Khorana and Servaes (1999) find that fund families follow industry leaders by attempting to replicate their fund opening decisions.

However, following industry trends may also be accomplished if fund families simply change the names of existing funds. Cooper et al. (2005) find that fund families have taken successful advantage of current hot investment styles by changing fund names. They report a 28% average cumulative inflow without any concurrent performance improvement. The introduction of multiple share classes of the same investment portfolio is another option for fund families to address investor heterogeneity. Nanda et al. (2009) find that especially large fund families are more likely to benefit from and switch to a multiple share class structure.

Based on the benefits of fund openings, we would expect fund families to exhibit a propensity to open new funds regardless of investment objective. However, there are costs associated with new fund openings, such as initial marketing, organizational, and ongoing operating costs. However, these costs are lower on a per unit basis when fund families can benefit from economies of scale. Hence, the propensity to open a new fund may also depend on the potential of the fund family to benefit from economies of scale and scope. Khorana and Servaes (1999) find that economies of scale and scope are actually an important determinant of fund openings. They document a higher fund opening probability for larger and more experienced fund families.

In summary, fund families will open new funds when the expected benefits outweigh the anticipated costs. This cost-benefit trade-off may differ for real estate funds when compared to other asset classes. For example, fund flow cannibalization of existing funds through new fund openings is of particular concern with real estate funds because of the illiquidity of the underlying assets. We next provide a closer look at cannibalization, and develop testable hypotheses regarding the differences in real estate fund openings versus all other asset classes.

3.2.2 Cannibalization

New mutual funds are generally advertised heavily during their introduction phase. As a result of focused marketing efforts by the fund family, new funds may simply grow at the cost of existing funds, and they may even "steal" flows from existing funds. If existing funds fail to retain AuM or attract new investor money, they may be forced to liquidate portfolio positions in order to pay investors who wish to redeem shares. This raises two questions: 1) Is the overall effect of fund openings positive, and are the inflows into new funds offset by outflows from the existing funds of the family? and 2) are flows into existing funds of the family cannibalized through new fund openings, and to what extent?

Khorana and Servaes (1999) find that fund openings are more likely to occur in investment objectives in which the fund family is more strongly represented. They thus conclude that the benefits of specialization are likely to outweigh the costs of cannibalization. Khorana and Servaes (2012) also document that fund openings positively affect the fund family's market share, and they conclude that cannibalization of existing funds is not a significant problem. The literature provides considerable evidence that the overall effect of fund openings is positive. At the same time, these studies have not addressed the more specific issue of cannibalization. Thus, the second question remains to be answered.

In a working paper version of their study, Nanda, Wang, and Zheng (2009) conduct a test of cannibalization at the individual fund level by examining whether new share classes negatively affect fund flows into the existing share class of the same investment portfolio. They find no evidence of cannibalization for the A class by other share classes. To our knowledge, no published study has provided a direct test of cannibalization through new fund openings at the level of the fund family. We formulate our cannibalization hypothesis of fund openings as follows:

Hypothesis 1: *Cannibalization of fund flows occurs subsequent to a fund opening within a given family (i.e., the family's fund opening has a negative impact on subsequent fund flows).*

3.2.3 Liquidity

As we have noted, real estate funds are particularly subject to liquidity risk. Unlike REITs, where management is relatively free to distribute or raise capital to exploit market opportunities (Boudry et al., 2010), net flows into or out of real estate funds depend on the buying and selling decisions of individual investors or institutions. This is not as problematic for equity and fixed income funds, because they can sell their underlying securities in a short period of time for relatively low transaction costs. However, for a real estate fund, a negative cash flow shock can be challenging because the disposition of direct property is time-consuming and expensive.

If cannibalization is an issue, the fund opening itself is a source of liquidity risk for existing real estate funds, while funds in liquid asset classes may remain unaffected. Fund families may thus consider cannibalization as a barrier to real estate fund openings.

However, the literature provides ample evidence that this liquidity risk can be significantly reduced or even eliminated. For example, Warther (1995) documents that aggregate fund flows are highly autocorrelated. This implies that current positive fund flows are likely to persist, which can attenuate a potential cannibalization effect. Fund families can also derive optimistic expectations about future fund flows from the state of the real estate market. Plazzi et al. (2010) find that direct-property returns are predictable. If rational investors exploit this predictability by increasing their allocations to real estate, an expected upswing in the real estate market could lead to positive net flows into real estate funds. When fund flows into existing funds are high, fund families may open a new fund to absorb the excess demand.

In contrast, persistence in outflows or an expected decline in the market can be seen as barriers to real estate fund openings. Funds investing in liquid asset classes are robust to negative cash flow shocks, so their fund opening probability should be unrelated (or less related) to fund flows. In fact, Khorana and Servaes (1999), whose sample is restricted to funds that invest in liquid asset classes, find no relationship between fund flows and fund opening probability. We test whether a positive relationship exists, which leads to our liquidity hypothesis for the determinants of real estate fund openings:

Hypothesis 2: *The marginal effect of liquidity on real estate fund openings, relative to other asset classes, is positive.*

3.2.4 Economies of Scale and Scope

Latzko (1999) finds that the average costs of mutual funds fall with fund size. It is not surprising that economies of scale and scope exist at the fund family level. Many sources of scale economies can be shared across funds, such as costs for research, marketing, and distribution, as well as efficiencies in securities transactions execution (e.g., Deli (2002) and Khorana et al. (2009)). This raises the question of whether large fund families, which may seem positioned to benefit from economies of scale and scope, are better served by having a few large funds, or a large number of small funds.

The mutual fund literature suggests that fund families actually prefer small funds over large ones. Deli (2002) finds that competitive pressures force fund families to pass economies of scale along to investors. However, the extent of these pressures remains debatable. If fund families can charge higher fees for small funds, then the same amount of AuM will generate more fee income when spread over many smaller funds. Chen et al. (2004) finds that fund performance erodes with fund size, which provides another argument in favor of small funds. Consistent with this finding, Zhao (2004) documents that larger funds are more likely to be closed to new investors. Furthermore, fund families increase the probability of having a top performer by offering multiple small funds. Thus, large fund families have an incentive to open more funds in order to reduce the average size of existing funds. In fact, Khorana and Servaes (1999) find that larger families obtain a higher fund opening probability which is consistent with the view that fund families reap economies of scale and scope by opening more funds.

In contrast to the diseconomies of scale for mutual funds in general, the real estate literature provides (strong) evidence in favor of large real estate funds. Ambrose et al. (2005), for example, find economies of scale and scope for large REITs. Due to the general lumpiness and the indivisibility of direct real estate, large property-portfolios also tend to be more beneficial from a risk-return perspective.

Plazzi et al. (2008) document a positive relationship between the total risk and return of commercial property. They note that only systematic risk is priced in the equity markets, while idiosyncratic risk is also priced in the real estate market, because it cannot be diversified away. This implies that larger property-portfolios may earn superior risk-adjusted returns.

Another argument in favor of large real estate funds comes from Eichholtz et al. (2001). They document the underperformance of international real estate companies when compared to domestic real estate companies. They posit that size appears to be the only factor that can improve the performance of global property portfolios, probably because only large international property companies can overcome the information disadvantages of covering multiple international markets. In addition, and for obvious reasons, the strategy of opening multiple real estate funds (i.e., incubating direct-property funds), in the hope of breeding a top performer is not feasible.

Finally, family-level economies of scale and scope achieved from fund openings are likely to be smaller for real estate in comparison to other investment objectives. The heterogeneity of real estate reduces the potential to standardize the processes associated with fund operation. For example, efficiencies in the execution of securities transactions make it easy for a fund family to expand to the money market sector when it already offers equity or fixed income funds. However, this does not hold for a potential expansion into the real estate fund business. The potential efficiencies with real estate transactions are completely different, due to the different requirements of operational real asset management (e.g., taxes, transactions).

As a result of the reduced economies of scope at the fund family level, and incentives to let existing real estate funds to grow large, we anticipate a muted effect for economies of scale and scope as determinants of real estate fund openings. Accordingly, we formulate our economies of scale and scope hypothesis of real estate fund openings as follows:

Hypothesis 3: *The marginal effect of economies of scale and scope on real estate fund openings, relative to other asset classes, is negative.*

3.3 Data and Methodology

3.3.1 Data Sources

Our empirical analysis is based on the German open-end mutual fund industry over the 1992-2010 period. We obtain fund opening dates, family membership, and investment category affiliation from a survivorship bias-free sample of the German Investment and Asset Management Association (BVI). BVI members represent approximately 99 percent of the German mutual fund industry's AuM. The dataset also includes information on net flows into and the total size (i.e., AuM) of individual funds. Fund returns come from Morningstar and Datastream. Since fund families are sometimes split up into legally but not economically independent investment companies (KAGs), we group these together. Our final sample consists of 76 fund families that could potentially open new funds in 12 investment objectives, or asset classes, which we include in our study: real estate, equity, fixed income, money market, hedge funds, fund of funds, capital protected funds, management objective funds, balanced funds, life cycle funds, hybrid funds, and other funds.

Zhao (2005) stresses the importance of differentiating between the opening of a new investment portfolio, and the issuance of another share class for an already existing portfolio. Since our analysis focuses on actual extensions of a product line, as opposed to minimal modifications of existing products, we restrict our analysis to new portfolio openings. As such, we define a fund opening as any new investment portfolio opened by a fund family in a given year. If Morningstar characterizes a fund as the oldest share class, we include the fund opening in our sample. Otherwise, we consider the opening to be another share class of an existing portfolio.

In our sample of real estate fund openings, we focus on retail funds. We exclude semi-institutional funds, which are primarily intended for institutional investors.[6]

3.3.2 The Sample of Real Estate Fund Openings

Figure 3.1 shows the total number of fund openings by investment objective across the sample period, as well as the total AuM of the respective investment objective at the end of the sample period. The average AuM by investment objective is illustrated by the size of the bubble (i.e., circle). Although real estate represents the fourth largest investment objective, it accounts for less than one out of 100 fund openings. At the same time, the average size of a real estate fund is considerably larger than the size of other investment objective funds. This supports the view of strong fund-level economies of scale for the real estate investment objective.

Table 3.1 shows the distribution of fund openings over the 1992-2010 period in each of the 12 investment objectives. The first column lists the number of funds in existence at the beginning of the sample period (297). A total of 2,127 funds are opened with substantial variation over time and investment objective. Thus, we observe that the German fund industry has experienced strong growth over the course

[6] We identify 12 semi-institutional fund openings in our sample. However, our findings are unchanged if we include these funds. The results are available upon request. At the same time, we argue that semi-institutional funds do not belong in our analysis. They are legally classified as retail funds, but the minimum investment begins at one million Euros. Consequently, semi-institutional funds do not fit the framework of our paper, where a fund family offers and manages a fund that is accessible to all investors.

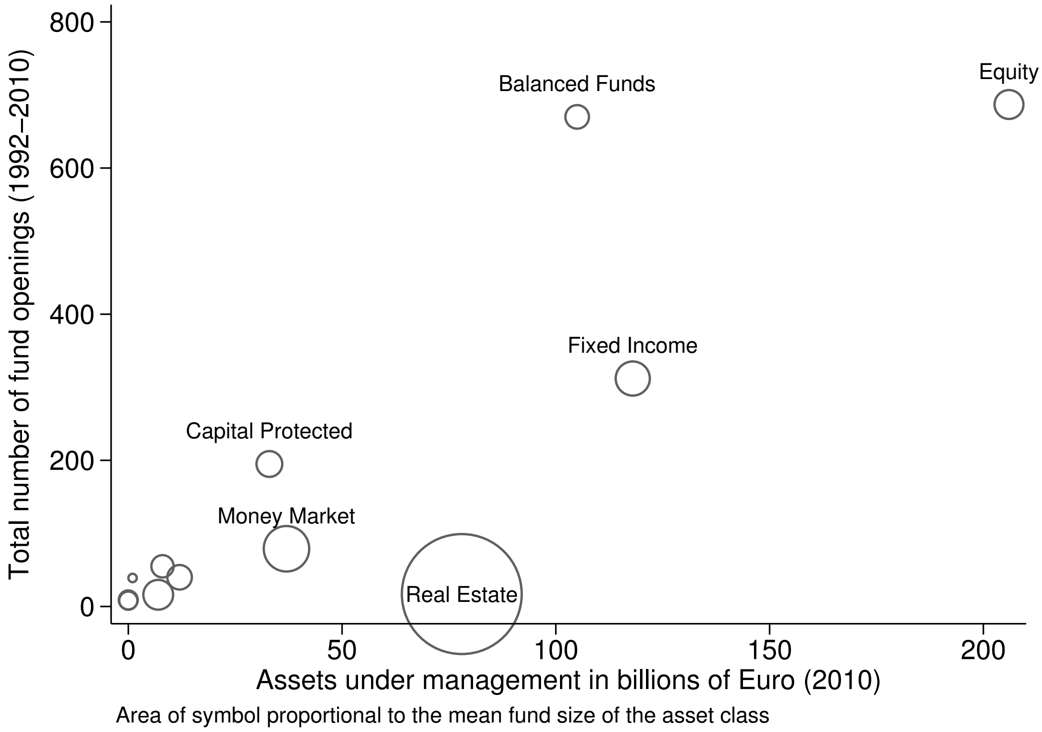


Figure 3.1: This figure shows the relation between the total number of fund openings between 1992 and 2010, and the size of the investment objective (AuM in billions Euros). The bubble, or circle, areas are proportional to the average fund size (AuM) within the respective investment objective.

of our sample period. The average number of new funds per year increased tenfold, from 26 in the first five years, to 256 in the last five years. Moreover, in 1992, the German mutual fund market was dominated by equity and fixed income funds; balanced, money market, and real estate funds played only a minor role. While most funds were opened in the equity investment objective (687), balanced funds (670) outgrew fixed income funds (312). And several new investment objectives emerged over the years, with capital protected funds (195) among the more significant groups. Combined fund openings in the remaining eight investment objectives account for 12.4% of all fund openings, with an average of 33 openings.

Most of the 17 real estate funds opened between 1997 and 2005. Almost all funds that opened prior to 2001 made use of a regulatory change that enabled German real estate funds to invest EU-wide without restrictions. Note that, prior to 1990, at least 80% of property portfolios were required to be invested in Germany. Since 2002, real

Table 3.1: Distribution of the sample of fund openings

	<1992	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Equity	111	4	8	14	11	16	35	20	49	39	49	36	15	15	45	51	40	109	80	51	687
Balanced	11	0	3	2	2	3	6	13	22	30	18	19	12	10	52	40	167	166	46	59	670
Fixed income	146	3	7	3	9	7	7	4	5	12	14	15	18	18	18	33	28	30	39	42	312
Capital protected	0	0	1	1	0	0	0	0	0	1	0	0	13	7	17	32	40	42	21	20	195
Money market	13	0	0	18	8	3	3	0	2	4	5	2	3	2	3	5	5	6	7	3	79
Management objective	0	0	0	0	0	0	0	0	0	1	0	2	4	6	2	5	19	10	0	6	55
Life cycle	0	0	0	0	0	0	0	0	0	0	0	5	0	0	4	8	22	0	0	0	39
Real estate	12	1	0	0	0	0	1	1	1	2	1	2	3	2	2	0	0	0	0	1	17
Hybrid	3	0	3	0	3	0	0	0	0	0	1	0	1	2	1	0	2	1	2	0	16
Fund of funds	0	0	0	0	0	0	0	0	0	3	5	1	0	0	0	0	0	0	0	0	9
Hedge funds	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	5	0	0	0	0	8
Other	1	0	0	1	0	0	0	0	0	0	0	1	1	0	2	1	1	11	2	20	40
Total	297	8	22	39	33	29	52	38	79	92	93	83	71	62	148	180	324	375	197	202	2127

This table shows the distribution of 2,127 new fund openings by investment objective and year over the 1992-2010 period. A new fund opening is defined as any new portfolio opened by a fund family in a given year. The issuance of another share class of an already existing portfolio is not considered a fund opening. The <1992 column contains the number of funds in our sample at the beginning of 1992.

estate funds have been permitted to invest globally, and nearly all new funds since then have done so.

This indicates that the real estate fund industry, like other investment objectives, is also subject to trends and fashions. Product heterogeneity is rather low. Each of the four largest fund families (industry leaders) has one European and one Global real estate fund. One family also has a third real estate fund with a German investment focus. We do not observe more than one real estate fund opening by the same family in a given year, which (intentionally or not) reduces cannibalization risks for existing real estate funds. Since 1992, seven fund families represented all the new entrants into the market. Nine fund families opened their second real estate fund, and one fund family opened its second and third real estate fund during the sample period.

3.3.3 Research Design and Variable Definitions

We examine fund openings from two distinct perspectives. First, we analyze the relation between fund openings and the subsequent (i.e., *ex post*) inflows of existing funds within the family objective. This allows us to understand whether, and to what extent, cannibalization exists for existing funds. The second set of tests analyzes the determinants of fund openings, or, more specifically, the marginal effects for real estate fund openings. Because cannibalization is so closely related to our liquidity hypothesis, the two approaches are complementary, and potentially offer important insights.

In our first approach, we propose a novel and direct test of cannibalization. Equation (1) is the base model. The dependent variable measures the net flows into the existing funds of family i within investment objective j during time period t. By subtracting net flows into newly opened funds from the total *family-objective inflow*, we ensure we are measuring cannibalization, and not the overall effect of fund openings. We also use total family-objective inflows as the dependent variable in order to quantify the overall effect of fund openings. For the purpose of our empirical tests, we estimate the following generalized least squares regression model, controlling for panel-specific autocorrelation:

$$\begin{aligned}\text{Family-objective inflow measure}_{ij,t} = \alpha_0 + \alpha_1 &\text{real estate}\\ + \beta_1 &\text{number of funds opened in the objective}_{ij,t-1}\\ + \beta_3 &\text{family-objective inflow}_{ij,t-1}\\ + \beta_4 &\text{family-objective excess return}_{ij,t-1}\\ + \beta_5 &\text{family size}_{i,t-1}\\ + \beta_6 &\text{family assets in objective (\%)}_{ij,t-1}\\ + \beta_7 &\text{total number of funds opened}_{i,t-1}\end{aligned} \tag{3.1}$$

The explanatory variables include our key variable of interest, the number of funds opened by the family in the respective investment objective (*number of funds opened in the objective*). We expand the base model with the interaction effects of a real estate indicator variable. This allows us to test whether a cannibalization effect exists, and whether it differs for real estate fund openings. To isolate the effect of fund openings on subsequent fund flows, we also control for variables internal to the fund, and, hence, within the fund family's information set. The lagged family-objective inflow controls for possible autocorrelation in the dependent variable. The literature on the flow-performance relationship documents that top-performing mutual funds attract above-average fund flows. Therefore, we include the lagged *family-objective excess return* as an explanatory variable, and we calculate it as the mean return of all funds of the family within the investment objective in excess of the mean return of all funds of the corresponding investment objective.

We also control for the total AuM of the fund family (*family size*), and the fraction of family assets invested in the corresponding investment objective (*family assets in objective (%)*). Finally, we include the total number of funds opened by the family in all investment objectives (*total number of funds opened*) in order to examine whether a cannibalization effect may arise from fund openings by the family in other investment objectives.[7] We observe family-objective inflows over the 1993-2010 period if a family

[7] We acknowledge that fund fees may also affect fund flows at the family-objective level. A limitation of our data is that information on fees is only available from 2005. As suggested by a referee, we performed an additional analysis where we also control for fees. We calculate a family's average total expense ratio in an investment objective in excess of the overall average in that investment objective.

had funds in existence in a given year and a given investment objective. All asset-based variables are in CPI-deflated constant 2010 Euros. We include year dummies to account for any time effects.

In our second set of tests, we use a probit regression model to analyze the determinants of real estate fund openings relative to all other investment objectives. The dependent variable is an indicator that measures whether or not fund family *i* opens a fund in objective *j* during time period *t*.

$$\begin{aligned}\text{Fund opening}_{ij,t} = {} & \alpha_0 + \alpha_1 \text{real estate} \\ & + \beta_1 \text{family-objective inflow}_{ij,t-1} \\ & + \beta_3 \text{family size}_{i,t-1} \\ & + \beta_5 \text{family assets in objective (\%)}_{ij,t-1} \\ & + \beta_7 \text{total number of funds opened}_{i,t-1} \\ & + \beta_9 \text{objective-family excess return}_{ij,t-1} \\ & + \text{control variables}\end{aligned} \tag{3.2}$$

The explanatory variables consist of internal measures contained in the fund family's information set. The control variables are aggregate industry-level variables. Only the explanatory variables (i.e., the internal measures and not the control variables) are interacted with the real estate indicator variable. The underlying rationale behind our approach is that we expect potential differences in the fund opening determinants between real estate and all other investment objectives to occur from family-specific characteristics such as the potential to compensate for cannibalization or the ability to reap economies of scale and scope. At the same time, we have no reason to believe that broad trends at the aggregate industry level affect the real estate fund opening probability differently than they would for all other investment objectives.

We use *family-objective inflow* as our liquidity proxy in order to test the liquidity hypothesis of real estate fund openings. This follows because high outflows from

As expected, we find that fees are negatively related to family-objective flows. Interestingly, the results on the other variables are qualitatively the same, so we do not include this incomplete variable here because it does not appear to bias our other findings. Similarly, we control for a family's Morningstar rating, which is also available from 2005. We found no significant impact on the dependent variable. After controlling for other variables, we find that a higher average Morningstar rating in an investment objective is not associated with additional inflows into the funds of the family in this investment objective.

existing funds may lead liquidation demand, while high inflows may lead investment demand. We have three proxies for economies of scale and scope in fund openings. First, *family size* captures scale and scope effects at the fund family level. Since it is well known that specialization can result in scale economies, we also include the *family assets in objective (%)* as a proxy for economies of scale and scope. The *total number of funds opened* in the prior year is included because the fund opening process itself may be subject to economies of scale and scope if fund families learn to innovate more efficiently. Our last variable internal to the fund family is the *family-objective excess return*, which we include to examine the relationship between fund openings and fund family performance.

Our choice of external control variables is guided by the mutual fund literature. Khorana and Servaes (1999) find that fund opening probability is positively related to the potential to generate additional fee income. This potential is captured by the total size (*objective size*), and by the aggregate inflows into the investment objective (*objective inflow*). Khorana and Servaes (1999) also find that more funds are opened in investment objectives that have performed well in the previous year, or where one of the industry leaders has opened a fund in that investment objective. Therefore, we include the variables *objective return*, which is the mean unadjusted return of all funds within the investment objective, and the indicator variable *large family opens*, which is equal to one if one of the four largest fund families opens a fund in the respective investment objective. This captures potential industry trends. All asset-based variables are in CPI-deflated constant 2010 Euros. We account for potential family fixed effects by clustering standard errors at the fund family level. In addition, year dummies are included to account for any time effects.

3.3.4 Comparing the Explanatory Variables for Real Estate with Other Investment Objectives

Table 3.2 contains the descriptive statistics and the distribution of the explanatory variables. We also divide the sample into real estate investment objective (second line), and all other investment objectives (third line). To obtain meaningful values, we calculate family-level statistics if the fund family has at least one fund in the corresponding

Table 3.2: Distribution of the explanatory variables

		Standard		Percentile		Autocorrelation	
	Mean	Deviation	5th	Median	95th	AR(1)	T-statistic
Family-objective inflow	0.05	0.99	-0.59	0.00	0.90	0.40***	25.48
Real estate objective	0.34	0.95	-0.95	0.16	1.97	0.38***	6.23
All other objectives	0.03	0.99	-0.55	0.00	0.63	0.40***	24.38
Family size (total assets)	17.47	33.59	0.15	2.64	108.80	1.02***	328.17
Real estate objective	27.43	38.70	0.47	6.72	113.30	1.02***	77.90
All other objectives	16.76	33.09	0.14	2.44	10.88	1.02***	318.49
Family assets in objective (%)	23.83	25.56	0.30	15.20	81.05	0.88***	113.31
Real estate objective	47.28	35.36	7.46	30.00	100.00	0.90***	32.05
All other objectives	22.14	23.84	0.27	14.27	74.47	0.87***	103.54
Total number of funds opened	4.06	7.89	0	1	18	0.80***	68.84
Real estate objective	4.02	8.44	0	1	20	0.82***	19.29
All other objectives	4.07	7.85	0	1	18	0.80***	66.04
Family-objective excess return	-0.10	5.35	-7.95	0.00	7.32	0.03*	1.71
Real estate objective	-0.02	3.32	-2.94	0.22	4.14	0.85***	8.19
All other objectives	-0.10	5.46	-8.07	0.00	7.69	0.02	1.27
Objective size(total assets)	41.68	55.85	0.10	9.84	156.89	0.98***	410.27
Real estate objective	60.37	25.03	16.19	61.10	93.99	0.88***	135.20
All other objectives	39.63	57.89	0.09	6.72	159.82	0.98***	387.04
Objective inflow	0.86	7.66	-10.91	0.03	11.55	0.44***	57.93
Real estate objective	4.19	5.84	-6.29	3.84	15.77	0.31***	12.16
All other objectives	0.49	7.75	-11.25	0.02	11.17	0.44***	54.18
Objective return (%)	3.60	10.66	-16.59	4.43	19.62	-0.00	-0.13
Real estate objective	4.68	2.53	-0.52	4.60	8.88	0.88***	36.22
All other objectives	3.48	11.20	-16.82	4.30	19.63	-0.00	-0.55
Large family opens	0.53	0.50	0	1	1	0.43***	58.03
Real estate objective	0.20	0.40	0	0	1	-0.27***	-10.51
All other objectives	0.57	0.50	0	1	1	0.45***	58.80

This table shows the distribution of the annual values of the explanatory variables over the 1991-2010 period. All asset-based variables are measured in CPI-deflated constant year 2010 billions of Euros. The statistics of the investment objective-level variables *objective inflow, objective size, objective return* and *large family opens* are calculated if the respective investment objective was in existence at that time. We calculate family-level variables *family-objective inflow, family-objective excess return, family assets in objective, family size*, and *total number of funds opened* if the family was invested in the respective investment objective. The second number shows the subsample statistics for the real estate investment objective. The third number shows the respective values for all other asset classes. Parameters marked with ***,**, and * are significant at the 1

investment objective. Investment objective-level statistics are calculated if at least one fund exists in the respective investment objective.

In line with the results of Warther (1995), we observe substantial autocorrelation in aggregate fund flows. This is evident for our liquidity measure, *family-objective inflow*, as well as for the aggregate investment objective (*objective inflow*). Annual flows into real estate funds, as well as other investment objectives, regularly fall into the negative range. For the real estate funds in our sample, we find outflow values at the fifth percentile of nearly one billion Euros. Given the high persistence in fund flows, this liquidity risk is likely to be a factor in the decision to open a new real estate fund. On the other hand, average inflows of 340 million Euros per year may compensate for potential cannibalization during normal times.

As might be expected, fund families that offer real estate funds are larger on average than families that do not offer real estate funds. Furthermore, real estate fund families are, generally, focused on the real estate investment objective. For example, if real estate funds are offered by a family, they make up an average of 47% of the family's total AuM. And some fund families are pure real estate specialists. We find no noticeable differences between the overall fund opening activity of families that offer real estate funds and those that do not: Both types average four new funds per year.

Note that the relatively low volatility of the average return of all real estate funds (*objective return*) is characteristic of real estate as an asset class. Interestingly, we observe strong evidence of persistence in the outperformance of fund families that offer real estate funds (*family-objective excess return*). The size of the real estate investment objective (*objective size*) is above average. However, in only 20% of the years does one of the four largest families in the sample open a real estate fund. This proportion is much higher (i.e., 50%) in the other investment objectives.

3.4 Results

3.4.1 Cannibalization

Table 3.3 contains the generalized least squares regression results of the ex-post effects of fund openings. It is important to note that, in models (i) and (ii), we examine the effect of fund openings by measuring inflows for all funds in the family objective. In contrast, in models (iii) and (iv), we only measure inflows for the funds in the family-objective that were in existence prior to the opening. This innovation allows us to directly control for the cannibalization effect of fund openings on existing funds (i.e., net of the inflows attributable to the newly opened fund). To this end, we thus adjust family-objective inflows by subtracting flows into new funds. Finally, we interact the number of funds opened with a real estate indicator variable in models (ii) and (iv) to determine whether the effects of fund openings are different for real estate.

The regression results of models (i) and (ii) show the overall effect of fund openings is positive and statistically significant. Based on model (i), each fund opening increases the net inflows of the family within the opened investment objective by an average of

Table 3.3: Fund openings and fund flows

	Family-objective inflow (All Funds)		Family-objective inflow (Only Existing Funds)	
	Model (i)	Model (ii)	Model (iii)	Model (iv)
Number of funds opened in the objective$_{t-1}$	0.074***	0.078***	0.031***	0.037***
	(8.66)	(9.03)	(4.20)	(4.90)
Number of funds opened in the objective$_{t-1} * re$	-	0.118	-	-0.475**
	-	(0.53)	-	(-2.43)
Family-objective inflow$_{t-1}$	0.368***	0.364***	0.259***	0.253***
	(22.85)	(22.60)	(18.34)	(18.00)
Family size (total assets)$_{t-1}$	0.004	-0.001	-0.019***	-0.025***
	(0.61)	(-0.14)	(-3.40)	(-4.46)
Family assets in objective (%)$_{t-1}$	-0.002***	-0.003***	-0.002***	-0.004***
	(-3.43)	(-4.75)	(-4.72)	(-6.15)
Total number of funds opened$_{t-1}$	-0.013***	-0.012***	-0.009***	-0.009***
	(-4.06)	(-4.08)	(-3.22)	(-3.16)
Family-objective excess return$_{t-1}$	0.004	0.004	0.003	0.003
	(1.46)	(1.50)	(1.43)	(1.44)
Real estate (re)	-	0.328***	-	0.440***
	-	(4.81)	-	(7.18)
Constant	0.102**	0.087	0.166***	0.139***
	(2.01)	(1.62)	(3.69)	(2.82)
Wald Chi^2	725.37	769.55	475.06	539.40
Prob >Chi^2	0.0000	0.0000	0.0000	0.0000
Observations	3580	3580	3580	3580

This table contains the generalized least squares (GLS) regression results for the ex-post effects of fund openings. The unit of observation is the fund family investment objective-year. The dependent variables in models (i) and (ii) are flows into all funds of the family in a given investment objective that year. This allows us to study the overall effect of fund openings. In models (iii) and (iv), flows into existing funds of the family exclude flows into funds opened the previous year. This allows us to isolate and study the cannibalization effect of fund openings. Explanatory variables are the number of funds opened by the family in the given investment objective, asset inflows into the investment objective within the family, average excess return of the funds of the family in the investment objective, total size of the fund family, fraction of all family assets invested in the investment objective, and total number of funds opened by the family in any investment objective. Models (ii) and (iv) control for real estate-specific differences in the effects of fund openings through the inclusion of a real estate indicator variable, and an interaction term of the real estate indicator variable with the number of funds opened by the family in the given investment objective. We estimate the model by controlling for panel-specific autocorrelation. All asset-based variables are in CPI-deflated 2010 constant Euros. T-statistics are in parentheses. Coefficients marked with ***,**, and * are significant at the 1%, 5%, and 10% levels, respectively. Wald Chi^2 is the Wald Chi-Square statistic, used to test the hypothesis that at least one of the predictors' regression coefficients is not equal to zero. Prob >Chi^2 is the probability of getting a Wald test statistic as extreme as the observed statistic under the null hypothesis that all the regression coefficients are equal to zero.

7.4 million Euros in the subsequent year. This overall effect holds for real estate fund openings as well, since the coefficient on the interaction term in model (ii) is not statistically different from zero. Because the number of funds opened also has a positive effect on flows into existing funds, we conclude that "own-product" cannibalization is not an issue.

However, in sharp contrast to the overall effect, we observe substantial cannibalization for real estate fund openings. The coefficient on the interaction term in model (iv) reveals that the marginal effect of real estate fund openings leads to an expected outflow of 475 million Euros from existing real estate funds of the family in the year following the opening.[8] In isolation, an outflow of this magnitude is likely to cause a liquidity crisis for most real estate funds. This suggests that fund families should account for liquidity risk from cannibalization prior to opening another real estate fund. The following analysis reveals under which circumstances this effect may be mitigated.

The strong autocorrelation in family-objective inflows documented in Table 3.2 is evident in Table 3.3, even after controlling for several other variables. The result also holds for family-objective flows into existing funds of the family, as seen in models (iii) and (iv). This has important implications for a potential compensation of the cannibalization effect. All else being equal, we expect the cannibalization effect of existing real estate funds to be compensated for when current family-objective inflows are approximately 1.6 standard deviations above average.[9] However, high outflows are also likely to persist, thus the liquidity risk would be increased further by opening another real estate fund.

[8] We thank an anonymous referee for drawing our attention to the possibility that a strong cannibalization effect may result from a limited number of real estate fund options. For example, consider a scenario where investors desire global real estate exposure, but the fund family only offers a fund with European property exposure. When the global fund is opened, investors could switch to the new fund. In a setting where more direct-property fund choices exist, of course, cannibalization may not be as extreme. While we acknowledge this concern, we believe that the small number of real estate fund choices itself is likely to be a result of the cannibalization risk. Figures 3.5 and 3.6 in the Appendix show that other countries with real estate fund industries also tend to be characterized by a small number of large real estate funds. This evidence suggests that the German case is representative, and the results are thus generalizable.

[9] This approximation is based on the following analysis: (0.34+x)*0.253=0.475. 0.34 is the average family-objective inflow for real estate, as stated in Table 3.2. x is the amount of above-average flows needed to compensate for the cannibalization effect. The cannibalization effect of 0.475 and the autocorrelation parameter 0.253 come from model (iv) in Table 3.3. x equals 1.54, which is 62% larger than the standard deviation of real estate family-objective inflows (0.95).

Although overall family-objective inflows are unaffected by the size of the fund family, we document a negative relationship between family size and the flow into existing funds. This result might be attributable to more fund openings by larger fund families, which may have stronger marketing campaigns, and can hence draw investor attention to new funds while neglecting existing funds. On the other hand, this effect could also reflect a natural rate of outflows from large and established fund families, which causes them to open new funds in order to maintain market share. We also find that outflows are higher for more specialized fund families.

The coefficient on the total number of funds opened by the family provides evidence of cross-cannibalization. Flows into a family's investment objective-specific funds are negatively affected by fund openings of the family in other objectives. This could again be attributable to increased marketing efforts for the new funds, while neglecting existing funds in other objectives.

In contrast to what we would expect from the flow performance literature, we find that excess performance does not result in higher inflows. The effect of performance on family-objective inflows is not statistically different from zero. Hence, fund families cannot expect higher inflows as a result of good performance, and performance may be a poor predictor of fund openings.

Overall, the results in Table 3.3 confirm certain advantages of fund openings. For example, they lead to an increase in fund flows into the family, which generally comes at little cost to existing fund flows. However, we find a substantial cannibalization effect for real estate fund openings. Thus, we posit that fund families should closely track the flow liquidity of their existing real estate funds when they are considering opening another real estate fund. The results in Table 3.3 also suggest that the cannibalization effect may be mitigated when current inflows are high.

3.4.2 The Determinants of Real Estate Fund Openings

Table 3.4 contains the regression results of several specifications concerning the determinants of fund openings. Each model consists of our fund family-specific proxies for liquidity, economies of scale and scope, and returns. The control variables are all comprised of information external to the fund family that aim to capture broader industry trends likely to affect fund opening probability. The specifications differ with respect to which real estate interaction terms are included.

Model (i) is our base specification, which models the fund opening probability in general, without emphasizing real estate-specific differences. In models (ii) to (vi), each explanatory variable that is internal to the fund family is interacted separately with a real estate indicator variable. Model (ii) tests our liquidity hypothesis of real estate fund openings through the interaction term between family-objective inflow and real estate. In models (iii) to (v), each of our three proxies for economies of scale and scope is interacted separately to test our scale and scope hypothesis of real estate fund openings. Model (vi) interacts real estate and family-objective excess return, our final measure that is internal to the fund family. This progression enables us to assess each real estate-specific effect individually. The conclusive empirical evidence of our study is based on model (vii), where all interaction terms are included simultaneously.

Because the interpretation of interaction terms in non-linear models is not straightforward, we follow the advice of Greene (2010), and conduct our hypothesis tests based on the statistical significance of the interaction term coefficient, while the economic implications are analyzed graphically. Figures 3.2, 3.3, and 3.4 contrast how the fund opening probabilities for real estate and all other investment objectives change when the explanatory variable of interest is varied over a range of representative values. All other explanatory variables are held constant at their respective subgroup means. The graphical analysis is based on the model (vii) results. The representative values range from 1) the 5th to 95th percentiles, to 2) two standard deviations below and above the mean for real estate fund variables, as reported in Table 3.2.

The regression results of model (i) in Table 3.4 indicate that fund openings are generally not driven by liquidity, as the coefficient on family-objective inflows is not statistically different from zero. This is consistent with the absence of a general cannibalization effect, and the fact that non-real estate funds have fewer problems liquidating portfolio positions in the event of high outflows.

In contrast, the coefficient on the interaction term between real estate and family-objective inflow in model (ii) is positive and significant. This effect becomes even more pronounced in model (vii), where the coefficient on the interaction term increases from 0.171 to 0.358.

Table 3.4: Determinants of new fund openings

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Liquidity							
Family-objective inflow$_{ij,t-1}$	0.046	0.044	0.053	0.052	0.052	0.052	0.044
	(1.32)	(1.21)	(1.49)	(1.48)	(1.48)	(1.48)	(1.20)
Family-objective inflow$_{ij,t-1} * re$	-	0.171*	-	-	-	-	0.358***
	-	(1.88)	-	-	-	-	(3.03)
Economies of Scale and Scope							
Family size (total assets)$_{i,t-1}$	0.110***	0.111***	0.114***	0.111***	0.112***	0.111***	0.113***
	(6.61)	(6.74)	(6.88)	(6.77)	(6.92)	(6.77)	(6.71)
Family size (total assets)$_{i,t-1} * re$	-	-	-0.053***	-	-	-	-0.064*
	-	-	(-2.91)	-	-	-	(-1.92)
Family assets in objective (%)$_{ij,t-1}$	0.014***	0.015***	0.014***	0.015***	0.014***	0.015***	0.015***
	(11.18)	(11.19)	(11.22)	(10.33)	(11.26)	(11.32)	(10.33)
Family assets in objective (%)$_{ij,t-1} * re$	-	-	-	-0.004	-	-	-0.007**
	-	-	-	(-1.43)	-	-	(-2.23)
Total number of funds opened$_{i,t-1}$	0.027**	0.027**	0.027**	0.026**	0.028**	0.027**	0.027**
	(2.12)	(2.12)	(2.11)	(2.09)	(2.18)	(2.12)	(2.13)
Total number of funds opened$_{i,t-1} * re$	-	-	-	-	-0.036***	-	-0.023
	-	-	-	-	(-3.25)	-	(-1.02)
Returns							
Family-objective excess return$_{ij,t-1}$	-0.007	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
	(-0.98)	(-0.97)	(-0.97)	(-0.97)	(-0.96)	(-0.90)	(-0.90)
Family-objective excess return$_{ij,t-1} * re$	-	-	-	-	-	-0.083	-0.101
	-	-	-	-	-	(-1.28)	(-1.38)
Control variables							
Objective size (total assets)$_{j,t-1}$	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(5.15)	(5.38)	(5.42)	(5.08)	(5.45)	(5.38)	(5.15)
Objective inflow$_{j,t-1}$	0.007***	0.007***	0.007***	0.008***	0.007***	0.008***	0.007***
	(3.40)	(3.64)	(3.65)	(3.67)	(3.64)	(3.65)	(3.61)
Objective return$_{j,t-1}$	0.002	0.002	0.002	0.002	0.003	0.002	0.003
	(1.07)	(1.40)	(1.39)	(1.41)	(1.44)	(1.44)	(1.44)
Large family opens$_{j,t-1}$	0.768***	0.670***	0.668***	0.665***	0.665***	0.669***	0.660***
	(14.51)	(11.97)	(12.05)	(11.95)	(12.03)	(12.00)	(11.78)
Real estate (re)	-	-0.711***	-0.545***	-0.553***	-0.537***	-0.662***	-0.416**
	-	(-4.69)	(-4.03)	(-3.44)	(-4.44)	(-5.16)	(-2.49)
Constant	-3.133***	-3.053***	-3.056***	-3.063***	-3.053***	-3.055***	-3.065***
	(-20.61)	(-19.26)	(-19.45)	(-19.51)	(-19.49)	(-19.33)	(-19.61)
Observations	17328	17328	17328	17328	17328	17328	17328
Pseudo R^2	0.274	0.281	0.281	0.281	0.281	0.281	0.283

This table contains the results of cross-sectional, time-series probit regression models of the probability of a new fund opening. The unit of observation is the fund family investment objective-year. The dependent variable takes the value of one if the fund family opened a fund in the given investment objective that year, and zero otherwise. Explanatory variables are asset inflows into the investment objective within the family, the size of the family, the fraction of all family assets invested in the investment objective, the number of funds opened by the family in the previous year, and the average excess return of the funds of the family in the investment objective. Control variables are total size, asset inflows into the investment objective, and return of the investment objective. An indicator variable is used for whether a large family opened a fund in the matched investment objective in the previous year, and year dummies (not reported). Models (ii) to (vii) control for real estate-specific differences through the inclusion of a real estate indicator variable, and additional interaction terms of the real estate indicator variable with the explanatory variables. Standard errors are clustered at the family level. All asset-based variables are in CPI-deflated 2010 constant Euros. Z-statistics are in parentheses. Coefficients marked with ***,**, and * are significant at the 1%, 5%, and 10% levels, respectively. We compute pseudo R^2 as 1 minus the log-likelihood ratio at convergence over the log-likelihood ratio at zero.

Figure 3.2 shows two curves. One is the predicted probability of a new fund opening for real estate as a function of family-objective inflows; the second is for all other asset classes. When the existing real estate funds of the family experience high outflows, the real estate fund opening probability converges to zero. This is intuitive, given that the liquidity risk of existing real estate funds is already above average due to the persistence in outflows, and it would only further increase through the cannibalization effect of a new real estate fund opening.

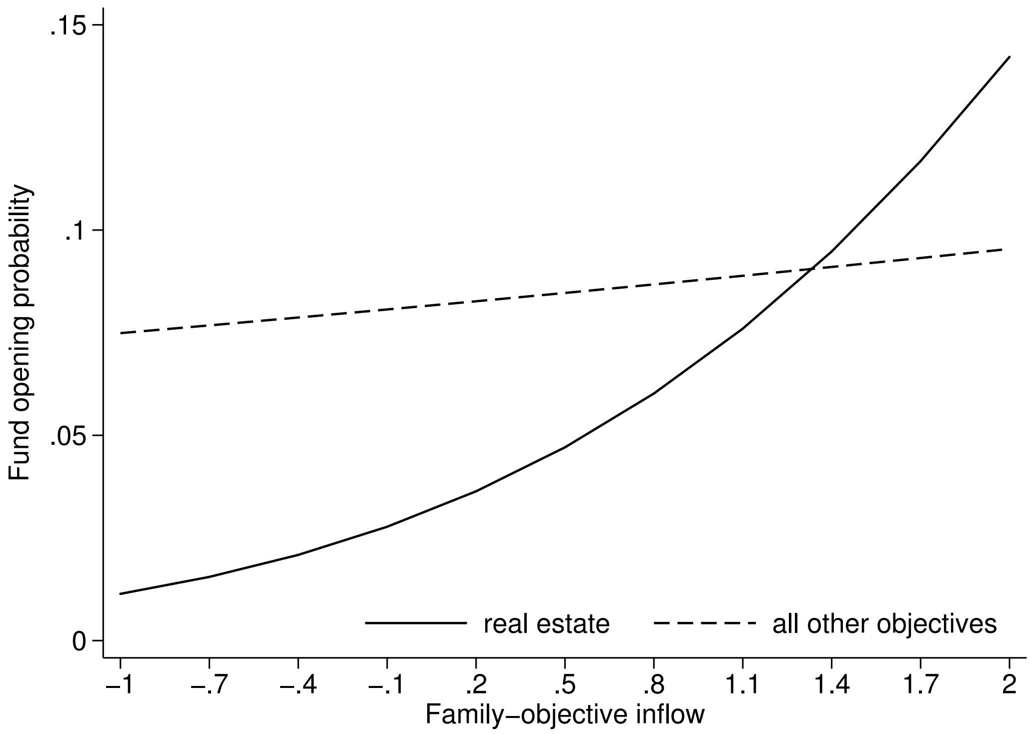


Figure 3.2: This figure compares how fund opening probabilities react to changes in the liquidity measure *family-objective inflow*. *Family-objective inflow* is measured in billions of Euros, and is varied over the range of representative values for fund families with existing real estate funds. The other explanatory variables are fixed at their respective subgroup means, as reported in Table 3.2.

In contrast, the fund opening probability in all other investment objectives shows almost no reaction to outflows of the same magnitude. If outflows are a barrier to real estate fund openings, high inflows can be viewed as a necessary (although not sufficient) condition for real estate fund openings because they attenuate the cannibalization effect. In fact, the real estate fund opening probability surpasses that of fund openings in other investment objectives during times of high inflows. Consequently, we find evidence in support of the liquidity hypothesis of real estate fund openings.

Next, we examine fund opening probability and economies of scale and scope. The positive and statistically significant coefficient for family size in model (i) implies fund opening probability is positively related to fund family size. This is consistent with the theory that large fund families reap economies of scale and scope by opening more funds. However, this effect is significantly less pronounced for real estate fund openings, as indicated by the negative sign of the coefficient on the interaction term between real estate and family size in models (iii) and (vii). Nevertheless, real estate fund opening probability increases with fund family size. While a one-standard deviation increase in family size raises the probability in all other investment objectives by 6.9%, real estate fund openings become only 1.9% more likely.

Figure 3.3 illustrates the comparative insensitivity of the real estate fund opening probability to our proxy for economies of scale and scope. This finding is consistent with the hypothesis that fund families do not reap economies of scale and scope by opening more real estate funds, and they thus have incentives to allow existing real estate funds to grow large.

Specialization is another well-known source of scale economies. In general, fund families tend to specialize their products when opening new funds. This is evident in model (i) by the positive coefficient on the fraction of family assets invested in an investment objective (%). This may be attributable to the fact that the performance-related advantages of fund openings, as outlined in Section 3.2, are most likely to be achieved when new fund openings are concentrated in one investment objective. The coefficient on the interaction term between family assets invested in an investment objective (%) and real estate is negative, although insignificant in model (iv). However, after controlling for further real estate-specific effects in model (vii), the relation is significant, with a t-statistic of -2.23. Note this does not mean fund families do not specialize in real estate. It merely suggests that real estate fund openings are a comparatively weak tool to achieve specialization gains.

For example, as we have noted, the strategy of opening new funds in order to generate a higher likelihood of a star performer is risky in the case of real estate because of cannibalization risk and high transaction costs. Therefore, fund families that open

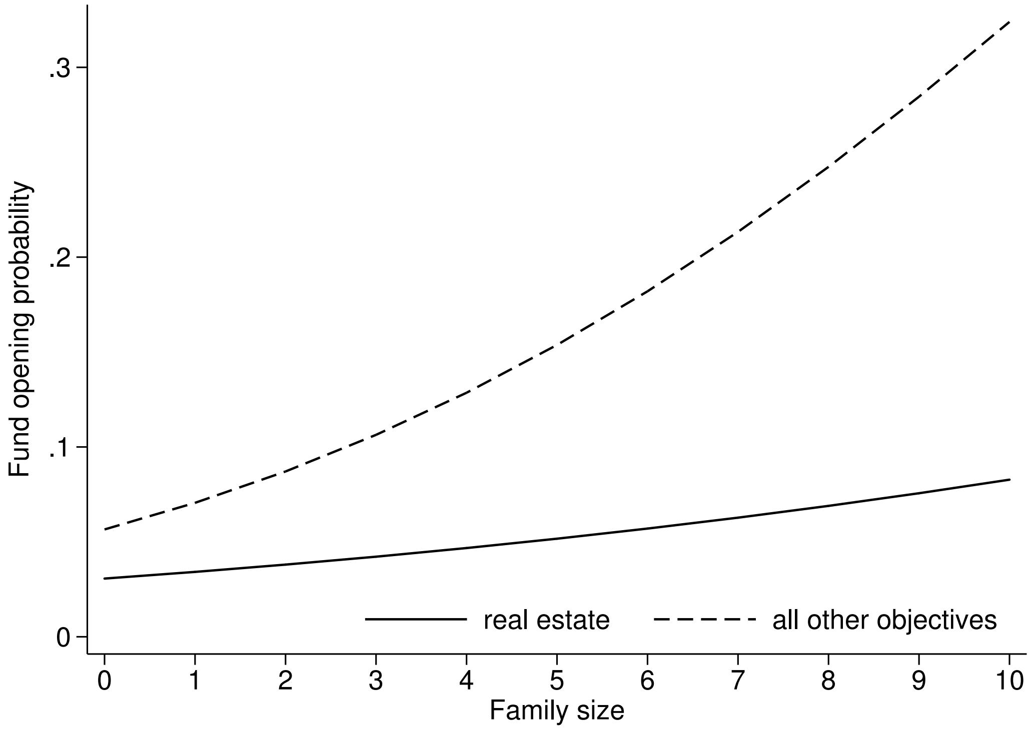


Figure 3.3: This figure compares how fund opening probabilities react to changes in the economies of scale and scope measure *family size*. *Family size* is measured in 10 billion Euros, and is varied over the range of representative values for fund families with existing real estate funds. The other explanatory variables are fixed at their respective subgroup means, as reported in Table 3.2.

a new real estate fund may be more interested in the extension of their product line than in other considerations. Figure 3.4 illustrates this relationship graphically.

The number of funds opened in the prior year is our third proxy for economies of scale and scope in fund openings. A positive relationship would indicate scale and scope economies in the process of launching new funds. The coefficient on the number of funds opened is positive and statistically significant in model (i). This suggests that fund families with more experience in opening new funds are in a better position to transfer that knowledge and the associated efficiencies to additional fund openings.

However, scale and scope economies in the fund opening process do not seem to be transferable or applicable to real estate. We observe that the main effect in model (i) is not only reduced for real estate, it is neutralized. The interaction or marginal effect is significantly negative in model (v). But a joint test of the linear combination

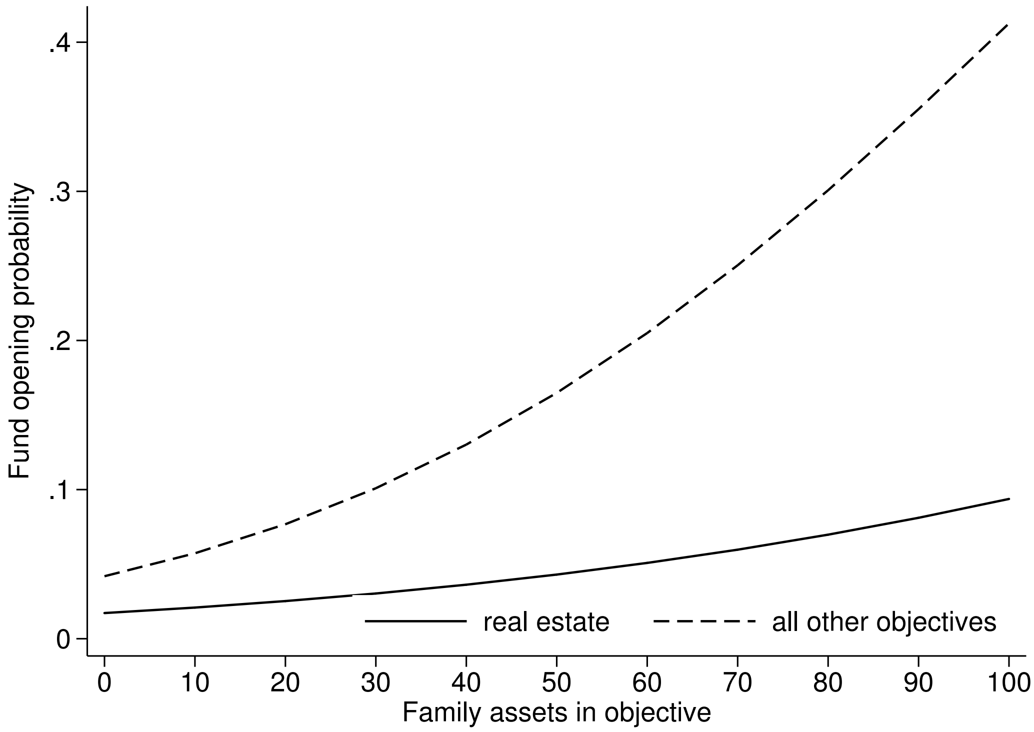


Figure 3.4: This figure compares how fund opening probabilities react to changes in the economies of scale and scope measure *family assets in objective*. *Family assets in objective* is measured in (%), and is varied over the range of representative values for fund families with existing real estate funds. The other explanatory variables are fixed at their respective subgroup means, as reported in Table 3.2.

of funds opened and the interaction term with real estate in model (vii) reveals that the effect of the number of funds opened on the real estate fund opening probability is not statistically different from zero.[10] This result provides further evidence that scale and scope economies are not a driver of real estate fund openings. One explanation is that the process of launching a real estate fund has little in common with the opening of a fund that invests in other assets.

We next analyze the relationship between fund opening probability and the performance of existing funds within a family's investment objective. A negative relationship would support the "window-dressing" argument of fund openings. Our results show no significance for the family-objective excess return in model (i), and no statistically significant difference for real estate in models (vi) and (vii). Thus, we find no evidence

[10] Family size and the number of funds opened are highly correlated (p=0.61), so we suspect these variables mask each other. This is likely the reason why the interaction effect of the number of funds opened becomes insignificant in model (vii).

that fund families try to window dress the poor performance of existing funds by opening new funds.

The results on the investment objective-level control variables are robust across all models. We find that fund opening probability is positively related with aggregate flows into and the size of the investment objective. Both variables capture the potential to generate fee income in the market, so this result supports the view that maximizing fee income is an important motive for fund openings. We find no significant relationship between the prior returns of an investment objective and the respective fund opening probability in that investment objective. Thus, fund families do not appear to chase returns in their decision to open a new fund, but they do follow industry leaders. The fund opening probability significantly increases if one of the four largest fund families in our sample opens a fund in that investment objective.

In additional robustness tests, we investigate whether real estate fund openings are driven by a family's return forecasts. We use an event study setting, and find that real estate fund openings tend to occur as the average return of existing real estate funds increases relative to the risk-free rate. We observe a 1.5-percentage point increase in the excess return of real estate funds in the months prior to a fund opening. This suggests that fund families tend to open new real estate funds in environments where real estate returns have become increasingly attractive. However, this effect is not statistically significant in our econometric framework.[11]

As a final caveat, our findings are predicated on the generalizability of results obtained from historical data for the German mutual fund industry. Due to the small number of real estate fund openings, this may not be the ideal setting in which to study the determinants of fund openings and, in general, cannibalization effects. We acknowledge this potential concern, nonetheless we believe Germany is the best setting in which to study these issues in a real estate context.

Of course, one must always be careful when generalizing results across borders. This is particularly true in a setting with a relatively small number of real estate fund openings. However, the global overview of real estate fund markets in the Appendix confirms Germany's status as a leader in this industry, with the largest and most de-

[11] These untabulated results are available from the authors upon request.

veloped market for open-end, direct-property real estate funds available to retail (individual) investors.

As Figure 3.6 in the Appendix shows, the large size and small number of real estate funds compared to other fund types is the rule rather than the exception on a global scale. Thus, the cannibalization of fund flows due to new openings increases the liquidity risk for all types of real estate investment vehicles with an open-end structure. Likewise, and given the fact that there are virtually no differences between global mutual fund industries, the absence of a cannibalization effect in all other investment objectives seems intuitive and anecdotally obvious.

A similar argument can be made for closed-end real estate funds. Liquidity, in the form of high capital inflows, mitigates the cannibalization effect, and would seem to increase the probability of achieving minimum subscription amounts. Independent of real estate investment vehicle type, direct-property portfolios benefit from economies of scale and scope. This, of course, gives fund families an incentive to let existing funds grow large before new real estate funds are opened. Furthermore, fund families that offer investment products in diverse asset classes are less likely to benefit from economies of scope through real estate fund openings. This is most likely not the case for fund openings within and across the classical asset classes or investment objectives (i.e., stocks, bonds, and money market).

3.5 Conclusion

This paper examines fund flow cannibalization and the determinants of fund openings, with an emphasis on real estate. Drawing on a unique dataset and institutional detail of the German mutual fund industry over the 1992-2010 period, we analyze 2,127 fund openings within 12 investment objectives for 76 fund families.

The decision to open a new fund is essentially a cost-benefit trade-off for managers. Our results indicate that this trade-off generally favors new openings for funds that invest in liquid asset classes. We find that fund flow cannibalization is not an issue for these funds. At the same time, we find evidence of economies of scale and scope through fund openings. Thus, fund openings are a relatively low-risk, high-reward strategy that appeals to fund families seeking to capitalize on the advantages they can offer. Our results are consistent with Khorana and Servaes (2012), who find that fund openings lead to higher market share. We also show that fund openings lead to increased fund flows, which is beneficial for the AuM and fee income of fund families.

Our main contribution comes from examining the contrasts evident in real estate fund openings. Here, we find new openings are significantly less beneficial to fund families. We document a substantial cannibalization effect, which is of even greater concern (i.e., potentially costly) due to the illiquid nature of real estate as an underlying assets. Our results illustrate that high liquidity (i.e., high inflows into existing real estate funds) is the key factor in overcoming the cannibalization barrier. Furthermore, we find that real estate fund openings are not sensitive to our proxies for family-level economies of scale and scope. This result is consistent with strong fund-level economies of scale that provide the incentive to let existing real estate funds grow large. Together with the cannibalization result, the lack of scale and scope economies implies that opening a new real estate fund can be a high-risk, low-reward strategy for fund families.

We conclude by reminding readers that the real estate funds we examine are not perfect. We caution readers – whether academics, fund families, investors, or regulators – to remember there is "no free lunch: diversification and lower volatility through an investment in private real estate comes at the price of less liquidity" (Esrig et al., 2013).

At the same time, the benefits and appeal of real estate funds are recognized globally. During the period following our sample construction, Morningstar reported 48 newly opened real estate funds with the global category used for our study – i.e., "property-direct." And as recently reported in France, "retail open-end real estate funds are finally taking off."[12]

Our paper does not specifically address the risk-return characteristics of direct-property investment, or the benefits of real estate-related diversification in a multi-asset portfolio. Recent and global evidence on that topic is easily accessible elsewhere: See MacKinnon and Al Zaman (2009) and Rehring (2012) for examples.

[12] See http://www.pie-mag.com/articles/6523/french-retail-opci-funds-finally-take-off-in-2012/. For clarification, we point out that the term "retail" in this article title refers to "the general public" (e.g., individual or retail investors), as opposed to the retail property type.

On the other hand, our research contributes to the literature by examining the factors and trade-offs associated with the launch of new funds, specifically, those devoted to an underlying asset that is inherently illiquid in an open-end format that preserves the risk-return characteristics of a direct-property investment. The continued evolution of this investment vehicle as a form of financial intermediation, and the industrial organization of the markets in which new funds are formed, is a topic of ongoing interest in the U.S. and abroad.[13]

[13] See Esrig, Kolasa, and Cerreta (2013) for a discussion of how defined contribution retirement planning – obviously, a changing landscape – may benefit from open-end, direct-property funds.

3.A Appendix

The German mutual fund industry shares many similarities with mutual fund industries around the world. As Khorana et al. (2005) state, "There is a recognizable mutual fund 'style' of intermediation in most countries, characterized by a transparent investment vehicle whose underlying assets are identifiable with the value of the fund marked-to-market on a regular (usually daily) basis and reflected in the NAV of the fund with new shares created or redeemed upon demand."

A mutual fund of the type described above is an open-end investment company.[14] Bodie et al. (2011) define investment companies as "financial intermediaries that collect funds from individual investors and invest those funds in a potentially wide range of securities or *other assets*." We add the emphasis on "other assets" (i.e., not securities), as our study focuses on open-end funds where the underlying investments are real assets (i.e., private market properties).

The underlying assets of German real estate funds – and their counterparts around the world – are direct-property investments along with cash or other liquid securities.[15] Note, for example, that the top five holdings of the German fund *Grundbesitz Global* are all office properties – the largest one is in China, two are in the U.K., and two are in the U.S. The fact that open-end, direct-property mutual funds are available to retail investors through the German mutual fund industry is a key point of differentiation with the U.S. experience. In 2010, Morningstar reported 174 open-end funds in the global category "property-direct." None of these funds was U.S.-domiciled.

Figure 3.5 shows the number of funds and total net assets for open-end, direct-property funds available to retail investors across countries with significant real estate fund markets. For the U.S., where there is no comparable market for retail investors, we use institutional open-end real estate funds reported by NCREIF to illustrate the point. Although the institutional details of open-end, direct-property funds for retail

[14] The term "mutual fund" is common nomenclature for an investment company that pools assets to be invested by a fund manager. In contrast to hedge funds or private equity funds, which are less regulated because they are typically structured as private partnerships, mutual funds are sold to the general public.

[15] The first description of the German version of this investment vehicle published in a U.S.-based real estate journal is Focke (2006).

investors vary somewhat across countries, Germany is the world leader, with 102.4 billion USD in assets, and a total of 28 funds.

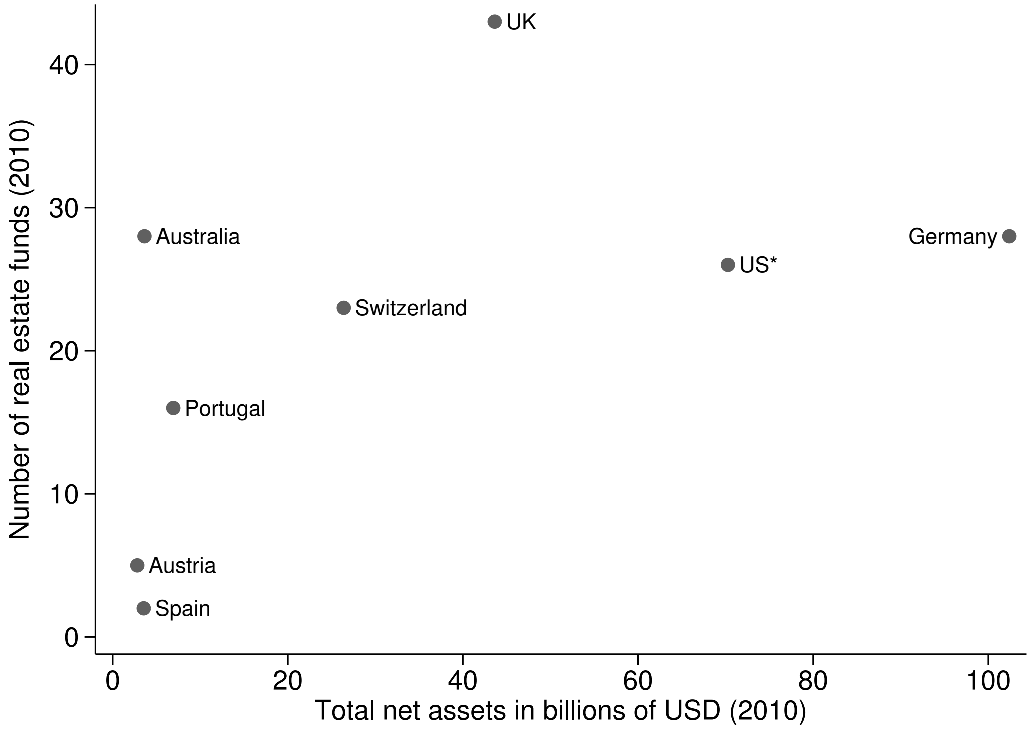


Figure 3.5: This figure shows the number of open-end real estate funds and the total net asset value of all real estate funds in a given country in billions of USD for 2010. The figure includes countries with open-end real estate fund industries in excess of one billion USD. We identified the countries by filtering open-end funds in Morningstar with the global category "property-direct" (*For the U.S., we considered commingled real estate funds that are included in the NFI-OE (NCREIF Fund Index - Open End Equity). Data on the four largest markets are carefully supplemented with country-specific data. Data on German open-end real estate funds (offene Publikumsfonds) are based on the BVI Investmentstatistik. Data on U.K. open-end property unit trusts that are accessible to retail investors are obtained from the AREF/IPD Property Fund Vision Handbook. For Switzerland, we consider all Swiss real estate funds.

Given the relative illiquidity of real estate as an underlying asset, the issues of pricing, fund-level liquidity, and fees are of particular interest in an open-end fund format. German real estate funds report NAV daily, based on the market value of cash and liquid securities, as well as on appraisal-based property value. Properties are valued by independent appraisers annually or more frequently, based on a staggered schedule. Consequently, a real estate fund's entire portfolio is revalued on at least an annual basis. The NAV-based pricing scheme results in a risk-return profile that is comparable to the NCREIF private real estate indices.

Several mechanisms aim to support fund-level liquidity. These include high cash reserves. The regulated minimum cash reserve for German real estate funds is 5%; the average is approximately 30%, which is considerably higher than the cash holdings of equity and other investment objective funds. The fee structure also helps to mitigate fund-level liquidity shocks. Front-end loads of 5% are remarkably consistent across German real estate funds and across time. Average total expense ratios (TERs) for German real estate funds in 2010 were 0.97%, compared to 1.44% for other investment objectives within the German mutual fund industry.

Surprisingly, back-end loads are not assessed on German real estate funds. While the front-end load might dissuade short-term trading, it is not a deterrent to fund-level liquidity shocks due to redemptions. In July 2013, two years after the end of our sample period, the legislature introduced additional mechanisms to support fund-level liquidity. These measures include minimum holding periods of 24 months, as well as a 12-month announcement period for the redemption of shares.

Fund-level liquidity may also benefit from the size of German open-end, direct property funds. Figure 3.6 illustrates one of our stylized facts: Real estate funds (specifically, the open-end, direct property funds that are the subject of this analysis) are on average larger than funds dedicated to other investment objectives.

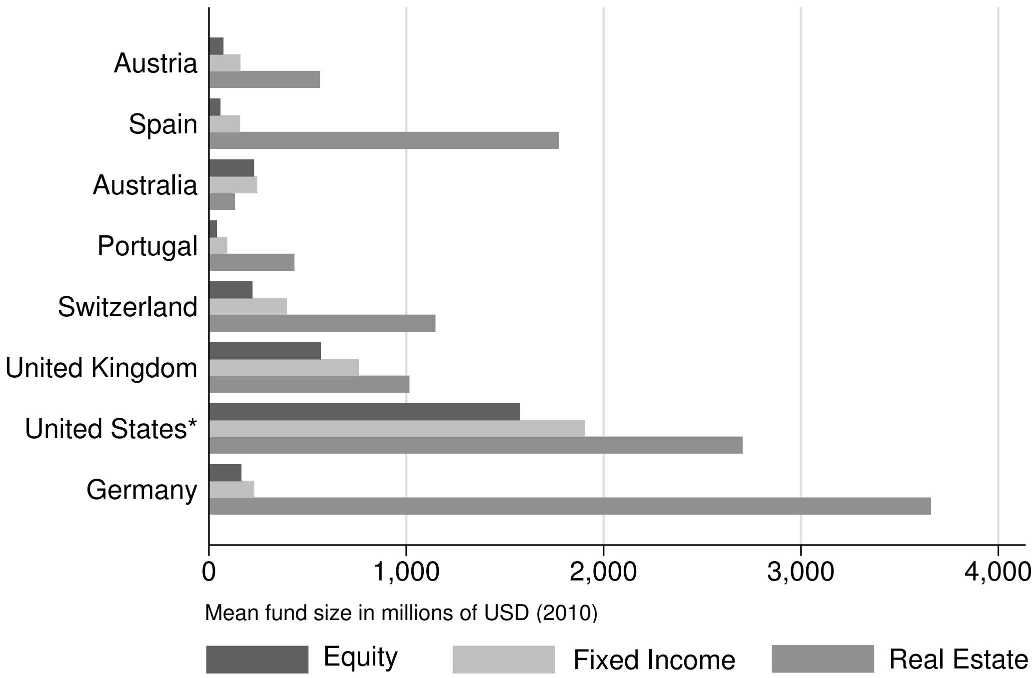


Figure 3.6: This figure compares the mean fund size of real estate, fixed income, and equity funds in millions of USD for 2010. The figure includes countries with open-end real estate fund industries in excess of one billion USD. The countries are ordered, top to bottom, based on total NAV, as shown in Figure 3.5. We identified the countries by filtering open-end funds in Morningstar with the global category "property-direct" (*For the U.S., we considered commingled real estate funds that are included in the NFI-OE (NCREIF Fund Index - Open End Equity). Data on the four largest markets are carefully supplemented with country-specific data. Data on German open-end real estate funds (offene Publikumsfonds) are based on the BVI Investmentstatistik. Data on U.K. open-end property unit trusts that are accessible to retail investors are obtained from the AREF/IPD Property Fund Vision Handbook. For Switzerland, we consider all Swiss real estate funds.

Chapter 4

Capturing the Value Premium – Global Evidence from a Fair Value-Based Investment Strategy

This paper is the result of a joint project with *Christian Weis*. We are grateful to *Steffen Sebastian* and *Felix Schindler* for valuable comments.

Abstract

This paper examines the risk premium of value stocks within a global investment strategy framework. We test whether absolute or relative mispricing is better suited to capture the global value premium by using fair value-based net asset values (NAVs) as our proxies for fundamental value. We find that investing in the most underpriced stocks relative to the average ratio of price to fundamental value in a country is the key to achieving superior risk-adjusted returns. The annualized excess return of the global value portfolio sorted according to relative mispricing is 8.0%, and remains significant after controlling for common risk factors.

4.1 Introduction

Numerous studies show that value stocks (those with a low ratio of price to fundamental value) on average outperform growth stocks, both for the U.S. (Rosenberg et al., 1985; Fama and French, 1992) and international stock markets (Fama and French, 2012; Asness et al., 2013). The literature exhibits some discrepancies regarding how to interpret the value premium. Proponents of the efficient market hypothesis argue it is compensation for higher risk (e.g. Davis et al., 2000), while others attribute the return anomaly to suboptimal investor behavior (e.g. Lakonishok et al., 1994; De Bondt and Thaler, 1985). However, the commonality among these studies is that they separate value and growth stocks according to their book-to-market ratios of equity. Thus, whether explicitly or implicitly, the book value of equity is used as the proxy for a firm's fundamental or intrinsic value.

Most academics agree that a firm's intrinsic value is determined primarily by the present value of its future cash flows, which is not necessarily reflected by balance sheet data. Therefore, if viewed as a rather poor proxy for mispricing, the robust outperformance of stocks with high book-to-market ratios of equity appears somewhat surprising. It also raises the question of how returns are distributed when a more reliable proxy for intrinsic value is used. For example, Lee et al. (1999) use a residual income valuation approach to determine the intrinsic value of the Dow Jones Industrial Average, and find it has much higher explanatory power than the aggregate book-to-market ratio. This study focuses on a sample of stocks for which we believe the book value of equity is actually a good proxy for intrinsic value: property holding companies in countries with fair value-based accounting regimes.

The introduction of the International Financial Reporting Standards (IFRS) led to a paradigm change in many countries. In general, IFRS increased the comparability of accounting data across countries, thus reducing investors' information costs Ball (2006). In contrast to historical cost-based accounting regimes, IFRS accounting emphasizes reporting assets at their fair value. In the case of property holding companies, whose cash flows are heavily dependent on the rental income of their properties, the assets consist primarily of regularly appraised property values. Presuming that other assets and liabilities are also reported close to market value, the book value of equity (or the net asset value (NAV)) of property holding companies can be seen as a sum of the parts valuation of the company whereby each property is appraised using property-specific risk-adjusted discount rates. This provides a unique setting to study discrepancies between market prices and estimates of intrinsic value across countries. Overall, our sample consists of 255 listed property holding companies in 11 countries over the 2005-2014 period.

Our objective is 1) to examine the relationship between price and value at an individual country level using NAV as the proxy for intrinsic value, and, more importantly, 2) to explore whether mispricings across countries can be exploited to generate risk-adjusted excess returns by investing in a globally diversified value portfolio. The underlying rationale is that NAV deviations are temporary, and mean reversion will ultimately cause prices to return to their intrinsic values. Another potential source of diversification may arise from less than perfect cross-country correlations of the risk factors that can cause NAV discrepancies across countries.

Our empirical approach is based on a monthly trading strategy. At the end of each month, we rank all stocks according to their deviations from intrinsic value, as measured by the NAV spread. We then form three portfolios whose returns are observed over the following month, with the focus being on the value portfolio, which is defined as the quintile of stocks with the highest discount to NAV.

We examine value investment strategies at both an individual country level and a global level. At the global level, we compare two approaches. First, we follow the country-level approach and form portfolios according to their absolute discounts to NAV. However, one drawback with this approach is that the global value portfolio may be overly exposed to country risk. Thus, if an entire country is trading at depressed levels relative to other countries, the global value portfolio may even include growth stocks of the discount country, which would nullify any potential diversification gains from within-country mean reversion.

Second, we control for such country effects by sorting stocks according to their relative NAV discounts (e.g., with respect to a country's average NAV discount in a given month). A comparison of both approaches enables us to determine whether absolute or relative deviations from NAV are better suited to exploit security mispricings across countries. To this end, after portfolio formation, we first compare the risk-return characteristics based on absolute returns before using time series regressions to evaluate risk-adjusted performance. In additional tests, we examine the cross-section of returns, and test whether absolute or relative NAV discounts are better predictors of future returns.

We find that value portfolios strongly outperform their benchmarks in most countries, but they are also more risky, as indicated by higher return volatility, higher loadings with respect to systematic risk factors, and significant risk-adjusted returns in only two out of eleven countries. The results improve considerably at a global level, especially when country-specific effects are taken into account (i.e., when the portfolios are sorted according to relative NAV spreads). The annualized excess return of the global value portfolio is 8.0%, based on country-adjusted NAV discounts, and it is 6.5% based on absolute NAV discounts. At the same time, the value portfolio, which is based on country-adjusted NAVs, is also less risky by all measures, and it produces significant risk-adjusted returns. Overall, our findings suggest that relative mispricing is better suited to capture the global value premium, at least in the short term.

The remainder of this paper is organized as follows. Section 4.2 reviews the related literature, and introduces our hypotheses. The methodology, data, and descriptive statistics are described in section 4.3. Section 4.4 provides the empirical results, and section 4.5 concludes.

4.2 Related Literature and Hypotheses

4.2.1 Value Stocks and Risk

The literature has long been dominated by the view that financial markets are efficient, or, in other words, that price equals intrinsic value at all times. Early academic opponents of this view include Shiller (1981), who finds that stock price volatility appears to be too high to reflect changes in fundamental information; Shiller et al. (1984), who argue that stock prices are subject to fads and fashions that can result in overreactions to new financial information; De Bondt and Thaler (1985), who provide empirical evidence for the overreaction hypothesis by documenting how portfolios of past losers outperform past winners; and Rosenberg et al. (1985), who find that stocks with high book-to-market ratios of equity have higher returns than those with low ratios. Because these return patterns cannot be described by the capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965), they are referred to as return anomalies.

Fama and French (1992) address these shortcomings by extending the CAPM by two further factors: size and book-to-market. They find that the three-factor model is better at explaining stock returns. Assuming that assets are priced rationally, the authors argue that the book-to-market factor is a proxy for undiversifiable risk. However, this view has been criticized by Daniel and Titman (2006), for example, who argue that the Fama-French model "is designed to explain the book-to-market effect." Ferson et al. (1999) make a similar argument, and caution that empirical regularities will appear to be useful risk factors even when their attributes are "completely unrelated to risk."

Proponents of behavioral finance argue that value strategies produce higher returns not because they are fundamentally riskier, but because they exploit suboptimal investor behavior. For example, the extrapolation theory, which goes back to Lakonishok et al. (1994). The authors posit that some investors naively extrapolate past trends into the future, thereby bidding up (down) prices to irrationally high (low) levels, which provides an opportunity for contrarian investors to earn excess returns.

On the other hand, a number of studies provide evidence in favor of the theory that the value premium is a compensation for higher fundamental risk. For example, Fama and French (1995) find that firms with a high book-to-market ratio have higher leverage ratios and tend to be distressed relative to growth stocks.

Another strand of the literature tries to explain the value premium by the conditional CAPM, which uses time-varying betas. Petkova and Zhang (2005) find that time-varying risk is indeed better suited to explain the value premium. But the authors concede that the value premium is still too large to be fully explained by the conditional CAPM.

Choi (2013) also uses a time-varying beta approach, and finds further evidence for the risk-based explanation of the value premium. He documents that the asset risk and financial leverage of value stocks are particularly likely to increase during economic downturns. However, his model leaves approximately 60% of the unconditional value premium unexplained.

Overall, the literature tends to agree that value stocks are somewhat fundamentally riskier than growth stocks. But the value premium appears too large to be explained solely as compensation for additional risk, which gives some credence to mispricing theories.

The aforementioned studies are generally based on common stocks, and, in many cases, property holding companies or REITs were deliberately excluded (e.g. Fama and French, 1992). Ooi et al. (2007) examine the value premium by using U.S. REIT data, and find that the quintile of value REITs outperforms the quintile of growth REITs by 8.5% p.a. The authors also find support for the extrapolation theory of Lakonishok et al. (1994), because value REITs exhibit poorer returns prior to portfolio formation, but their subsequent performance tends to be better than anticipated. This results in positive earnings surprises and higher returns. We exclude U.S. REITs here, however, because their book values are based on historical costs and not on fair values, due to U.S. GAAP accounting regulations. To the best of our knowledge, our study is the first to address the value premium in the context of fair value accounting.

The interpretation of the value premium in the context of fair value accounting is somewhat ambivalent. On the one hand, it seems straightforward to interpret price deviations from NAV as mispricings, because the NAV is supposed to be a relatively reliable proxy for intrinsic value. On the other hand, if reliable information about intrinsic value is easily available to all investors, then it seems counterintuitive that prices would depart from NAV, unless the discount was related to some risk factor.

For example, investors may not trust reported appraisal values, or they may anticipate devaluations. This could hence lead to a lower NAV when the next financial report is published. Moreover, the fact that property holding companies tend to be highly leveraged would amplify the impact of property devaluations on NAVs, potentially justifying large discounts before publication of the next report. Brounen and Laak (2005) find empirical support for such risk-based explanations of NAV discounts. In their sample of European property holding companies from 2002, a large discount to NAV is positively related to firm-specific risk factors such as high leverage or a lack of transparency.

In summary, if the book-to-market ratio is seen as a proxy for mispricing, there are good reasons to anticipate that value investment strategies will work even better when the proxy for intrinsic value is more reliable (as with the NAV of property holding companies under fair value-based accounting regimes). However, precisely because the NAV is supposed to be a relatively reliable proxy for intrinsic value which is also publicly available to all investors, deviations from intrinsic value may be explained only by risk factors that do not appear on a firm's balance sheet, such as anticipated financial distress. For example, the market may use higher discount rates on the firm's expected cash flows than property appraisers – a scenario that seems particularly likely during periods of market distress, when the price of risk is higher, as suggested by Zhang (2005). Reflecting these risk-based explanations for the NAV discounts, we formulate our first hypothesis as follows:

Hypothesis 1: *Discounts to NAV are at least partially attributable to risk factors that are not fully reflected on a firm's balance sheet; hence, value stocks don't produce superior returns on a risk-adjusted basis.*

4.2.2 The Value Premium and International Diversification

Is it possible to capture the value premium with little risk by holding a diversified value portfolio? Fama and French (1993) negate this question by arguing that value stocks are subject to undiversifiable factor risk. More precisely, Fama and French (1995) argue that the book-to-market factor is a proxy for default risk or financial distress, an explanation that is particularly relevant during recessions. In line with this business cycle view, Liew and Vassalou (2000) find that the size (SMB) and book-to market (HML) risk factors are significantly related to future GDP growth, while Vassalou (2003) finds that SMB and HML lose much of their predictive power if a factor is added that contains information related to future GDP growth. Zhang (2005) provides a technological explanation for the underperformance of value stocks during recessions. He argues that, during bad times, value stocks are burdened with unproductive capital because of costly reversibility, while growth stocks can more easily scale down their expansions temporarily.

But what about the risk-return profile of value stocks beyond individual economies? Numerous studies document that the value premium is not a U.S. phenomenon, but rather a worldwide one (e.g. Fama and French, 1998; Asness et al., 2013). In case not all economies fall into recession simultaneously, the factor risk of value stocks is country-specific and hence (at least to some extent) diversifiable at a global level. However, the results of Fama and French (1998) suggest this may not be the case. Using a global two-factor model, they find that the global value premium is captured by a global factor for relative distress, which is basically an international HML factor. In contrast, Griffin (2002) finds that country-specific versions of the three-factor model offer much better explanatory power for international stock returns than a global factor model. This result suggests that the factor risk of value stocks exhibits a country-specific component that could provide an opportunity for diversification gains at the global level. This leads us to our second hypothesis:

Hypothesis 2: *The factor risk of value stocks has a country-specific component. Thus, superior risk-adjusted returns can be achieved by diversifying the risk of value stocks across countries.*

4.2.3 Absolute versus Relative Mispricing

When a global value investment strategy is implemented, the question arises of how to take advantage of potential mispricings across the international sample of value stocks. In that regard, one advantage of the real estate stock context is that the value premium can also be seen from a mean reversion perspective. If the book value of equity is a good proxy for intrinsic value, stocks should trade for a book-to-market ratio of around 1, which is equivalent to a NAV discount of 0. The most underpriced stocks, or, alternatively, those with the highest NAV discounts, are then defined as value stocks. If the NAV discount closes through share price appreciation, the value premium could be explained by the mean-reverting relationship between price and NAV.[1] Both the real estate literature (e.g. Patel et al., 2009) and the closed-end fund literature (e.g. Pontiff, 1995) provide strong evidence in favor of a mean-reverting relationship between prices and NAV.

[1] Alternatively, the discount may also close because the market correctly anticipated decreases in NAV, which would be consistent with risk-based explanations for the value premium.

The implications of mean reversion for the global value investment strategy are twofold. To reflect this, we empirically test two different versions of the strategy. First, assuming that all stocks trade around their intrinsic value as measured by the book value (or NAV), it seems straightforward to sort the global stock sample according to the book-to-market ratio (or discount to NAV), and invest in the most underpriced stocks according to this measure. We refer to this as the absolute mispricing strategy, because it is based on a stock's absolute discount to NAV.

However, value stocks may also "catch up" relative to growth stocks within the same country, rather than relative to their own intrinsic value. Thus, if mean reversion occurs primarily at a country level, the absolute mispricing strategy may be suboptimal. Furthermore, it is possible that all the stocks of one country may trade at a deep discount, while the stocks of other countries are trading at a large premium. In this case, the global value portfolio would comprise all the stocks of the discount country, but none of the premium countries. While this reflects the idea of absolute mispricing, it also implies that, from a country-level perspective, the global value portfolio may be composed of all the growth stocks of the discount country while excluding all the value stocks of the premium countries.

To avoid this scenario, and to account for the possibility that mean reversion occurs primarily at the country level, our second test examines an alternative global value investment strategy where all stocks are sorted according to their relative NAV discounts (i.e., their relative average NAV discounts in a country). This strategy ensures that the global value portfolio only consists of stocks that are actually considered value stocks on a within-country basis. This global value portfolio subsequently invests in the most underpriced securities relative to the average level of price to fundamental value in a country.

We refer to this as the relative mispricing strategy. Reflecting its advantages, we formulate our third hypothesis, as follows:

Hypothesis 3: *The global value portfolio sorted according to relative mispricing outperforms the global value portfolio sorted according to absolute mispricing.*

4.3 Data, Methodology, and Sample Description

4.3.1 Sample Description and Data Sources

Our sample is based on the 2005:01 to 2014:05 period, which features a yet unparalleled degree of accounting information comparability across countries due to the introduction of IFRS in the EU and many other countries. To ensure the book value of equity is a good proxy for a firm's fundamental value, we base our sample on the FTSE EPRA/NAREIT Global Real Estate Index, which is comprised of listed equities with "relevant real estate activities." The index provider defines relevant real estate activities as "the ownership, trading and development of income-producing real estate."

Accordingly, these firms mainly derive their cash flows from income-producing assets that are shown on their balance sheets. If the accounting regime requires fair value reporting, the book value of equity can be understood as a sum of the parts valuation of the company, assuming that cash and other assets, and liabilities are also reported at their market values.[2]

To ensure this is the case, we only include FTSE EPRA/NAREIT Global Real Estate Index constituents of countries that either adopted the IFRS, or whose national standards converged to or can be seen as equivalent to IFRS according to information provided on IAS Plus.[3]

In their study of the global value premium, Fama and French (1998) only include countries for which they obtain a minimum of ten observations over the sample period. Our study focuses on only one sector, however, so we lower that minimum to more than five in order to avoid losing too many observations. Of those countries fulfilling this condition, we only exclude the U.S., because, according to U.S. GAAP, assets are generally reported at historical costs as opposed to fair value.

[2] Of particular relevance in this study is IAS 40, which requires investment properties to be reported at fair value. IAS 40 also allows companies to report properties at historical costs, and to disclose fair values only in footnotes. However, this option is rarely implemented in actual practice. Using U.K. data,Liang and Riedl (2013) document unanimous recognition of fair values on the balance sheet, while EY (2011) international survey shows that only three out of thirty-eight property holding companies opted for the cost model.

[3] http://www.iasplus.com.

Our final sample consists of 255 stocks from 11 countries with fair value-based accounting regimes. Panel A of Table 4.1 reports the number of stocks by country, and the total number of country-month observations.

4.3.2 Monthly Trading Strategy

The majority of asset pricing studies separates value and growth stocks only once per year based on end of June data for the book-to-market ratio of equity (e.g. Fama and French, 1993). The rationale behind this procedure is to ensure that financial reporting data for the previous year are actually published and available to all investors.

However, there are two primary problems with this approach. First, any mispricing of value stocks may already be reversed before the value portfolio is formed. For example, Bernard and Thomas (1989) find that stock returns tend to drift in the direction of the earnings surprise following the earnings announcement. This is all the more a concern as earnings surprises are systematically more positive for value than growth stocks (see Porta et al., 1997). Second, it is possible that some stocks' share prices increase so much within the twelve months prior to the new portfolios being formed that they would no longer be classified as value stocks.

We avoid these shortcomings by using a monthly sorting procedure, based on Datastream's "Earnings per share report date (EPS)." We can thus ensure that financial reporting data are actually published as new portfolios are formed. For example, if the annual report for calendar year 2014 is published in April 2015, Datastream will report a new book value of equity from December 2014 onward, but we can shift this information by four months using the "Earnings per share report date." Financial reporting frequency is generally semiannual and may even be quarterly. Thus, NAVs may only change semiannually, but we observe monthly changes in the book-to-market ratios due to share price fluctuations.

To take advantage of potential security mispricings across countries, we use a monthly trading strategy that invests in those stocks with the highest departures from intrinsic value as measured by their NAV discounts. Sorting stocks based on NAV discounts is equivalent to sorting stocks according to their book-to-market ratios. Nevertheless, we adjust our terminology because, in our setting, stocks would be expected to trade closer to a book-to-market ratio of around 1 since the NAV is supposed to be a more reliable proxy for intrinsic value.

In terms of NAV, discounts should theoretically fluctuate around 0, where the stocks that trade at the highest discounts are referred to as value stocks. We calculate the NAV per share (or the book value of equity) by dividing Datastream's "common equity" by "number of shares." The discount to NAV is calculated with respect to the "unadjusted share price" as reported by Datastream. As stocks may also trade at a premium to NAV, we term our sorting criteria NAV spread:

$$\text{NAV Spread}_{i,t} = \frac{\text{Price}_{i,t}}{\text{NAV}_{i,t}} - 1 \tag{4.1}$$

To test whether absolute or relative mispricing is better suited to capture the value premium (Hypothesis 3), we also form portfolios based on the NAV discount of stock i relative to the average NAV discount in country j, as follows:

$$\begin{aligned}\text{Relative NAV Spread}_{i,j,t} = {} & \text{NAV Spread}_{i,j,t} \\ & - \text{Average Country NAV Spread}_{j,t}\end{aligned} \tag{4.2}$$

After sorting the sample based on month-end data for both measures, we form three portfolios, and observe their total returns as reported by Datastream over the following month. The value portfolio (P1) is defined as the quintile of stocks with the highest discount to NAV; the middle three quintiles are defined as the middle portfolio (P2); and the growth portfolio (P3) is defined as the quintile of stocks with the highest NAV premiums.

All portfolios are constructed using equal weights. We do not consider value-weighted returns because our sample size is rather small, and value-weighting would place undue emphasis on the performance of individual stocks. Note also that all returns are in local currencies to ensure our results are not driven by exchange rate fluctuations.

Our approach of sorting global portfolios based on absolute or relative NAV spreads differs from that of Fama and French (1998), who use MSCI weights to construct portfolios from country-level value and growth portfolios. Our proxy for fundamental value enables us to be more granular. The comparability of NAVs across countries means we are able to form the global value portfolio according to absolute attractiveness – an approach that would hardly make sense in a setting with a poor proxy for fundamental value, heterogeneous industries, or divergent accounting standards.

On the other hand, the approach of Fama and French (1998) avoids the problem of having a global value portfolio that excludes other countries' value stocks, while relying too heavily on one country's growth stocks. However, their approach is not well suited to capture relative mispricing as a potential source of global diversification gains. It is again the comparability of accounting measures that enables us to identify stocks with the highest potential to catch up relative to their peers in the same country. The approach of Fama and French (1998) can be understood as a compromise between our two extremes.

4.3.3 Risk-adjusted Returns

To evaluate the risk-adjusted performance of our monthly trading strategy, we follow the mutual fund literature and use the CAPM and the Fama-French three-factor model to obtain risk-adjusted returns. First, we regress the excess returns of portfolio i on the excess return of the benchmark portfolio, as follows:

$$\text{Excess return}_{i,t} = \alpha_i + \beta_i \text{benchmark excess return}_t \quad (4.3)$$

The excess return of portfolio i is calculated as the equally weighted return of all portfolio constituents in excess of their respective local currency's one-month risk-free rate, which we obtain from Datastream. We define the benchmark portfolio as the equally weighted portfolio of all stocks in our sample. Alternatively, we could use a broad stock market index that covers all sectors. However, this could result in all positive or all negative alphas for the three portfolios if the entire real estate sector over- or underperformes relative to the broad market. We are interested only in the relative performance of the value portfolio within this particular sector, so we believe an equally weighted sector benchmark is most appropriate. It ensures that the average alpha of the three portfolios is 0. The excess return of the benchmark portfolio is also calculated as the equally weighted excess return of all stocks in our sample relative to their local currency risk-free rates.

Next, we run Fama-French three-factor regressions by adding the size (SMB) and book-to-market (HML) factors as explanatory variables:

$$\text{Excess return}_{i,t} = \alpha_i + \beta_{1,i}\text{benchmark excess return}_t + \beta_{2,i}\text{SMB}_t + \beta_{3,i}\text{HML}_t \quad (4.4)$$

The three-factor model is a higher hurdle for the risk-adjusted performance than the one-factor model. For example, if a portfolio heavily loads on the small stock risk factor (SMB), higher returns will be required to compensate for the additional risk. Thus, although the absolute performance of the portfolio is strong, risk-adjusted returns may be small and insignificant.

In contrast to the benchmark portfolio, we do not restrict SMB and HML to the subsector of real estate stocks. This is done to reflect the original idea of the Fama-French three-factor model, according to which SMB and HML are marketwide and are not industry-specific proxies for undiversifiable factor risk. In our international context, it may seem straightforward to use global SMB and HML factors. However, Griffin (2002) finds that domestic factor models explain time series portfolio variations much better than a world factor model. Thus, our SMB and HML factors are constructed according to the (time-varying) country weights of the benchmark portfolio.

The monthly local currency SMB and HML factors for nine of the eleven countries in our sample come from Stefano Marmi's website.[4] The risk factors for Belgium and the Netherlands are approximated using Marmi's regional factors for "Western Europe ex UK." Note that Marmi's data library ends in March 2013, so, for the remaining fourteen months until the end of our sample period in May 2014, we complement the time series with data from Kenneth French's website.[5] French's data library provides regional factors in USD for "Asia Pacific ex Japan," "Europe," "Japan," and "North America," so we convert the regional USD returns into local currency returns for the respective countries.

[4] http://homepage.sns.it/marmi/DataLibrary.html.
[5] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/datalibrary.html.

Table 4.1: Descriptive statistics of returns and NAV spreads

	Returns (%)		NAV-Spreads (%)		Number of	
	Mean	Std. Dev	Mean	Std. Dev.	Stocks	Obs.
Panel A: Individual Stock Level						
Australia	0.20	9.55	10.76	62.99	28	1761
Belgium	0.70	5.10	8.33	21.07	7	667
Canada	1.12	6.40	94.45	181.92	34	2061
France	0.87	8.99	42.13	75.87	11	992
Germany	0.03	13.92	7.27	104.29	16	870
Hong Kong	1.36	13.44	27.00	114.93	31	2186
Japan	1.08	10.36	70.08	134.38	41	2611
Netherlands	0.65	9.16	-3.83	26.92	9	741
Singapore	1.20	9.67	15.40	65.88	21	1413
Sweden	1.56	8.33	16.13	33.03	8	625
United Kingdom	0.56	12.50	7.02	75.66	49	3345
Global	0.86	10.62	32.53	110.36	255	17524
Panel B: Aggregate Index Level						
Australia	0.26	6.39	5.75	31.28	-	113
Belgium	0.74	3.73	8.57	12.91	-	113
Canada	1.09	4.47	95.70	36.85	-	113
France	0.99	6.63	44.08	27.76	-	113
Germany	0.45	10.05	24.92	92.46	-	113
Hong Kong	1.41	10.04	24.13	55.35	-	113
Japan	1.05	7.55	68.22	72.71	-	113
Netherlands	0.61	6.53	-6.10	23.16	-	113
Singapore	1.30	7.87	16.04	37.99	-	113
Sweden	1.57	7.38	17.44	25.33	-	113
United Kingdom	0.81	7.19	6.89	27.32	-	113
Global	0.93	5.51	31.73	31.18	-	113

This table contains the returns, NAV spreads, and number of observations for the global sample of real estate stocks over the January 2005 to May 2014 period. All returns are monthly and in local currencies. Panel A is at the individual stock level; Panel B is at the index level, calculated as equally weighted portfolios of the numbers shown in Panel A.

4.3.4 Summary statistics

Table 4.1 contains the descriptive statistics of total returns and NAV spreads for individual countries and for the global sample over the 2005:01 to 2014:05 period. Panel A shows the data at the individual stock level; Panel B shows the same metrics at the aggregate index level, which are also used as benchmark portfolios. Panel A also reports the number of stocks per country and the total number of country-month observations; Panel B reports the number of monthly portfolio observations for the indices.

The first column of Panel A in Table 4.1 shows that the average monthly return of all real estate stocks over our sample period is 0.86%. Average returns are the highest in Sweden (1.56%) and the lowest in Germany (0.03%). Panel B shows similar returns when aggregated at the index level, but, of course, return volatility is substantially reduced, especially for the global index and for countries with a large number of stocks. For example, the monthly return volatility of the global sample of stocks is 10.62%, but it is only 5.51% at the diversified index level.

Columns 3 and 4 of Table 4.1 show the mean and standard deviation of the NAV spreads. On average, the entire sample of real estate stocks trades at a 32.53% premium to NAV over the sample period. The average premium is highest in Canada with 94.45%, and lowest in the Netherlands, with an average discount to NAV of -3.83%. The standard deviations of the NAV spreads are in Panel A. They reveal a substantial degree of cross-sectional variation in the relative pricing of stocks within countries. The index-level NAV spreads are in Panel B, and indicate that there is also substantial variation in the aggregate pricing levels over time and across countries. This suggests that the relative mispricing strategy that accounts for these country effects may be well suited to exploit cross-country potential mispricings.

Table 4.2 contains the correlation coefficients for the time series of returns and NAV spreads at the aggregate index level. The correlation of country-level return indices (or benchmark portfolios) is shown in Panel A. Panel B shows the same metrics for the subsector of value stocks for the respective countries. Interestingly, the correlations for the value portfolios tend to be lower than those for the benchmark portfolios. The average correlation across countries (i.e., excluding the correlation with the global portfolio) is 54% for the benchmark portfolios and 47% for the value portfolios. This suggests that the benefits of international diversification across the value stock subsector are higher than those that can be obtained from general cross-country diversification.

Panel C of Table 4.2 shows the correlations of the time series of average country-level NAV spreads. Although the average correlation coefficient is rather high at 60%, it is still far from perfect. Thus, international diversification benefits may also accrue from relative pricing levels across countries moving in different directions over time.

Table 4.2: Correlations of country-level returns and NAV spreads

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Correlations of Country-Level Indices												
(1) Australia	1.00	-	-	-	-	-	-	-	-	-	-	-
(2) Belgium	0.47	1.00	-	-	-	-	-	-	-	-	-	-
(3) Canada	0.70	0.55	1.00	-	-	-	-	-	-	-	-	-
(4) France	0.61	0.77	0.71	1.00	-	-	-	-	-	-	-	-
(5) Germany	0.33	0.39	0.60	0.60	1.00	-	-	-	-	-	-	-
(6) Hong Kong	0.45	0.19	0.49	0.48	0.45	1.00	-	-	-	-	-	-
(7) Japan	0.52	0.34	0.50	0.41	0.39	0.47	1.00	-	-	-	-	-
(8) Netherlands	0.45	0.69	0.65	0.84	0.75	0.44	0.45	1.00	-	-	-	-
(9) Singapore	0.50	0.36	0.68	0.64	0.52	0.79	0.53	0.57	1.00	-	-	-
(10) Sweden	0.26	0.52	0.50	0.68	0.65	0.34	0.26	0.74	0.41	1.00	-	-
(11) United Kingdom	0.61	0.61	0.65	0.81	0.57	0.38	0.39	0.70	0.50	0.62	1.00	-
(12) Global	0.73	0.60	0.82	0.84	0.71	0.74	0.70	0.79	0.81	0.63	0.81	1.00
Panel B: Correlations of Value Portfolios												
(1) Australia	1.00	-	-	-	-	-	-	-	-	-	-	-
(2) Belgium	0.44	1.00	-	-	-	-	-	-	-	-	-	-
(3) Canada	0.53	0.37	1.00	-	-	-	-	-	-	-	-	-
(4) France	0.51	0.52	0.59	1.00	-	-	-	-	-	-	-	-
(5) Germany	0.36	0.34	0.51	0.54	1.00	-	-	-	-	-	-	-
(6) Hong Kong	0.47	0.13	0.54	0.51	0.41	1.00	-	-	-	-	-	-
(7) Japan	0.58	0.27	0.53	0.48	0.38	0.52	1.00	-	-	-	-	-
(8) Netherlands	0.43	0.41	0.58	0.68	0.67	0.44	0.49	1.00	-	-	-	-
(9) Singapore	0.49	0.33	0.60	0.56	0.37	0.70	0.51	0.47	1.00	-	-	-
(10) Sweden	0.32	0.35	0.52	0.64	0.58	0.45	0.35	0.60	0.46	1.00	-	-
(11) United Kingdom	0.50	0.43	0.54	0.67	0.40	0.29	0.35	0.43	0.32	0.49	1.00	-
(12) Global	0.68	0.46	0.70	0.80	0.68	0.69	0.66	0.70	0.65	0.63	0.79	1.00
Panel C: Correlations of NAV Spreads												
(1) Australia	1.00	-	-	-	-	-	-	-	-	-	-	-
(2) Belgium	0.81	1.00	-	-	-	-	-	-	-	-	-	-
(3) Canada	0.39	0.34	1.00	-	-	-	-	-	-	-	-	-
(4) France	0.79	0.84	0.35	1.00	-	-	-	-	-	-	-	-
(5) Germany	0.73	0.76	0.36	0.76	1.00	-	-	-	-	-	-	-
(6) Hong Kong	0.44	0.25	0.64	0.32	0.37	1.00	-	-	-	-	-	-
(7) Japan	0.82	0.78	0.41	0.72	0.82	0.47	1.00	-	-	-	-	-
(8) Netherlands	0.84	0.78	0.39	0.88	0.79	0.38	0.81	1.00	-	-	-	-
(9) Singapore	0.83	0.81	0.57	0.78	0.81	0.69	0.85	0.80	1.00	-	-	-
(10) Sweden	0.72	0.68	0.20	0.77	0.66	0.13	0.58	0.86	0.59	1.00	-	-
(11) United Kingdom	0.55	0.68	0.13	0.70	0.51	0.07	0.39	0.66	0.56	0.67	1.00	-
(12) Global	0.89	0.85	0.58	0.84	0.85	0.63	0.90	0.88	0.97	0.68	0.61	1.00

This table contains the correlation coefficients of monthly data over the January 2005 to May 2014 period. All returns are monthly and in local currencies. Panel A shows the correlation of total returns for equally weighted country-level indices; Panel B shows the correlation of total returns for the value portfolios. The value portfolios consist of the quintile of stocks with the highest NAV discounts in a given month in the respective country. Panel C shows the correlation coefficients of the average NAV spreads in a given country. We calculate NAV spreads as the average equally weighted NAV spread of all stocks in a given month for the respective country.

4.4 Empirical Results

4.4.1 Raw Returns

Table 4.3 shows the performance and portfolio characteristics of value (P1), middle (P2), and growth (P3) portfolios over the January 2005 to May 2014 period. While our primary objective is to examine the performance of globally diversified value portfolios, we also report results at an individual country level to give readers a sense of how country-level data tie to global data. Columns 1-4 of Table 4.3 show the mean, standard deviation, minimum, and maximum of the portfolio returns. Panel A reports the results at the individual country level, and Panel B reports the results at the global level, where the portfolios are sorted according to either the absolute or relative NAV spread as described in section 4.3.2.

The country-level results in Panel A reveal a consistent pattern regarding the relative performance of the value portfolios. For example, the value portfolio (P1) outperforms the growth portfolio (P2) in each country. Moreover, except for France and the Netherlands, the value portfolio also outperforms the middle portfolio (P2) in most cases. At the same time, the value portfolios appear more risky, as indicated by the fact that the highest volatility for the three portfolios is found in nine of the eleven cases. This outperformance of the value portfolio is most pronounced in Germany, Japan, Singapore, and the U.K., where the average excess return over the benchmark portfolio is greater than 0.5% per month.

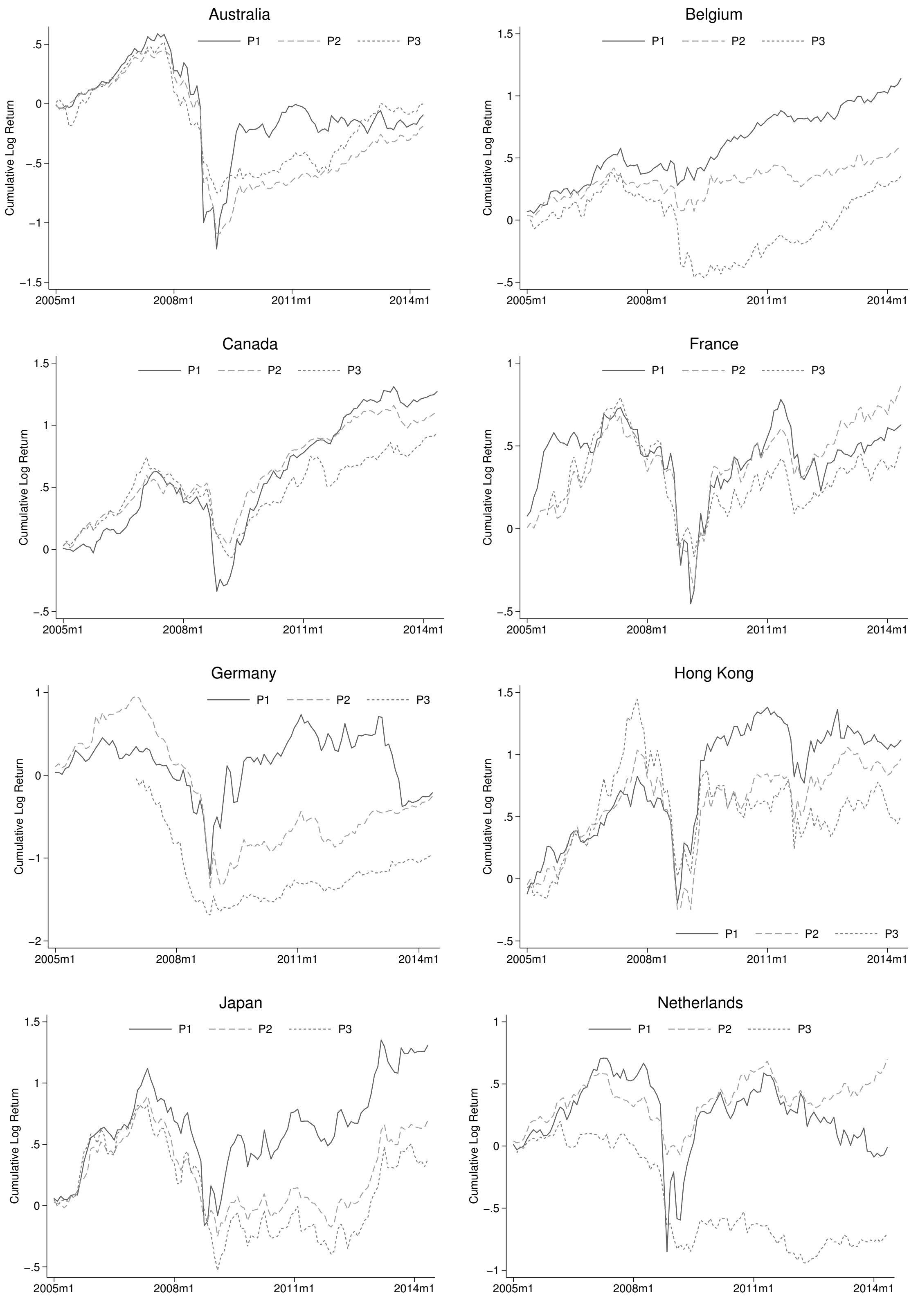
Overall, the country-level results are in line with the literature. And they lead us to the question whether the risk associated with the strong relative performance of the value portfolios at the individual country level can be diversified at the global level. However, we caution against overinterpreting the country-level results, because the number of portfolio constituents is very low in many cases. In contrast, the number of stocks in the value portfolio at the global level ranges from 21 to 38, which is sufficiently high from which to draw empirical conclusions.

Panel B shows the return distribution of the global portfolios that are constructed according to either absolute or relative NAV spreads. In general, the global-level results are consistent with the findings for individual countries. According to both

Table 4.3: Performance and characteristics of portfolios sorted by NAV spreads

		Return Distribution (%)			
		Mean	Std. Dev	Min	Max
Panel A: Country Level					
Australia	P1	0.50	9.49	-62.25	29.80
	P2	0.10	6.59	-46.47	14.28
	P3	0.16	5.62	-22.97	11.15
Belgium	P1	1.09	4.02	-15.93	10.40
	P2	0.61	4.08	-14.40	15.17
	P3	0.48	5.68	-27.50	15.10
Canada	P1	1.33	6.19	-29.70	21.57
	P2	1.07	4.34	-22.06	10.89
	P3	0.96	5.01	-17.07	14.53
France	P1	0.93	8.50	-30.45	26.80
	P2	1.02	7.13	-26.27	27.18
	P3	0.70	6.61	-18.95	18.90
Germany	P1	0.80	14.76	-34.00	80.50
	P2	0.35	10.75	-38.52	54.40
	P3	-0.82	7.43	-23.10	26.50
Hong Kong	P1	1.54	10.76	-28.40	53.04
	P2	1.38	10.17	-32.69	40.07
	P3	1.19	12.13	-35.93	40.00
Japan	P1	1.64	9.72	-40.85	33.48
	P2	0.86	7.09	-16.73	25.68
	P3	0.76	9.26	-22.45	25.73
Netherlands	P1	0.75	12.32	-46.55	74.65
	P2	0.77	5.51	-13.30	17.65
	P3	-0.51	5.93	-21.70	10.50
Singapore	P1	2.09	8.98	-30.40	33.30
	P2	1.37	8.46	-25.32	53.37
	P3	-0.54	7.41	-26.95	18.50
Sweden	P1	2.02	8.97	-19.40	38.40
	P2	1.61	7.72	-19.70	37.80
	P3	0.86	6.77	-15.00	20.40
United Kingdom	P1	1.61	12.84	-45.30	81.29
	P2	0.50	6.24	-22.40	31.33
	P3	0.40	6.09	-26.97	27.48
Panel B: Global Level					
1) Absolute NAV Spread	P1	1.46	8.61	-37.26	40.49
	P2	0.82	5.03	-26.35	13.76
	P3	0.63	5.33	-20.24	15.43
2) Relative NAV Spread	P1	1.58	6.96	-30.12	29.33
	P2	0.78	5.52	-28.17	16.70
	P3	0.60	5.22	-21.94	14.40

This table contains the performance and portfolio characteristics of real estate stock portfolios sorted according to their NAV spreads over the January 2005 to May 2014 period (n = 117). All returns are monthly and in local currencies. Panel A shows the results at the individual country level. The P1 portfolio consists of the quintile of stocks with the highest NAV discounts in a given month; the P2 portfolio consists of stocks in the middle three quintiles of stocks sorted according to their NAVs; the P3 portfolio consists of stocks with the highest NAV premiums in a given month. Panel B shows the results at the global level. Methods (1) and (2) differ regarding the sorting procedure that is used to construct the portfolios. Method (1) sorts the global sample of stocks according to their absolute NAV spreads in a given month; method (2) sorts the global sample according to each stock's NAV spread relative to the average NAV spread in the respective country in a given month.



sorting procedures, the value portfolio provides the highest returns, but it is also the most risky as measured by monthly return volatility. Overall, the Table 4.3 results are

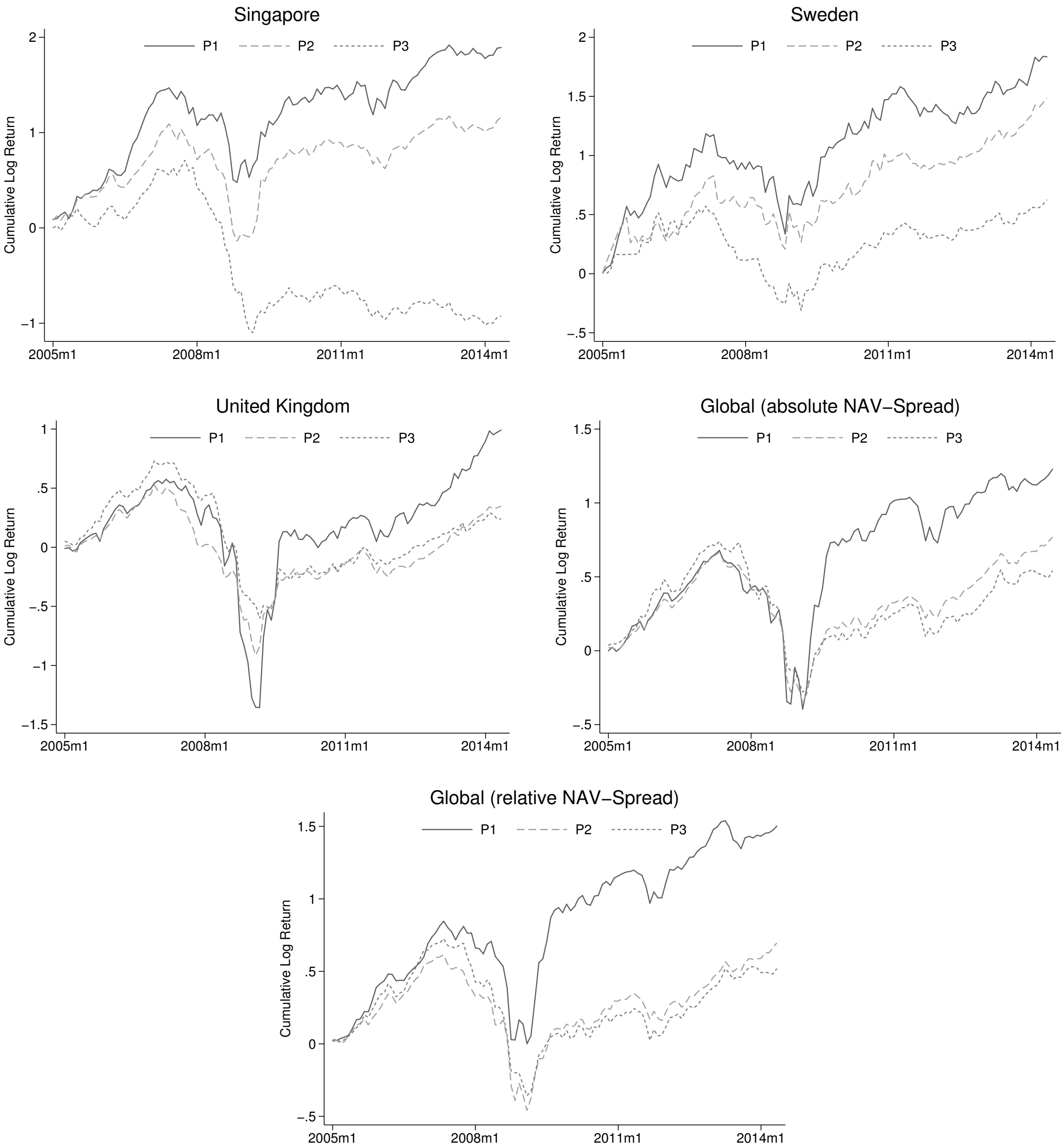


Figure 4.1: This figure shows the cumulative (log) returns of portfolios of real estate stocks sorted according to their NAV discount for eleven countries, as well as two global portfolios over the January 2005 to May 2014 period. All (log) returns are monthly and in local currencies. The P1 portfolio consists of the quintile of stocks with the highest NAV discounts in a given month; the P2 portfolio consists of stocks in the middle three quintiles of stocks sorted according to their NAVs; the P3 portfolio consists of stocks with the highest NAV premiums in a given month. The two global portfolios differ regarding the sorting procedure used to construct the portfolios. For the figure titled "Global (absolute NAV Spread)," the global sample of stocks is sorted according to their absolute NAV spreads in a given month. For the figure titled "Global (relative NAV Spread)," the global sample of stocks is sorted according to their relative NAV spreads in the respective country in a given month.

in line with Hypothesis 1, which is tested in the following section where we examine risk-adjusted returns.

Interestingly, the value portfolio that is sorted according to relative mispricing has both higher average returns (1.58% versus 1.46%) and lower risk (6.96% versus 8.96%) than the value portfolio sorted according to absolute NAV spreads. This result is in line with Hypothesis 3. On an annualized basis, the global value portfolio based on relative mispricing outperforms its global growth equivalent by 13.26%. The annualized value premium, defined as the return of the value portfolio over the benchmark portfolio, is 8.95%.

Figure 4.1 illustrates the empirical evidence by plotting the cumulative log returns to the value, middle, and growth portfolios over the sample period. The results are consistent with Table 4.3: The cumulative returns to the value portfolio are highest in eight of the eleven countries. The outperformance of the two global value strategies is evident in the last two subfigures, where the graph for the relative mispricing strategy shows the most pronounced outperformance.

4.4.2 Risk-adjusted Returns

Tables 4.4 and 4.5 contain the regression results for the CAPM and Fama-French three-factor model regressions, which are based on the same portfolios as in Table 4.3. To test Hypotheses 1-3, our focus is on the intercepts of the regressions that can be interpreted as alphas or risk-adjusted returns, where the t-statistics indicate their statistical significance.

Panel A of Table 4.4 contains the country-level results for the CAPM regressions. In general, alphas tend to be highest for the value portfolios (P1), and lowest for the growth portfolios (P3). However, only the alphas for the value portfolios of Belgium and Singapore are significantly different from 0.

The coefficients on the benchmark portfolios, or "betas," can be interpreted as measures of the respective portfolios' exposures to systematic risk. The betas of the value portfolios are highest, and the betas of the growth portfolios tend to be the lowest. This indicates that the growth portfolios carry lower systematic risk. As in Table 4.3, Belgium and Hong Kong are the exceptions, with riskier growth than value

Table 4.4: Risk-adjusted performance of portfolios sorted by NAV spreads (CAPM)

		Alpha		MKT		R^2
Panel A: Country Level						
Australia	P1	0.003	(0.75)	1.343***	(22.5)	82.0
	P2	-0.002	(-1.04)	0.997***	(39.94)	93.5
	P3	-0.001	(-0.42)	0.673***	(12.48)	58.4
Belgium	P1	0.004*	(1.93)	0.874***	(14.72)	66.1
	P2	-0.001	(-1.02)	1.021***	(27.9)	87.5
	P3	-0.003	(-0.97)	1.194***	(13.36)	61.9
Canada	P1	0.000	(0.17)	1.209***	(18.91)	76.3
	P2	0.000	(0.37)	0.937***	(38.21)	92.9
	P3	0.000	(0.05)	0.844***	(12.09)	56.8
France	P1	-0.001	(-0.25)	1.061***	(15.67)	68.9
	P2	0.000	(-0.03)	1.045***	(43.68)	94.5
	P3	0.000	(0.1)	0.798***	(14.59)	67.2
Germany	P1	0.003	(0.36)	1.214***	(15.6)	68.7
	P2	-0.001	(-0.31)	1.012***	(30.78)	89.5
	P3	-0.008	(-1.28)	0.443***	(7.85)	42.3
Hong Kong	P1	0.002	(0.4)	0.955***	(20.52)	79.1
	P2	0.000	(-0.16)	0.997***	(57.19)	96.7
	P3	-0.003	(-0.52)	1.056***	(19.01)	76.5
Japan	P1	0.004	(1.09)	1.164***	(22.48)	82.0
	P2	-0.001	(-0.59)	0.913***	(44.33)	94.7
	P3	-0.004	(-0.81)	1.068***	(18.7)	75.9
Netherlands	P1	-0.002	(-0.33)	1.674***	(20.58)	79.2
	P2	0.003	(1.19)	0.761***	(21.83)	81.1
	P3	-0.009**	(-2.17)	0.617***	(9.48)	47.6
Singapore	P1	0.008**	(2.05)	1.030***	(22.07)	81.4
	P2	0.000	(0.06)	1.050***	(47.54)	95.3
	P3	-0.014***	(-2.96)	0.698***	(11.68)	55.6
Sweden	P1	0.003	(0.85)	1.091***	(21.5)	80.6
	P2	0.000	(0.1)	1.020***	(47.14)	95.2
	P3	-0.005	(-1.23)	0.799***	(15.56)	71.6
United Kingdom	P1	0.004	(0.98)	1.680***	(30.19)	89.1
	P2	-0.002	(-1.52)	0.845***	(42.94)	94.3
	P3	-0.002	(-0.69)	0.695***	(15.14)	67.4
Panel B: Global Level						
1) Absolute NAV Spread	P1	0.002	(0.65)	1.444***	(25.95)	85.9
	P2	0.000	(-0.60)	0.904***	(68.83)	97.7
	P3	-0.002	(-0.73)	0.846***	(18.97)	76.4
2) Relative NAV Spread	P1	0.005**	(2.08)	1.177***	(27.12)	86.9
	P2	-0.001	(-1.46)	0.985***	(55.67)	96.5
	P3	-0.002	(-1.20)	0.874***	(25.10)	85.0

This table contains the risk-adjusted returns of real estate stock portfolios sorted according to their NAV discounts over the January 2005 to May 2014 period (n = 117). We obtain risk-adjusted returns (alphas) from time series regressions of the excess portfolio returns (P1, P2, and P3) on the excess benchmark portfolio (MKT) return. All returns are monthly and in local currencies. The risk-free rate is the local currency one-month T-bill rate. In Panel A, the benchmark return is the equally weighted return of all real estate stocks of the respective country; in Panel B, the market return is the equally weighted return of all global stocks. Panel A shows the risk-adjusted returns at the individual country level. The P1 portfolio consists of the quintile of stocks with the highest NAV discounts in a given month; the P2 portfolio consists of stocks in the middle three quintiles of stocks sorted according to their NAVs; the P3 portfolio consists of stocks with the highest NAV premiums in a given month. Panel B shows the risk-adjusted returns at the global level. Methods (1) and (2) differ regarding the sorting procedure that is used to construct the portfolios. Method (1) sorts the global sample of stocks according to their absolute NAV spreads in a given month; method (2) sorts the global sample according to each stock's NAV spread relative to the average NAV spread in the respective country in a given month. T-statistics are in parentheses, and parameters marked ***,**, and * are significant at the 1%, 5%, and 10% levels, respectively.

Table 4.5: Risk-adjusted performance of portfolios sorted by NAV spreads (Fama-French three-factor model)

		Alpha		MKT		SMB		HML		R^2
Panel A: Country Level										
Australia	P1	0.003	(0.71)	1.344***	(22.45)	0.127	(0.55)	-0.108	(-1.49)	82.4
	P2	-0.002	(-1.06)	0.998***	(39.97)	0.013	(0.13)	0.051*	(1.68)	93.7
	P3	-0.001	(-0.35)	0.667***	(12.27)	-0.186	(-0.88)	-0.028	(-0.43)	58.8
Belgium	P1	0.004*	(1.89)	0.869***	(13.57)	-0.023	(-0.31)	-0.004	(-0.03)	66.2
	P2	-0.002	(-1.08)	1.011***	(25.63)	-0.033	(-0.71)	0.038	(0.59)	87.6
	P3	-0.003	(-0.87)	1.228***	(12.78)	0.121	(1.07)	-0.086	(-0.55)	62.3
Canada	P1	0.000	(-0.02)	1.116***	(16.82)	0.200***	(3.52)	0.171*	(1.85)	78.8
	P2	0.001	(0.62)	0.970***	(37.71)	-0.064***	(-2.91)	-0.081**	(-2.26)	93.6
	P3	0.000	(0.08)	0.870***	(11.39)	-0.061	(-0.93)	-0.031	(-0.30)	57.2
France	P1	-0.001	(-0.29)	1.018***	(13.03)	0.043	(0.29)	0.251	(1.52)	69.5
	P2	0.000	(-0.02)	1.036***	(37.24)	-0.021	(-0.40)	0.026	(0.44)	94.5
	P3	0.001	(0.21)	0.875***	(14.28)	-0.014	(-0.12)	-0.382***	(-2.94)	69.8
Germany	P1	0.001	(0.1)	1.195***	(15.01)	0.047	(0.16)	0.317	(1.31)	69.2
	P2	0.000	(-0.06)	1.024***	(30.62)	0.098	(0.8)	-0.125	(-1.23)	89.8
	P3	-0.007	(-1.04)	0.456***	(7.83)	-0.087	(-0.40)	-0.227	(-1.23)	43.3
Hong Kong	P1	-0.001	(-0.21)	0.932***	(20.74)	0.045	(0.54)	0.531***	(3.53)	81.5
	P2	0.000	(-0.20)	0.991***	(57.14)	-0.086***	(-2.67)	0.045	(0.78)	96.9
	P3	0.001	(0.16)	1.098***	(20.92)	0.148	(1.51)	-0.776***	(-4.42)	80.1
Japan	P1	0.003	(0.84)	1.173***	(21.87)	0.126	(0.91)	0.06	(0.41)	82.1
	P2	-0.001	(-0.34)	0.910***	(42.75)	0.026	(0.47)	-0.057	(-1.00)	94.7
	P3	-0.003	(-0.75)	1.066***	(18.39)	-0.314**	(-2.10)	0.09	(0.58)	77.0
Netherlands	P1	0.000	(-0.09)	1.726***	(17.52)	0.244	(1.22)	-0.541**	(-2.17)	80.1
	P2	0.002	(0.99)	0.748***	(17.67)	-0.071	(-0.82)	0.203*	(1.89)	81.8
	P3	-0.011**	(-2.44)	0.535***	(6.74)	-0.298*	(-1.87)	0.318	(1.61)	49.5
Singapore	P1	0.009**	(2.25)	1.039***	(22.42)	-0.194**	(-2.20)	-0.089	(-0.55)	82.4
	P2	-0.001	(-0.36)	1.047***	(48.25)	0.102**	(2.48)	0.077	(1.01)	95.6
	P3	-0.015***	(-2.90)	0.704***	(11.61)	-0.088	(-0.76)	0.084	(0.4)	55.9
Sweden	P1	0.003	(0.86)	1.122***	(20.35)	0.149	(1.52)	-0.044	(-0.28)	81.1
	P2	0.000	(0.06)	1.007***	(42.93)	-0.071*	(-1.70)	-0.002	(-0.04)	95.4
	P3	-0.005	(-1.22)	0.804***	(14.18)	-0.003	(-0.03)	-0.07	(-0.44)	71.7
United	P1	0.005	(1.22)	1.618***	(26.34)	0.337***	(2.83)	0.409***	(2.79)	90.2
Kingdom	P2	-0.002*	(-1.71)	0.870***	(39.85)	-0.100**	(-2.36)	-0.152***	(-2.91)	94.8
	P3	-0.002	(-0.71)	0.681***	(12.75)	-0.001	(-0.01)	0.067	(0.52)	67.5
Panel B: Global Level										
1) Absolute	P1	0.000	(0.08)	1.417***	(25.51)	0.086	(0.62)	0.542***	(3.01)	87.0
NAV Spread	P2	-0.000	(-0.54)	0.904***	(66.25)	-0.017	(-0.51)	-0.010	(-0.22)	97.7
	P3	-0.000	(-0.02)	0.876***	(20.17)	-0.057	(-0.53)	-0.550***	(-3.92)	79.4
2) Relative	P1	0.005**	(2.19)	1.203***	(27.75)	0.315***	(2.92)	-0.091	(-0.65)	87.9
NAV Spread	P2	-0.002*	(-1.81)	0.973***	(54.79)	-0.084*	(-1.90)	0.112*	(1.95)	96.8
	P3	-0.001	(-0.76)	0.885***	(25.05)	-0.077	(-0.88)	-0.260**	(-2.28)	85.8

This table contains the risk-adjusted returns of real estate stock portfolios sorted according to their NAV discounts over the January 2005 to May 2014 period (n = 117). We obtain risk-adjusted returns (alphas) from time series regressions of the excess portfolio returns (P1, P2, and P3) on the excess benchmark portfolio (MKT) return, the global SMB risk factor, and the global HML risk factor. All returns are monthly and in local currencies. The risk-free rate is the local currency one-month T-bill rate. In Panel A, the market return is the equally weighted return of all real estate stocks of the respective country; in Panel B, the market return is the equally weighted return of all global stocks. Panel A shows the risk-adjusted returns at the individual country level. The P1 portfolio consists of the quintile of stocks with the highest NAV discounts in a given month; the P2 portfolio consists of stocks in the middle three quintiles of stocks sorted according to their NAVs; the P3 portfolio consists of stocks with the highest NAV premiums in a given month. Panel B shows the risk-adjusted returns at the global level. Methods (1) and (2) differ regarding the sorting procedure that is used to construct the portfolios. Method (1) sorts the global sample of stocks according to their absolute NAV spreads in a given month; method (2) sorts the global sample according to each stock's NAV spread relative to the average NAV spread in the respective country in a given month. T-statistics are in parentheses, and parameters marked ***,**, and * are significant at the 1%, 5%, and 10% levels, respectively.

portfolios. The R-squareds are generally relatively high, which is due to the narrow definition of the benchmark portfolio. This is particularly true for the middle portfolio (P2), where the overlap with the benchmark portfolio is 60% (three out of five quintiles). Again, the country-level results should be interpreted with caution because of the low number of portfolio constituents in many cases. The resulting vulnerability to outliers may explain the lack of statistical significance of most of the alphas, although the economic differences between them are generally substantial. Overall, and in conjunction with the country-level raw returns of Table 4.3, the results are in line with Hypothesis 1: At the individual country level, value portfolios tend to produce higher returns in absolute terms, but not on a risk-adjusted basis.

However, our primary focus is on the global-level results, which are shown in Panel B of Table 4.4. The alpha of the global value portfolio sorted according to absolute NAV spreads is positive, but it is also rather small economically and not statistically different from 0. In contrast, and consistent with Hypothesis 2, the risk-adjusted excess return for the global value portfolio sorted according to relative NAV spreads (method 2) is 0.5% per month. This is not only economically but also statistically significant. Furthermore, comparing the alpha coefficients for methods 1 and 2 clearly reveals that the relative mispricing strategy (method 2) works better than the absolute mispricing strategy. This result also supports Hypothesis 3: The relative mispricing strategy is better suited to capture the global value premium.

Comparing the beta coefficients provides a potential explanation for the differences in the risk-adjusted performance of both global portfolios. The beta of the method 1 strategy is 1.44, while the beta of method 2 is only 1.18, which suggests the latter value portfolio is less exposed to systematic risk.

The regression results in Table 4.5 for the Fama-French three-factor model are largely in line with the results in Table 4.4. Importantly, the economic and statistical significance of the alphas is nearly unchanged, especially for the two global value portfolios. Therefore, our conclusions regarding Hypotheses 1-3 remain unchanged. However, the analysis of the portfolio sensitivities with respect to the systematic risk factors SMB and HML reveal important insights regarding the portfolio characteristics. Although we may expect that the value portfolios will load heavily on the book to market factor (HML), this is actually only true in Canada, Hong Kong, the U.K., and for the global value portfolio sorted according to absolute NAV spreads. Interestingly, the global value portfolio sorted according to relative NAV spreads is not sensitive to the book-to-market factor. This suggests that sorting the global value portfolio according to relative mispricing reduces its risk exposure with respect to the global book-to-market factor. However, the global value portfolio of method 2 is sensitive with respect to the SMB factor, although this is not the case for method 1. Nevertheless, even after controlling for the small stock risk factor, the risk-adjusted performance of method 2 remains highly significant.

Overall, the country-level results show that value stocks have higher returns, but they are also more risky. The relatively high risk of value stocks at the country level can be reduced significantly by a global diversification strategy. However, only the global value investment strategy based on relative NAV spreads provides superior risk-adjusted returns.

4.4.3 Discussion

Although the idea to invest in the most underpriced securities relative to their estimates of fundamental value is theoretically appealing, several reasons may explain why the global value investment strategy based on absolute NAV discounts fails to produce superior risk-adjusted returns. First, individual stocks and entire sectors may trade at depressed levels over extended time periods. But our analysis is based only on a monthly trading strategy, which is designed to benefit from short-term return dynamics. Thus, the strategy may work better over longer investment horizons, which is beyond the scope of this paper.

Second, and related to the first problem, the global value portfolio based on absolute mispricing may contain stocks that are not cheap on a within-country basis. This may negatively impact absolute performance, because growth stocks tend to produce lower returns. Third, the introduction of IFRS and associated fair value-based accounting regimes in many countries has increased the information quality and accounting comparability across countries, as Horton et al. (2013) note. Nevertheless, Kvaal and Nobes (2010) reject the hypothesis that IFRS practices are the same across countries, thus the international comparability of accounting data is still far from perfect.

Finally, a fair value-based NAV is clearly an imperfect measure of fundamental value, although it is certainly better than historical cost-based book values of, e.g., tech companies. Therefore, large NAV discounts may simply be justified, or at least uncertainty regarding the justification may warrant a risk premium.

In contrast, the global value investment strategy based on relative NAV spreads implicitly addresses many of these shortcomings. Investing in the global sample of stocks that are cheapest relative to their peers in the same country not only avoids the potential problem of investing in growth stocks, but it also controls for various types of cross-country systematic differences. For example, differences in accounting practices across countries may justify systematically different levels of NAV discounts.

A similar argument can be made for cross-country institutional differences such as tax regimes. In particular, the REIT structure that is so prevalent in many companies in our sample is often associated with strong tax advantages. Consequently, a higher premium to NAV would be warranted for REIT-dominated countries, or for countries with low corporate taxes. This may explain the high average premium to NAV for Canadian stocks, which are all classified as REITs, and are hence not subject to taxation at the corporate level.

We acknowledge some potential limitations of our study. To avoid the impact of exchange rate effects on our results, for example, we consistently use local currency returns, which assume fully hedged positions. And accounting for hedging costs would reduce absolute performance, but our major implications regarding the relative performance of the global value portfolio over the global growth portfolio should be unaffected.

Furthermore, we do not account for transaction costs, which may be particularly high if portfolios are rebalanced on a monthly basis. Currency hedging costs should exhibit a symmetrical effect on all portfolios and on the benchmark. But transaction costs may be more detrimental to a global value portfolio if it invests predominantly in smaller, and hence potentially less liquid, stocks with higher transaction costs.

We attempt to minimize any issues caused by small and illiquid stocks by choosing an index with particularly strong minimum liquidity requirements. For this reason, Serrano and Hoesli (2009) find that the FTSE/EPRA Global real estate index is well suited to evaluate the performance of active trading strategies. Nevertheless, the global value portfolio sorted according to relative mispricing loads significantly on the SMB factor, which suggests relative transaction costs are higher. Assuming that transaction costs for stocks in the global value portfolio are 0.5% higher per trade, and assuming an annual turnover rate of 100% for all portfolios and the benchmark, the annualized value premium would be reduced by 1%.

4.5 Conclusion

This paper examines a global value investment strategy in the context of fair value-based NAVs as proxies for fundamental value. We consider a special case of global diversification by focusing on value stocks whose risk-return profiles make potential diversification gains particularly desirable. We use a sample of 255 real estate stocks in 11 countries with fair value-based accounting regimes over the 2005-2014 period. We find the value premium can be captured using a global investment strategy, but only when based on relative instead of absolute mispricing.

Investing in the most attractively priced stocks relative to their peers in the same country seems a particularly suitable way to benefit from short-term return dynamics. Our results suggest that the country-level "catching-up" processes are what drive our results. Because there are few theoretical reasons why this type of mean reversion at a country level would be highly correlated across countries, this opens the potential for strong diversification gains, which may ultimately explain the superior risk-adjusted returns. Overall, our results suggest that the value premium is diversifiable, at least at a global level. This finding is in contrast to Fama and French (1993), who argue that the excess returns of value stocks are subject to undiversifiable factor risk.

While our empirical results are based on a sample of real estate stocks, our findings have broader implications. In principle, we believe our empirical approach, which includes the methodological innovation of sorting stocks based on relative NAV spreads, could be transferred to any international or intersectoral dataset that provides relatively reliable estimates of fundamental value.

Chapter 5

Conclusion

This dissertation aims to explore the tension between the asset and fund liquidity of real estate investment vehicles. Chapter 1 provides a rationale for the existence of real estate investment vehicles, and describes how open- and closed-end real estate funds provide a means of investing in an inherently illiquid asset on a day-to-day basis. It also identifies the liquidity-providing mechanism as a potential source of tension. Chapter 2 examines fund flows into German open-end real estate funds, and documents that investors tend to chase the best past performers. Furthermore, the shape of the flow-performance relationship is found to depend on the liquidity ratio of the fund, suggesting that investors are aware of the risks associated with low fund liquidity. Chapter 3 highlights the crucial role of fund flows in the context of real estate fund openings. The documented real estate-specific cannibalization effect following a fund opening is a threat to the existing funds of a family. High inflows into a fund family's existing real estate funds are shown to be key to overcoming this cannibalization barrier, because positive inflows strongly increase the probability of a real estate fund opening. The excess returns to the investment strategy examined in Chapter 4 provide evidence that the prices of publicly traded real estate stocks may deviate too far from their intrinsic values.

The joint consideration of these key issues related to the tension between asset and fund liquidity for two entirely different types of real estate investment vehicles leads to important conclusions. Investors face a trade-off when deciding which vehicle to use to gain exposure to real estate as an asset class. The pricing mechanism of open-end real estate funds, which is tightly bound to the value of the underlying assets of the fund, results in a relatively good transformation of the risk-return characteristics of direct real estate. Accordingly, open-end real estate funds should be a good proxy for direct real estate, which regularly obtains high optimal allocations in multi-asset portfolio studies. In line with this view are the results of Schweizer et al. (2011), who find that German open-end real estate funds have a diversification advantage over real estate stocks in mixed-asset portfolios. The drawback of the NAV-based pricing mechanism and the associated open-end fund structure is that open-end real estate funds are subject to liquidity risk. The results in Chapter 2 suggest that investors are aware of these risks, however. The results in Chapter 3 suggest that fund family managers try to minimize the liquidity risk of open-end real estate funds when they decide whether to open a new real estate fund. However, the liquidity risk cannot be entirely eliminated, as evidenced by the recent financial crisis.

In contrast, investors in closed-end real estate funds or real estate stocks do not face the risk of temporary share redemption suspensions or potentially costly portfolio liquidations due to other investors' redemptions. But the pricing mechanism of real estate stocks makes them more susceptible to the fads and fashions of stock markets. The success of the trading strategy presented in Chapter 4 suggests that the risk-return characteristics of the underlying assets are not always sufficiently transmitted by publicly traded real estate stocks. In line with this view are the results of MacKinnon and Al Zaman (2009), who document that REITs become a redundant asset class when direct real estate is available. Overall, real estate investors face a trade-off between liquidity risk and stock market risk.

This dissertation seeks to contribute to a better understanding of the yet underexplored strand of research on real estate investment vehicle structures by documenting the various ways that market participants affect or are affected by tensions between asset and fund liquidity. These issues are not only relevant for investors and financial intermediaries, but also for legislators. In July 2013, the German legislature responded to the recent financial crisis by introducing the Kapitalanlagegesetzbuch (KAGB). Prior to the passage of this Act, German open-end real estate funds issued and redeemed shares on a daily basis. Today, investors must announce their redemptions twelve months in advance, and face a minimum holding period of 24 months. This change reduces the liquidity transformation provided by the vehicle, but it also reduces the liquidity risk.

Future research may wish to explore the numerous variations of the two major real estate investment vehicles studied here. Ultimately, the choice of the optimal real estate investment vehicle structure depends on specific investor characteristics such as risk tolerance, investment horizon, and the ability to bear liquidity crises.

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