Liquidity Transformation Risk: An Investigation of German Open-End Real Estate Funds

DISSERTATION
zur Erlangung des Grades eines Doktors der Wirtschaftswissenschaft
(Dr. rer. pol.)

eingereicht
an der Fakultät für Wirtschaftswissenschaften
der Universität Regensburg

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Tag der Disputation: 10.07.2018

Acknowledgements

I would like to thank my first supervisor and co-author, Professor Dr. Steffen Sebastian, and my second supervisor, Professor Dr. Klaus Röder, for their guidance and support. I greatly appreciated their always helpful advice.

Moreover, I would also like to thank my other co-authors Michael Heinrich, and René-Ojas Woltering for their hard work on our joint research projects.

At last I am deeply grateful to my wife Elizaveta and to my family for their strong encouragement.

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Chapter 1

Introduction

The German public consider residential property as desirable. In economic terms this is a reasonable wish, since real estate investors gain substantial, relative stable returns from their direct real estate assets due to rental income or the saving of own rental costs in case of owner-occupied property. Especially in current times of historical low interest rates, an investment in direct real estate seems to be even more favorable, when comparing real estate returns to capital market returns. Real estate asset returns are also considered to show less volatility compared to stocks. The stock market's volatility is one reason for the common German mistrust in the secondary market.

In addition, direct real estate provides a considerable inflation protection due to an general increase in property values in response to inflationary pressures and index lease agreements. This inflation protection is of special importance for German investors, since the accruing hyperinflation in succession of the Great Depression of 1923 was a trauma for the German society and, therefore, fear of inflation became a commonplace in Germans collective memory.

As a consequence, home ownership is generally considered as a conservative, preferable investment opportunity and serves for numerous people as a central part of their retirement planning.

Nevertheless, direct real estate investments also exhibit considerable risks. For most pri-

vate investors the purchase of a house or an apartment is a one-in-a-lifetime decision. These investors get into debt to purchase real estate to an extent, which exceed their current overall fortune. This considerable lot size risk is especially true for direct real estate investments in Germany's "Big 7" cities, which show a tremendous increase in real estate prices in the last decade. Moreover, due to large lot sizes, the construction of a diversified direct real estate portfolio for private investors is unfeasible. Therefore, direct real estate investments additionally contain a considerable cluster risk.

One preferable investment opportunity for German investors, which are not willing to participate in the stock market, and seek to avoid the addressed risks of direct real estate are German open-end real estate funds. Investors of these listed indirect real estate investments are able to purchase fund shares for a minimum investment amount per share from EUR 40 to EUR 100, which eliminates the lot size risk.[1] For this minimum amount, fund investors are able to participate on the advantages of direct real estate. Fund investors also avoid the risk of insolvency associated with excessive property loans. Investors additionally benefit from the fund managements's portfolio diversification, since open-end real estate funds invest their capital worldwide and across different asset classes.

Moreover, German open-end real estate funds also provide a liquidity transformation for investors. For decades, these funds gave their investors the opportunity to constantly redeem fund shares, while most of the capital is invested in long-term real estate assets. As a consequence of these several advantages, open-end real estate fund are very popular in Germany, with invested capital of about EUR 171 billion (as of June 2017).

Nonetheless, this provided liquidity transformation bear the risk of a fund closure. In succession of the global financial crisis, starting in October 2008, ten open-end real estate retail funds, which represent 25% to 30% of the entire asset class, had to close due to liquidity squeezes.[2] Later on, these funds were also forced to liquidate their real estate portfolio.

[1] Mitropoulos (2017).

[2] The share depends considering either all funds, which are officially addressed as open-end real estate retail funds or "actual" retail funds, which exhibit a minimum investment amount below EUR 10.000.

This situation lead to a never seen before fund crisis, and creates large uncertainty. This thesis is designed to reduce the uncertainty of all market participants about an investment in German open-end real estate funds, and especially about the funds liquidation process. Accounting for the past helps to lower current uncertainty and, therefore, lead to a more stable market environment in case of future fund crises. This task is of special importance for German real estate retail investors, since these investors highly favor low volatility.

The present thesis is divided into three single studies (Chapter 2 to Chapter 4), which focus respectively on specific topics associated with the German open-end real estate fund crisis.

At first, it is of particular interest to derive the determinants of fund closures to answer the question why some funds were forced to close in succession of the global financial crisis, while others, which are exposed to the same market environment, remain unaffected. It becomes apparent that funds capital inflows, as well as larger liquidity ratios diminish fund closure probability. Moreover, funds immanent economies of scale and scope also show a decreasing effect on fund closure risk. In contrast, external spillover effects caused by other open-end real estate fund closures, as well as a greater share of institutional fund investors increase a funds closure probability.

A further step to diminish investors uncertainty, is to analyze the influential factors on fund performance, and the secondary market conditions, especially for distressed fund shares. It shows that emerging discounts to net asset value (NAV) on the secondary market for distressed funds, decrease fund performance due to fund managements loss in bargaining power in the selling process and due to pressure from current fund investors. These discounts to NAV are also a measure for the level of investors uncertainty about the liquidation process in general, as well as about the current real estate asset valuation. Beside the influence on fund closure risk, funds economies of scale and scope also positively affects fund performance.

Since, the discount to NAV play a key role to work through this open-end fund crisis, it is reasonable to analyze, at last, which internal (i.e., fund-specific) and external factors

influence the price reduction for fund shares on the secondary market. It became apparent that funds leverage ratio increase discounts to NAV, while a large liquidity ratio diminish them. Moreover, the discount to NAV depends on conflicts of interest between current fund investors and fund management. Besides these fund-specific factors, NAV discounts are also driven by spillover effects from the announcement of other fund liquidations, and by investor sentiment. This sentiment influence is proxied by the aggregate level of overall capital flows into the fund industry and by the degree of macroeconomic uncertainty.

Summarizing, all considered topics, which are associated with the German open-end real estate fund crisis, exhibit a significant influence of external, predominantly uncertainty-related, factors.

In succession of this serious fund crisis, there was also a large debate how to change the legal environment for open-end real estate funds to avoid future fund closures. Subsequently, the investment law was amended several times. To account for this legal changes, we additionally test the effect of the legal environment (i.e., selling restrictions for the real estate assets in times of closure) for German open-end real estate funds by including dummy variables indicating the current selling restriction in all three parts of this thesis. Nevertheless, we find no significant influence of law enforced selling restrictions on funds closure probability, performance, or discount to NAV.

Chapter 2

The Determinants of Real Estate Fund Closures

This study is the result of a joint project with Michael Heinrich, René-Ojas Woltering, and Steffen Sebastian

2.1 Introduction

With invested capital of EUR 145 billion, the German open-end real estate fund industry is the predominant indirect German real estate investment vehicle and the largest market for open-end real estate funds worldwide.[1]

Investors in open-end real estate funds trade with the fund's investment company, which sells and redeems shares at net asset value (NAV) on a regular basis. The open-end structure is associated with considerable "bank run" risk (i.e., fund run risk), because of the long-term direct real estate investments and daily share redemptions (Bannier et al. (2008); Weistroffer and Sebastian (2015); Fecht and Wedow (2014)). Therefore, German regulation demands a minimum liquidity reserve of 5% of a fund's NAV. In practice, average liquidity ratios range from 20%-30% (see Downs et al. (2017)). Nevertheless, these liquidity ratios occasionally prove insufficient, especially during times of high volatility.

[1] Downs et al. (2016).

The German open-end fund industry was hit severely in the aftermath of the global financial crisis. Starting in October 2008, ten public German open-end real estate funds with total assets under management of about EUR 28 billion were forced to suspend share redemption.[2]

We use a panel logit model to explain fund closure probability. Our empirical study is based on a monthly panel dataset that consists of twenty-four open-end German real estate retail funds, and which covers all closure events in the history of the asset class.[3]

We find that fund closure probability increases with increasing fund run risk, which is represented by a fund's liquidity ratio and net capital inflows. Economies of scale and scope, proxied by fund size, age, and the presence of a distribution network for fund shares, help prevent fund closures. Moreover, we find evidence that industrywide spillover effects from the closure of other open-end real estate funds tend to increase fund closure probability. Lastly, we find evidence that a larger share of institutional investors increases fund closure probability.

Identifying fund closure determinants helps diminish uncertainty about the overall asset class, while restoring trust in the remaining funds.

The most recent example of a fund crisis was the massive share redemptions from U.K. open-end real estate funds that took place in the aftermath of the Brexit referendum on June 23, 2016. Seven public open-end funds from the U.K. closed, which represented one-half the total assets under management of the U.K. market.[4] Hence, open-end fund participants in foreign countries like the U.K. could learn from the German experience.

The study is structured as follows. The next section (Section 2.2) gives an overview of the German open-end fund crisis. Section 2.3 describes the used variables, which are mainly

[2] The regulatory regime was modified in succession of the fund crisis. Nevertheless, our analysis is unaffected by those changes, since fund closure events occurred under the prior investment law (InvG, effective from January 1, 2004-July 22, 2013).

[3] In our sample, we focus on retail funds. We exclude semi-institutional funds, which are primarily intended for institutional investors. Semi-institutional funds are legally classified as retail funds, but the minimum investment ranges from EUR 10,000 to EUR 1 million.

[4] M&G Property Portfolio, Henderson UK Property PAIF, Standard Life UK Real Estate Fund, Aviva Investors Property Trust, Columbia Threadneedle UK Property Authorised Investment Fund (PAIF), Canada Life UK Property Fund, and Aberdeen UK Property Fund.

derived from the existing literature of business failure prediction models. Section 2.4 illustrates the dataset, while the regression results are presented in section 2.5. The last section exhibits our conclusion.

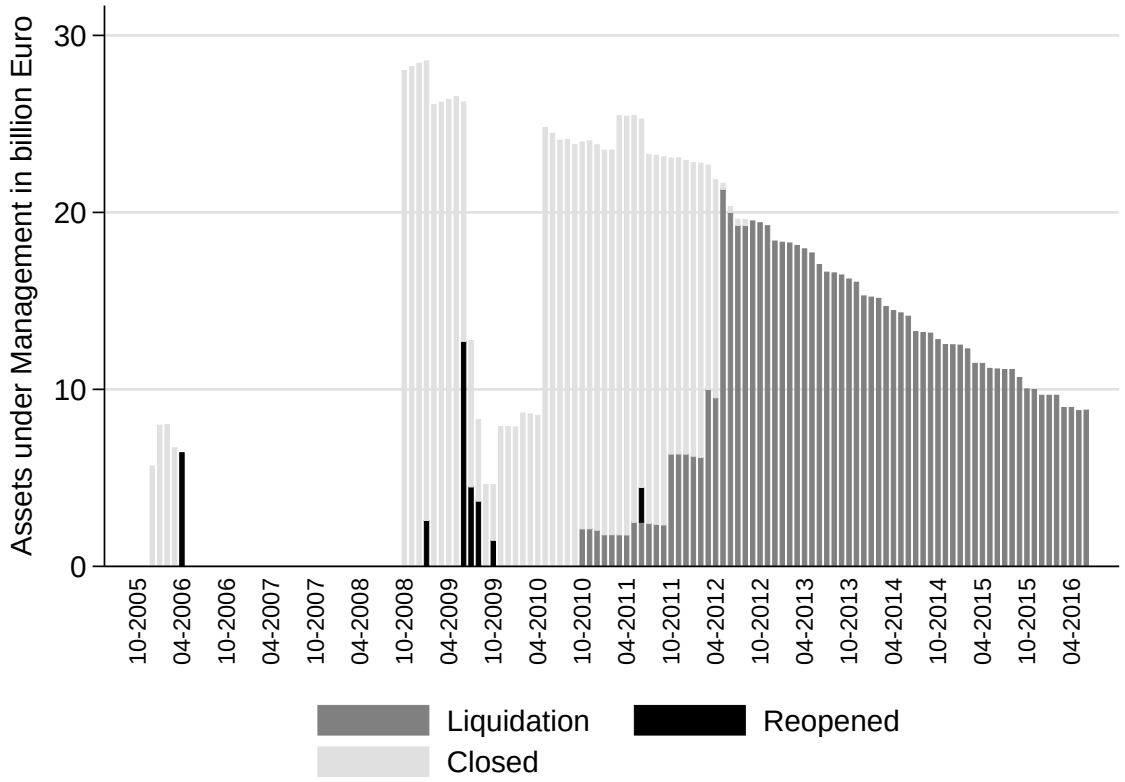
2.2 The German Open-End Fund Crisis

German open-end real estate funds are required by law to close (i.e., suspend share redemptions) if liquidity ratios fall below 5%. A shortfall in the fund liquidity ratio is very serious because open-end real estate funds are obliged to sell their real estate assets in the aftermath of their closure without a discount to the last appraisal value. Closed funds must sell sufficient assets to raise their cash reserves and fulfill share redemptions (i.e., reopen).

After a twenty-four-month period, funds are forced to sell off their entire real estate portfolios and pay out the proceeds to investors. However, selling properties during times of market turmoil, especially in the first months of closure, is almost impossible. Hence, all the funds that closed in October 2008 were ultimately forced to liquidate after the twenty-four-month period. Nevertheless, seven of these funds reopened subsequent to their first close in October 2008, but all were forced to close for good for a second time.

Figure 2.1 shows the size of closed German open-end real estate funds (grey bars), as well as the size of funds in liquidation (dark grey bars). The graph also illustrates the size of fund reopenings (black bars). During the first fund crisis in 2005/2006, two open-end real estate retail funds with total fund volume of EUR 8 billion, closed. These closures were caused by short-term uncertainty about the funds' property valuations. After a short period of time, both funds reopened. The second, and larger, crisis began in October 2008, with the closure of ten funds, with assets under management of about EUR 28 billion. The reopening of several funds over the following twelve months suggested an upward trend. Nevertheless all of these funds were forced to close again. As of May 2010, the total fund size of distressed funds was equal to earlier levels of around EUR 27 billion. Following

Figure 2.1: Overview Open-End Fund Crises



This figure shows the total fund size of German open-end real estate funds that either suspended share redemptions (grey bars) or were already in the process of fund liquidation (dark grey bars). The graph also indicates the total fund size of reopenings (black bars).

the first fund liquidation announcement in October 2010, and through August 2012, all previously closed funds were forced to announce their liquidations. The decreasing fund size over the sample period, as shown in Figure 2.1, is due to two primary effects: 1) The proceeds from distressed funds' sold properties were distributed to investors, and 2) a decrease in property appraisal values. As of June 2016, about EUR 10 billion of invested capital remained inaccessible to investors.

Table 2.1 gives a clear overview of the fund closure and liquidation dates.[5]

[5]The HansaImmobilia fund was ultimately forced to close and liquidate in 2012 without a twenty-four-month closing period. Furthermore, the UniImmo global fund closed in 2011 for three months due to uncertainty about its Japanese property reappraisals following the Tohoku earthquake. The UniImmo global fund was able to reopen.

Table 2.1: Overview Open-End Fund Closures and Liquidations

fund	1. crisis	2. crisis	last closure	notice liquidation
AXA Immoselect	-	10/08 - 08/09	11/09	10/11
CS Eur.	-	10/08 - 06/09	05/10	05/12
DEGI Eur.	-	10/08	10/08	10/10
DEGI Int.	-	10/08 - 01/09	11/09	10/11
HansaImmobilia	-	-	10/12	10/12
KanAm Grund.	01/06 - 03/06	10/08 - 07/09	05/10	03/12
MS P2 Value	-	10/08	10/08	10/10
UBS 3 Sector RE	-	10/08 - 10/09	10/10	09/12
SEB ImmoInvest	-	10/08 - 06/09	05/10	05/12
TMW Immobilien	-	10/08 - 10/09	02/10	05/11
DEKA Immo. Global	-	-	-	-
DEKA Immo.Fonds	-	-	-	-
DEKA Immo. Eur.	-	-	-	-
EURO ImmoProfil	-	-	-	-
Inter ImmoProfil	-	-	-	-
Grundbesitz Eur.	12/05 - 03/06	-	-	-
Grundbesitz Global	-	-	-	-
HausInvest Eur.	-	-	-	-
HausInvest Global	-	-	-	-
UniImmo D.	-	-	-	-
UniImmo EUR.	-	-	-	-
UniImmo Global	-	03/11 - 06/11	-	-
WestInvest 1	-	-	-	-
WestInvest Inter.	-	-	-	-

This table provides an overview of all open-end real estate retail funds. It gives the date of the first closure of each fund during the first fund crisis in 2005/2006. Nine funds closed in the second fund crisis in October 2008; seven of these reopened for a certain period of time. Those funds show a second closing date. After twenty-four months of closing, all nine funds were required to announce their liquidations. Column 5 gives the liquidation date.

2.3 Related Literature and Hypotheses

Our theoretical framework on fund closures is based on the literature on business failures. Business failure prediction models generally focus on identifying an imminent financial crisis by predicting individual firm insolvencies. Several firm bankruptcies can cause considerable negative economic effects (i.e., high unemployment rates and reduced stability of the financial market in case of bank failures). Kupiec and Ramirez (2013) find that U.S. bank insolvencies cause a significant drop in the overall economic development in the 1900 to 1930 period. Because of the importance of these issues, the literature on failure prediction models covers a plethora of scientific work over the past fifty years, beginning with Beaver (1966). Following Balcaen and Ooghe (2006), Zavgren (1985), Sheppard

(1994), Zmijewski (1984), Swanson and Tybout (1988), and Becchetti and Sierra (2003), we focus on conditional probability models, especially logit models. Zhao (2004) for example apply a logit model to derive the determinants of fund closings for U.S. open-end mutual funds in the 1992 to 2001 period.

One common problem of failure prediction models is that the balance sheet items are inconsistently defined. However, the fund-specific variables are regulated by law, so they are identically defined for all funds. Real estate fund closures are therefore somewhat predestined for use in failure predicting models.

According to Balcaen and Ooghe (2006), another important problem is how to precisely define failure. Most studies use a change in corporate legal status as the definition of a failure, although the closure of a fund does not immediately imply a loss for investors. Nevertheless, at the time of closure, the open-end fund structure dissolves, which does change the intrinsic nature of the fund. Therefore, we use the legal event of "fund closure" to mean failure in an effort to avoid the problem of poorly defining the dichotomy of the dependent variable.

Failing to capture corporate failures in a sample time period is another issue for failure prediction models. As a result, we find that the corporate qualities that may lead to a subsequent failure are assigned to the group of non-failing individuals. Moreover, most studies on failure prediction are non-random regarding particular industries or size classes. To avoid a distortion, we include the entire relevant time frame, including all fund closures independent of age, size, or investment focus.[6]

2.3.1 Fund Run Risk

Whenever fund investors observe increasing share redemptions that threaten to exceed a fund's liquidity ratios, they have an incentive to redeem their own shares. In the worst case, this "vicious cycle" leads to a fund closure. The mechanism is similar to a bank run, and is a serious shortfall of the open-end structure. Therefore, sufficiently large liquidity

[6] Balcaen and Ooghe (2006).

ratios are required. During times of economic uncertainty, this safety buffer can diminish the harmful impact of share redemptions.

Hill et al. (2011) find that a higher liquidity ratio, calculated as cash to total assets, leads to a lower probability of business failure. Gilbert et al. (1990) study the bankruptcies of seventy-six U.S. firms from 1974 through 1983, and find that larger liquidity ratios decrease the probability of a bankruptcy. Therefore, we expect a negative relationship between liquidity ratio and closure probability.

Large capital outflows that exceed a fund's cash reserves generally lead to fund closure. Individual fund net flows can be a consequence of poor fundamentals, such as, e.g., low liquidity ratios, high leverage ratios, or excessive management fees. If investors lose trust in their investments, they may opt to redeem shares.

On the other hand, fund net flows could affect fund closure probability independent of fund-specific variables. Bannier et al. (2008), for example, find that investors redeem shares only because of expected share redemptions by other investors. Those expectations could be a result of reported capital outflows, which by themselves do not allow for any direct conclusions about a fund's economic situation. Therefore, capital outflows may be a crucial element of a "self-fulfilling prophecy" that leads to fund closures. Hence, individual fund net flows could serve as an additional proxy for fund run risk.

The potential impact of a fund run leads us to Hypothesis 1:

Hypothesis 1: *Fund closure probability increases with increasing fund run risk.*

2.3.2 Economies of Scale and Scope

According to Laitinen (1992), Hill et al. (2011), and Assadian and Ford (1997), corporate size plays an important explanatory role in business failures. Size is a proxy for potential economies of scale and scope, as well as for learning effects. Hence, larger companies should exhibit lower failure probability.[7] Moreover, large open-end real estate funds that

[7] Hill et al. (2011).

show significant growth in prior periods are more likely to attract different, and therefore sufficiently uncorrelated, target groups. In contrast, smaller funds are more likely to depend on only a few investors. On the contrary, Laitinen (1992) finds that newly founded and fast growing companies (i.e., growth in net sales) that exhibit high leverage ratios also tend to exhibit higher bankruptcy risk. Moreover, Assadian and Ford's (1997) study on U.S. corporate bankruptcies from 1964 through 1991 finds that larger firms exhibit a higher probability of failure.

Although the literature is generally ambivalent about the sign of the influence on firm size, we include fund size as an additional explanatory factor. We suspect that the diminishing effect of size due to economies of scale and scope is dominant over the increasing effect of rapid growth on closure probability. Hence, we expect a negative overall influence of fund size on closure probability.

Company age is also a significant factor in business failures.[8] Young companies have a higher probability of failure than older ones. Analyzing Canadian corporate bankruptcies in 1996, Thornhill and Amit (2003) state that age indicates economies of scope in the organizational process. Therefore, we include fund age as a further fund-specific variable.

We note that eight of the twenty-four open-end real estate funds belong to large German banks.[9] Fund shares are sold by the retail distribution networks of these banks, which are actively advertised by bank advisors. Therefore, bank-owned funds have direct access to a plethora of bank customers. In addition, the purchase of open-end real estate fund shares is often part of clients' pension provision solutions, which are directly sold by the fund's sponsor (bank). Therefore, these funds have a wider target group and larger economies of scope than funds without such a distribution network.

Maurer et al. (2004) state that fund sponsors can buy a sufficient amount of their own fund shares during times of high share redemptions to stabilize liquidity ratios. Hence, the financial power of the fund sponsor may serve as an additional element to prevent

[8] Thornhill and Amit (2003).
[9] Hausinvest funds, DEGI funds, Grundbesitz funds, DEKA funds.

fund closures.[10] The open-end real estate funds that use a distribution network belong to the largest German banks and financial syndicates. Hence, we use the existence of a distribution network as an additional proxy for economies of scale and scope. The possible influence of economies of scale and scope are the basis of our second hypothesis:

Hypothesis 2: *Fund closure probability decreases with increasing economies of scale and scope.*

2.3.3 Industrywide Spillover Effects

Although fund specifics are suitable to describe a fund's economic situation, Zavgren (1985) and Maltz et al. (2003) find they are not sufficient to fully explain the probability of fund closure.

According to Aharony and Swary (1983) large-scale bank insolvencies lower the stock market value of the remaining solvent banks. Moreover, Bannier et al. (2008) analyze the first German open-end fund crisis in 2005/2006, and find that the closure of a particular fund can result in significant contagion effects to the overall industry. Closed funds could be forced to sell assets to reopen again, or, in the case of a subsequent liquidation, must sell their entire portfolio. Because total assets under management often amount to several billion euros, fire sales could lead to lower real estate prices for a fund's portfolio properties. Furthermore, open-end real estate funds often share the same investment focus (e.g., asset class, investment volume, country share), so a significant price drop could affect the overall property prices of the remaining funds. These funds sell parts of their real estate properties on a regular basis, and, therefore, could be directly affected by lower overall property prices, especially during liquidity shortages.

Our third hypothesis accounts for these potential negative externalities.

Hypothesis 3: *Negative spillover effects from the closure of other funds may increase fund closure probability.*

[10] However, in December 2005, when the Grundbesitz investment fund experienced a liquidity shortage, Bannier et al. (2008) note that the fund sponsor Deutsche Bank was not willing to pay for its "own" fund shares.

2.3.4 Institutional Investors

On average, 98% of all fund shares are held by retail investors. Thus, our research design focuses solely on retail funds. Nevertheless, some funds have a considerably larger share of institutional investors than others (the range is typically from 0% to 30%). These professionals exploit stable, valuation-based fund returns, and regard them as a high-yielding alternative to money market investments.

Prior to the crisis, when interest rates were low, institutional investors used the open-end fund structure to "park" their capital in higher-yielding open-end real estate funds. As the crisis deepened, professionals have to decide if their investment in open-end real estate funds is still favorable regarding the current risk-return profile. In consequence, they could even be forced to sell their shares, which could come as a surprise to the remaining retail investors. This effect increases with the share of professional investors.

According to Larrain et al. (2017), legal restrictions for pension funds led to distressed sales of Chilean stock holdings, which caused a significant higher loss for these stocks than for others. Hence, retail investors should consider the prevailing blockholder risk, which could create additional selling pressure and decrease a fund's liquidity ratios. Our fourth hypothesis reflects the risk associated with potentially fast-moving "smart money."
Hypothesis 4: *Fund closure probability increases with the share of institutional investors.*

2.3.5 Control Variables

Our control variables include management costs as an additional fund-specific factor. Fund investors, as well as potential new investors, may consider management fees as too high, which could lead to selling pressure or a lack of inflows. In particular, we use the fund-specific total expense ratio (TER), and we expect an increasing effect on fund closure probability.

We also control for funds' annual total returns as a measure of fund performance. While

large returns indicate funds high quality, there is also the possibility, especially in times of financial crisis, that these funds did not fully reappraise their portfolio to current, hence lower, values. This uncertainty about the current valuation could increase the funds closure probability.

Total return also includes the entire history of dividend fund payouts. Flagg et al. (1991) use COMPUSTAT data for the 1975-1981 time frame, and find that the reduction of dividends is a significant predictor of business failure.[11] We expect funds with higher dividend payouts to exhibit a lower closure probability.

Hill et al. (2011), Dimitras et al. (1996), and Zavgren (1985) find that a higher ratio of total liabilities to total assets increases the probability of bankruptcy. Therefore, we use funds' leverage ratios as an additional control variable affecting the probability of fund closure, and we expect a positive sign.

To strengthen our regression results, we also control for the macroeconomic environment by considering macroeconomic uncertainty and the returns of competing asset classes. The macroeconomic development of the national economy, especially during downturns, has a significant impact on business failure probability.[12] We use two popular uncertainty indices to control for macroeconomic influence. First, the Policy Uncertainty Index Europe from Baker et al. (2017) for macroeconomic uncertainty. Moreover, we use one of several implied volatility indices (shortened VIX), which are widely used to account for stock market uncertainty (e.g., Bekaert et al. (2013)). In detail, we use the VIX Europe volatility index based on the Eurostoxx 50. Ben-Rephael (2017) use a similar implied volatility index based on the S&P100 as a measure of uncertainty in his study to test the impact of uncertainty on fund management decision to sell assets in U.S. equity mutual funds from 1986 to 2009.

According to Zavgren (1983), higher interest rates can strongly affect bankruptcy rates. Moreover, Swanson and Tybout (1988) identify the interest rate as one of the two most important explanatory factors for business failures. Hence, we control for the external

[11] Flagg et al. (1991).
[12] Bhattacharjee et al. (2009).

environment by using the one-year German government bond yield to account for the German interest rate level, and the dividend yield of the German blue-chip stock market index (DAX30) to control for the return potential of the competing stock market. We also control for the development of the fund's target real estate markets by using the country-specific EPRA total return.

2.4 Data, Methodology, and Sample Description

2.4.1 Data

We use a panel logit framework to analyze fund closure probability for twenty-four open-end real estate funds over a 167-month period from August 2002 through June 2016. These twenty-four funds represent the population of both distressed and healthy open-end German real estate retail funds. Ten of the twenty-four funds were issued in the 2000s, five after August 2002. Therefore, our dataset begins in August 2002 in order to ensure a strongly balanced panel framework. Note further that a new investment law (InvG) was decided on in January 2002, based on an EU directive. This new regime had a significant effect on the legal environment for open-end real estate funds. The use of annual accounting information is also common in failure prediction models.[13] Hence, our data consists of monthly, semiannual, and annual fund reports provided by individual fund management to estimate the impact of fund-specific variables such as liquidity, leverage, and management fees on closure probability.[14] Furthermore, we use data about professional investors from MorningStar Direct.

[13] See, e.g., Balcaen and Ooghe (2006) and Dimitras et al. (1996).

[14] Asset Management Deutschland, AXA Investment Managers Deutschland, Credit Suisse, KanAm Grund Kapitalanlagegesellschaft, Morgan Stanley Real Estate Investing, Pramerica Property Investment, SEB Asset Management, UBS Real Estate.

2.4.2 Research Design and Variable Definitions

Our key variable of interest is the closure probability of fund *i* at the end of month *t*, which is calculated as a 0/1 indicator variable. In a fund closure month, the dummy variable is set to 1. In the following month, the distressed fund is excluded from the panel regression model. Hence, the closure events are captured solely in the panel logit framework.

For the purposes of our empirical tests, we estimate the following panel regression model:

$$\begin{aligned} Closure_{i,t} = \alpha &+ \beta_1\, Liquidity_{i,t-1} + \beta_2\, Individual\ Fund\ Flows_{i,t} \\ &+ \beta_3\, ln\ Fund\ Size_{i,t-1} + \beta_4\, ln\ Age_{i,t} + \beta_5\, Sale\ by\ bank_{i,t} \\ &+ \beta_6\, TER_{i,t-1} + \beta_7\, Total\ Return_{i,t-1} + \beta_8\, \Delta\ Leverage_{i,t-1} \\ &+ \beta_9\, Institutional_{i,t-1} + \beta_{10}\, Fund\ Closure_{i,t} \\ &+ \beta_{11}\, Policy\ Uncertainty\ Index\ Europe_{i,t} + \beta_{12}\, VIX\ Europe_{i,t} \\ &+ \beta_{13}\, German\ Bond\ 1Y_{i,t} + \beta_{14}\, DAX\ 30\ Dividend\ Yield_{i,t} \\ &+ \beta_{15}\, Individual\ EPRA\ TR_{i,t} + v_{i,t} \end{aligned} \tag{2.1}$$

Our regression results are estimated using a panel logit model with heteroscedasticity robust standard errors.

Since the provided fund-specific data is published with a significant time lag, we include a one-month time lag for these variables. In contrast, the individual fund flow variable, age, sale by bank, fund closure indicators, uncertainty indicators, and macroeconomic control indicators, are included without any time lag.

Due to the large assets under management of open-end real estate funds, a closure of one or more of these funds will be recognized by both institutional, as well as retail investors. As a consequence, fund investors will adjust their fund investment strategy within one month after the closure event occurs. The current market uncertainty and economic situation are also known by investors at present day. Hence, we do not include any time lag for the variables.

We use the following two variables as proxies for fund run risk.

Liquidity denotes the liquidity ratio, which is calculated as the ratio of a fund's cash reserves to gross asset value (GAV).

Individual Fund Flows denotes capital net flows into the specific open-end real estate fund. This variable is calculated as the monthly percentage change of net capital fund flows proportional to the respective fund size.

We use three variables to test for the impact of economies of scale and scope on fund closure probability.

Fund Size is the overall logarithmic fund volume measured in billions of euros.

Age represents the logarithmic monthly fund age.

Sale by Bank is a 0/1 indicator variable that is set to 1 if the shares of a particular fund are sold by the distribution network of the fund sponsor (bank).

We proxy for the effect of potential spillover effects on fund closure probability by using the closure announcements of other funds.

Fund Closure is a counting variable that captures the effect of other fund closure announcements. Thus, we test for the impact of industrywide spillover effects.

We also test for a relationship between the share of institutional investors and fund closure probability.

Institutional represents the percentage share of institutional fund investors. It is calculated as the ratio of a fund's market value held by institutional shareholders to its overall market value.

We use the following fund-specific control variables.

TER represents the annual management costs, calculated in percentage of the overall fund size.

Total Return denotes annual NAV performance measured as the percentage change in net asset value. Total Return also includes all extraordinary payouts, which are defined as total fund-specific payouts in a given month relative to a fund's NAV.

Leverage is the absolute difference (Δ) of the fund's debt compared to its GAV. In detail,

we use the first differences of the leverage ratio to correct for non-stationarity.

Furthermore, we use the general macroeconomic environment to validate our estimation results. First, we include two variables for market uncertainty. Second, we consider the impact of bond and stock market returns as alternative investments. We also control for the country-specific market return of the fund's target markets.

Policy Uncertainty Index Europe is a measurement of overall political uncertainty in the European market. In detail, Baker et al. (2017) use major newspapers from several European countries and count the number of articles, which include simultaneously the items "uncertainty", "economic", as well as items related to the political situation.[15]

VIX Europe is the Euro Stoxx 50 Volatility Index (VSTOXX), which represents our second proxy for macroeconomic uncertainty. The index measures implied stock market risk. Furthermore, we normalize both indices to make the comparison of the magnitude of both coefficients in the model framework more easier.

German Bond 1Y illustrates the German interest level for bond investments. The interest rate of short-term German government bonds is considered the benchmark for bond investments. This variable serves as a proxy for the opportunity costs for an investment in open-end real estate funds.

DAX 30 Dividend Yield captures the return potential of the German stock market. The DAX 30 consists of the largest thirty companies in Germany. We use the dividend yield instead of stock market performance in order to find a more suitable measure of the return potential of stocks versus fund investments, and bond market returns without speculative gains.

Individual EPRA TR is calculated as the weighted monthly EPRA total return of a fund's target real estate market returns. This variable captures the development of the overall real estate markets, and serves as a proxy for the business cycle.

[15] A full list is available at: www.policyuncertainty.com.

2.4.3 Descriptive Statistics

Table 2.2 shows the summary statistics for the explanatory variables.

The liquidity ratios show significant heterogeneity over time as well as across funds. The average liquidity ratio is 25.30%, with a range from 0.7% to 81.4%. Several funds were issued within the sample period. A fund opening is accompanied by a liquidity ratio of almost 100% because the accumulated capital has not yet been invested. Thus, we first consider newly issued funds after a twenty-four-month period. The liquidity ratios increase significantly from 2012 due to the progressing liquidation of ten funds in the dataset that were forced to sell their entire real estate property portfolios and transfer the earnings to investors. Figure 2.2 illustrates the considerable increase in average liquidity ratios due to property sales beginning in Q3 2012.

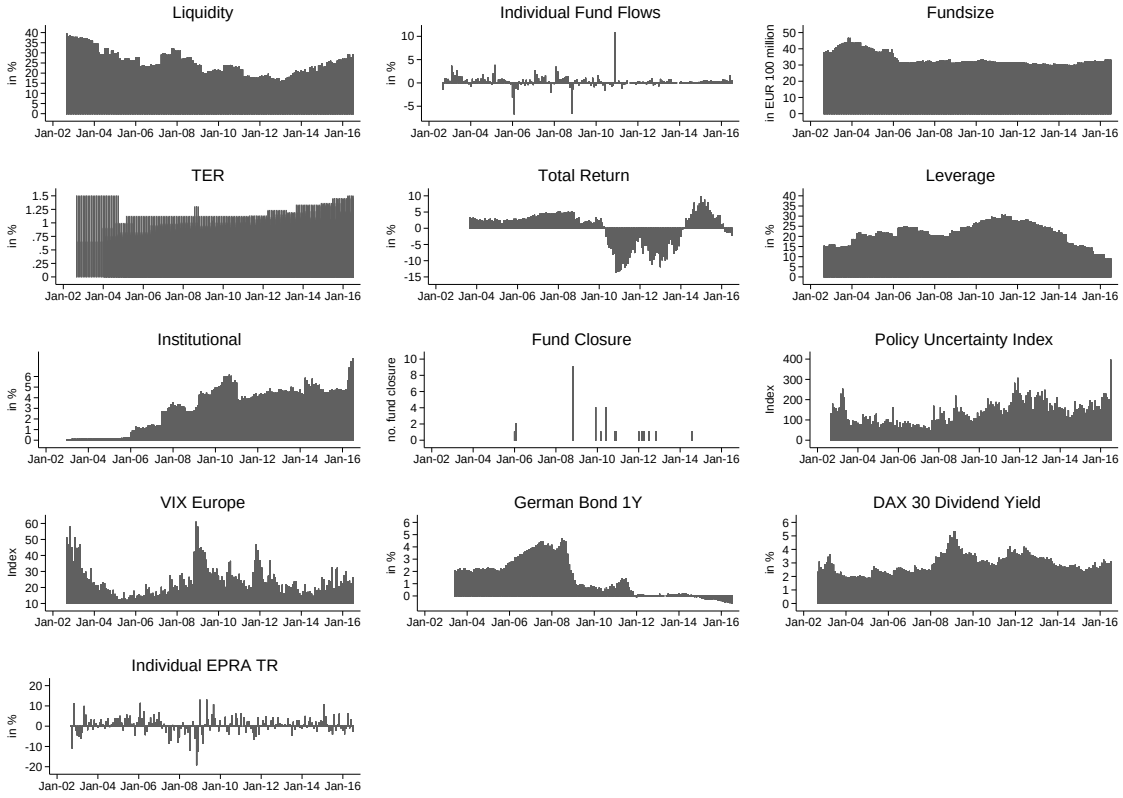
The funds show average monthly fund flows of about 0.2% relative to respective fund volume. Newly issued funds show strong capital inflows within the first two years, which could distort the regression results (note again that we only include funds if they are

Table 2.2: Overview Summary Statistics

	Mean	Std. Dev.	Min	Max	Obs
Closure	0.006	0.08	0	1	2931
Fund Specifics					
Liquidity	0.253	0.122	0.007	0.814	2820
Individual Fund Flows	0.002	0.036	-0.566	0.77	3091
Fund Size	36.118	32.772	0.69	136.896	3226
Age	242.927	173.67	25	599	3121
Sale by Bank	0.392	0.488	0	1	3173
Institutional	0.02	0.048	0	0.319	2144
TER	0.008	0.002	0	0.015	2554
Total Return	0.012	0.078	-0.579	0.489	2485
Leverage	0.222	0.113	0	0.641	2797
Industrywide Spillover					
Fund Closure	0.195	0.926	0	9	3246
Macroeconomic Control Variables					
Policy Uncertainty	138.466	55.911	47.694	394.635	3246
VIX Europe	24.939	9.920	11.938	60.677	3246
German bond 1Y	0.016	0.015	-0.006	0.047	3087
DAX 30 Dividend Yield	0.03	0.007	0.019	0.053	3246
Individual EPRA TR	0.005	0.052	-0.274	0.387	2899

This table provides an overview of the mean, standard deviation, minimum, maximum, and number of observations for all variables.

Figure 2.2: Summary Statistics



This figure illustrates the average progression of fund-specific, industrywide spillover effects and macroeconomic control variables from 2002:8 through 2016:6.

at least twenty-five months old). Moreover, several funds within the same fund family merged within the sample period.

For example, the WestInvest 1 fund had monthly capital outflows of 100% (purely arithmetical) in October 2009 due to a fund merge with the WestInvest Interselect fund, which had tremendous capital inflows over the same period. For the same reason, the Inter Immoprofil fund displayed a 248% capital inflow in November 2010. We control for fund merges by excluding these special events from our dataset (n = 5) in order to avoid distortions. Subsequently, the Euro ImmoProfil fund now shows the maximum capital inflows of 77.0% at the beginning of 2005, while the Inter ImmoProfil fund has -56.6% capital outflows in October 2009.

Fund size ranges from EUR 69 million to EUR 13.6 billion, with an average size of EUR 3.6 billion and a median of EUR 2.5 billion. Fund size is measured in EUR 100 million. The Deka Immobilien Europa fund is the largest open-end real estate fund, with an average

of EUR 9.87 billion and a maximum of EUR 13.6 billion. In contrast, distressed funds show a significantly negative trend in fund size. For example, the Morgan Stanley P2 value fund had a minimum of only EUR 69 million as of June 2016, due to advanced fund liquidations. But the remaining funds ultimately boosted their fund volumes due to the increased demand for open-end fund shares in Germany since 2014.

Figure 2.2 shows that average fund size decreased from EUR 4.5 billion in January 2004, due to newly issued funds (i.e., low fund volume), to the lowest levels over the 2006-January 2011 period of about EUR 3 billion. Since then, average fund size has risen, despite the fact that several funds were forced to liquidate. Significant capital inflows into the remaining funds led to an average fund volume of about EUR 3.5 billion as of June 2016.

Several funds were issued after August 2002, but within our sample period. The oldest fund at the beginning of the dataset was the UniImmo global fund at thirty-six years (433 months).

The Sale by Bank variable displays a mean of 0.39. This is because the vast majority of open-end real estate funds never switched from using a distribution network to sell fund shares to a system without a direct selling feature, or vice versa. Since October 2012, the DEGI fund family was the sole fund choosing to use a distribution network. Hence, about 40% of all funds sell shares via a distribution network.

Institutional shareholders on average represent 2% of all fund investors. The UBS 3 Sector Real Estate fund reports an institutional share of up to 31.9%, while DEGI Europa has a 0.00% minimum share and never exceeds 0.30%. According to Figure 2.2, the average share of institutional investors significantly increased to about 6% from August 2002 through Q1 2011. It subsequently decreased dramatically through June 2016. Nevertheless, the graph may be biased due to the quality of the data provided.

For example, the Morningstar Direct data is not fully available, because they only report data from seventeen of the twenty-four open-end real estate funds. Furthermore, at the end of the dataset, open-end funds with generally larger shares of institutional investors

(such as the UBS 3 Sector Real Estate fund and the TMW Immobilien Welt fund) had provided insufficient information. Therefore, the sharp decline in the average share of institutional investors reported appears excessive.

Closure announcements are clustered in a few months over the sample period. The mean of the counting variable is 0.195. In October 2008, nine funds suspended share redemptions, and four funds had been forced to close as of November 2009 and May 2010. All nine funds that closed in October 2008 reopened, but were ultimately forced to close again from November 2009 through October 2010. Hence, the counting variable, which captures every fund closure event, includes some duplicates.

TER denotes annual management costs for each investor as a percent of fund volume. Funds' expense ratios range from 0% to 1.5% of average annual fund volume. The average total expense ratio is 0.8%. Funds' total expense ratios generally increase over time. The CS Euroreal fund shows the largest management fees at the beginning of the sample period in 2002, with a 1.5% expense ratio.

Total Return is defined as the annual change in net asset value. Extraordinary payouts to investors, due to the selling off of real estate portfolios, are considered in the calculation of total return for all distressed funds, as well as in the regular dividend payout for both healthy and distressed funds. Average annual total return is 1%. Table 2.2 shows a minimum annual total return of -57.90% for the MS P2 value fund in October 2010, and a maximum of +48.9% for the Inter ImmoProfil fund in January 2016.

Leverage ratios also differ dramatically across funds. Five distressed funds (DEGI International, DEGI Europa, TMW Immobilien Welt, MS P2 Value, and UBS 3 Sector Real Estate) report leverage ratios of zero as of the end of the sample period. The Grundbesitz Europa fund exhibited a leverage ratio of 64.1% in Q3 2006 and Q1 2007. The average for all funds is 22.2%. In addition, the KanAM Grundinvest fund, which was forced to close in October 2008, exhibited an average leverage ratio of 38.66%, while the healthy Deka Immobilien global fund had only 18.48%.

Figure 2.2 shows that the average leverage ratio tended to rise through 2012. Afterward,

it decreased consistently and significantly to the end of the sample period, largely because distressed funds repay their property-related loans. In contrast, healthy funds show stable leverage ratios across time.

According to Table 2.2, our first uncertainty indicator, the Policy Uncertainty Index, displays an average index value of 138.46, with the lowest value of 47.69 in Q4 2007. In contrast, the Brexit referendum in June 2016 caused tremendous uncertainty (maximum of 394.63) in the overall European economy.

Our second uncertainty indicator is the Euro Stoxx 50 Volatility Index (VSTOXX) (commonly referred to as VIX). The VIX displays an average value of 24.94. The highest stock market uncertainty, at 60.67, is measured in Q1 2009; the lowest value of 11.93 was recorded in July 2005.

The interest rate of German government bonds with one-year maturity ranges from -0.6% in June 2016 to +4.7% in June 2008. The average interest rate is 1.6%. Figure 2.2 shows that government bond yields increase over 2002-2008. Due to the expansive monetary policy in the wake of the global financial crisis, interest rates decreased considerably and even reached negative values toward the end of the sample period.

On average, the thirty largest German companies distribute 3% annual payouts. The variable shows a minimum dividend of 1.9% in December 2004 and a maximum of 5.3% in February 2009. According to Figure 2.2, the DAX 30 exhibited relatively low dividend yields from 2004 through 2005. Afterward, dividends increased. In summary, the DAX 30 companies distributed significant and relatively stable annual dividend payments of about 2% to 4%.

Individual EPRA total returns ranged from -27.4% to 38.7%, with an average of 0.5%. Figure 2.2 shows a rather volatile development of the weighted funds' target real estate markets. The figure shows that the minimum was reached in Autumn 2008 during the financial market turmoil of the global financial crisis. In subsequent years, we observe a significant recovery of the funds' target real estate markets, with mainly positive total returns.

2.5 Results

Table 2.3 contains the results of four panel logit regression models (I-IV). The first model includes only fund-specific explanatory variables (I), while the second specification also includes the industrywide spillover variable (II). The third model (III) is estimated using fund-specific, industrywide spillover, and macroeconomic control variables.[16]

Model IV further includes the share of institutional investors. Unfortunately, Morningstar Direct provides data on fund ownership structure for only seventeen of the twenty-four funds. Hence, we lose 420 observations from model IV versus model III (N = 2,037). The standard errors of the regression coefficients are in parentheses. Due to the non-linear relationship, the interpretation of regression coefficients in panel logit models is not intuitive. While our empirical tests are based on the statistical significance of the coefficients, we use graphical analyses to judge the economic significance of our results.[17] Figures 2.3 to 2.9 show the mean marginal effect of a variation of the respective independent variable over all considered combinations with the other independent variables. We derive these figures from our preferred regression model (III), and the marginal effects of the share of institutional investors from model IV.

We first focus on testing Hypothesis 1, to determine whether higher fund run risk causes higher fund closure probability. Fund run risk is represented by the fund liquidity ratio, as well as by individual fund capital inflows. Both variables show the expected negative influence on closure probability. A larger liquidity ratio c.p. significantly reduces closure probability in the next month. This negative effect is robust for all four model specifications.

Figure 2.3 illustrates that closure probability increases if a fund exhibits a liquidity ratio of less than 5%, because, under German law, these funds are forced to close. Funds with liquidity ratios at 5% exhibit closure probabilities of about 2.5%. Under a liquidity

[16] We control for the legal fund environment (e.g., the selling restrictions on the properties) and do not confirm a significant influence on fund closure probability; According to Sheppard (1994) and Hall (1994), the level of diversification has a significant influence on business failures, but we find no influence of regional or sectoral diversification (Herfindahl index) on the probability of a fund closure.

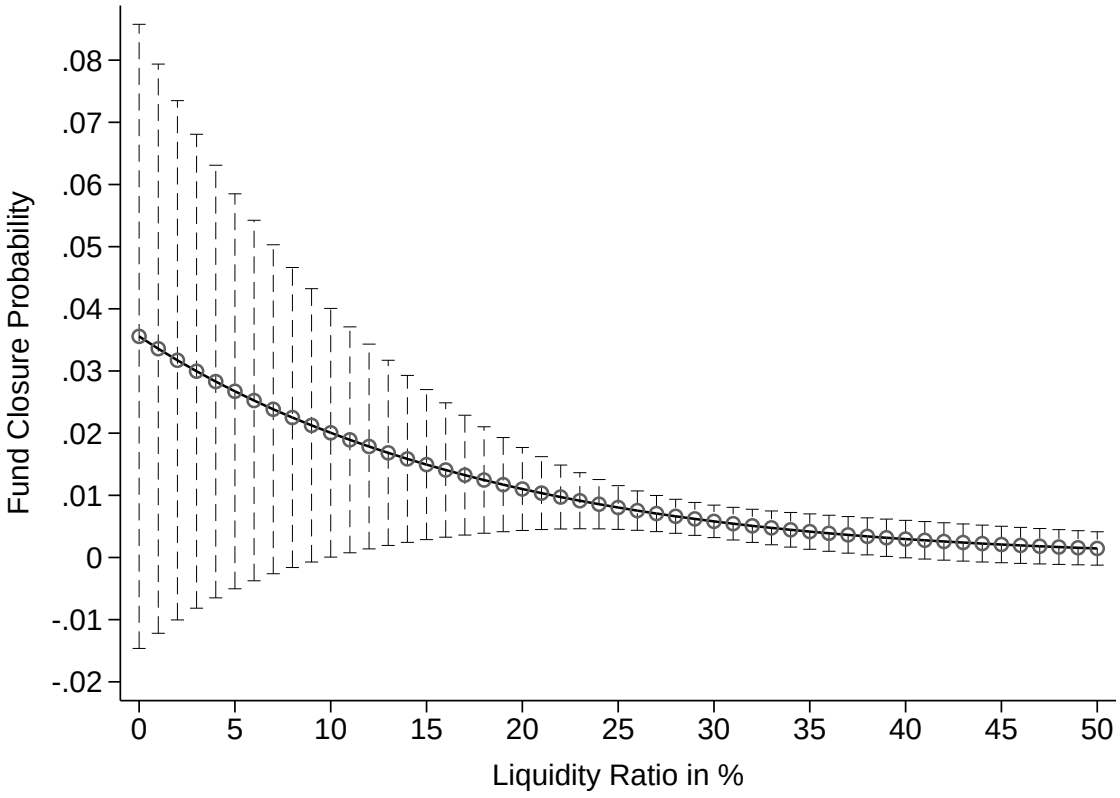
[17] Greene (2010), Downs et al. (2016).

Table 2.3: Explaining Fund Closure Probability

	(I)	(II)	(III)	(IV)
Fund Specifics				
$Liquidity_{i,t-1}$	-0.0583**	-0.0861**	-0.107*	-0.221**
	(0.0249)	(0.0378)	(0.0610)	(0.0981)
$Individual\ Fund\ Flows i,t$	-0.177**	-0.125***	-0.143***	-0.310***
	(0.0781)	(0.0349)	(0.0386)	(0.118)
ln $Fund\ Size_{i,t-1}$	0.950*	0.800*	0.709*	2.134*
	(0.560)	(0.461)	(0.405)	(1.285)
$ln\ Age\ i,t$	-1.271***	-0.772	-1.018*	-1.704**
	(0.480)	(0.503)	(0.578)	(0.830)
$Sale\ by\ Bank_{i,t}$	-1.287	-2.062**	-1.666*	-1.146
	(0.796)	(0.922)	(0.864)	(0.965)
$Institutional_{i,t-1}$				0.234***
				(0.0868)
$TER_{i,t-1}$	3.485***	5.100***	5.032**	7.212
	(1.236)	(1.571)	(2.309)	(4.406)
$Total\ Return_{i,t-1}$	0.103***	0.0557	0.0392	-0.0176
	(0.0387)	(0.0668)	(0.0889)	(0.278)
$\Delta\ Leverage_{i,t-1}$	0.184***	0.189***	0.168**	0.112
	(0.0511)	(0.0556)	(0.0675)	(0.0726)
Industrywide Spillover				
$Fund\ Closure_{i,t}$		0.620***	1.063***	1.120**
		(0.107)	(0.408)	(0.475)
Macroeconomic Control Variables				
$Policy\ Uncertainty\ Index\ Europe_{i,t}$			-0.383	-0.318
			(0.626)	(0.798)
$VIX\ Europe_{i,t}$			-0.212	-0.475
			(0.621)	(1.065)
$German\ Bond\ 1Y_{i,t}$			-0.727*	-0.394
			(0.387)	(0.457)
$DAX30\ Dividend\ Yield_{i,t}$			-1.978	-2.578**
			(1.234)	(1.224)
$Individual\ EPRA\ TR_{i,t}$			-0.0521	-0.135
			(0.0826)	(0.0928)
Constant	-3.607	-7.021**	1.124	0.168
	(2.359)	(3.201)	(4.275)	(4.628)
Observations	2,046	2,046	2,037	1,617
McFadden R-squared	0.287	0.530	0.568	0.675

This table gives the results of the panel logit model regression. Model I shows the influence of the fundamentals that explain the probability of fund closure. Model II further includes, besides the fund-specific variables, the industrywide spillover effects. Model III, our preferred model, includes further the macroeconomic control variables. Model IV adds the share of institutional investors. The Policy Uncertainty and VIX Europe variables are standardized with zero mean and a standard deviation of one. Robust standard errors are in parentheses. Stars denote significance as follows: *** p<0.01, ** p<0.05, * p<0.1.

Figure 2.3: Effects of the Liquidity Ratio on the Fund Closure Probability

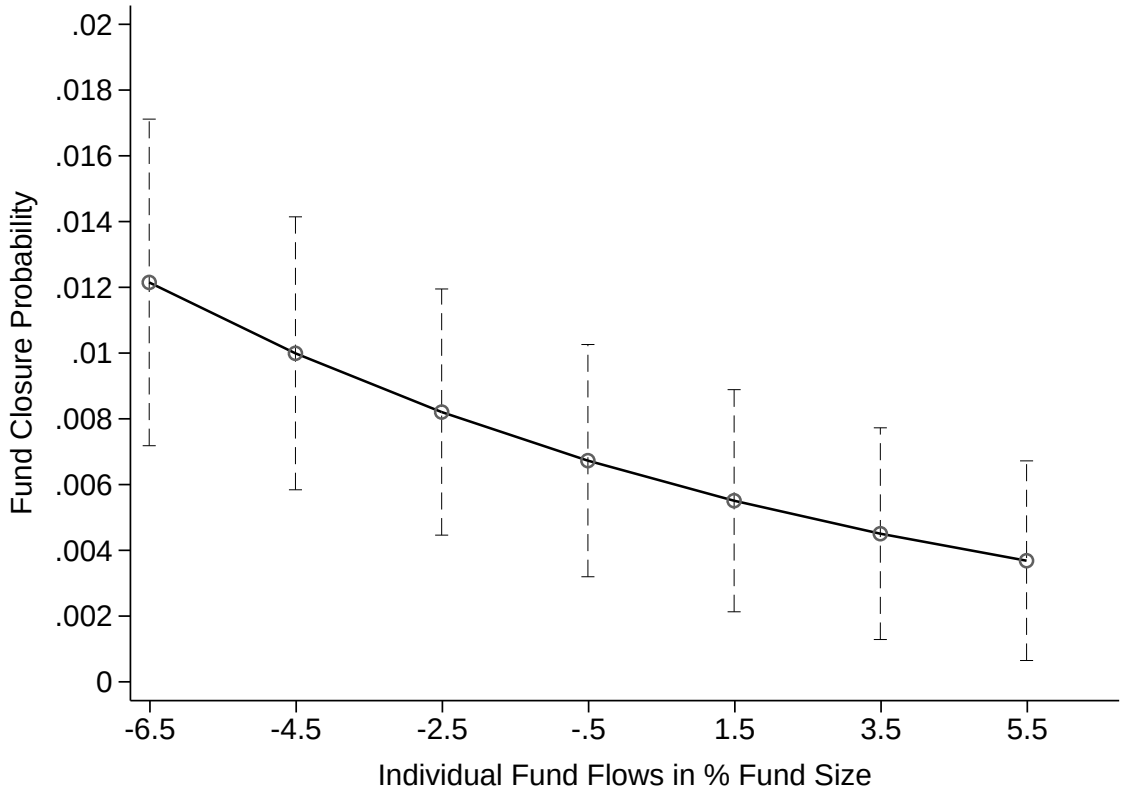


This figure compares how fund closure probability reacts to changes in fund run risk as represented by the liquidity ratio. The dashed lines denote the 95% confidence interval.

ratio of 10%, the probability decreases to 2%. Average liquidity ratios of 25%, as well as higher ratios of up to 50%, are associated with closure probabilities of around 1%. These results are in line with unconditional closure probabilities. Our dataset contains about twenty fund closure events, which equates to a 1% closure probability over 2,037 total observations. A larger share of cash and short-term money market positions serve as a safety buffer for investors. Hence, a higher liquidity ratio decreases the risk of beginning a vicious cycle. Especially if the liquidity ratio is already low, the decreasing impact on closure probability of a 1% increase in the liquidity ratio is more than proportional.

In addition, fund capital inflows exhibit a significant and robust negative effect on closure probability across all four model specifications. Capital inflows into a particular fund reduce closure probability c.p., while large contemporaneous capital outflows significantly increase it. Figure 2.4 illustrates the marginal impacts. Large capital outflows of about 6.5% lead to a 1.2% closure probability, while capital outflows of 4.5% exhibit a 1%

Figure 2.4: Effects of Individual Fund Flows on Fund Closure Probability



This figure compares how fund closure probability reacts to changes in fund run risk as proxied for by individual fund flows. The dashed lines denote the 95% confidence interval.

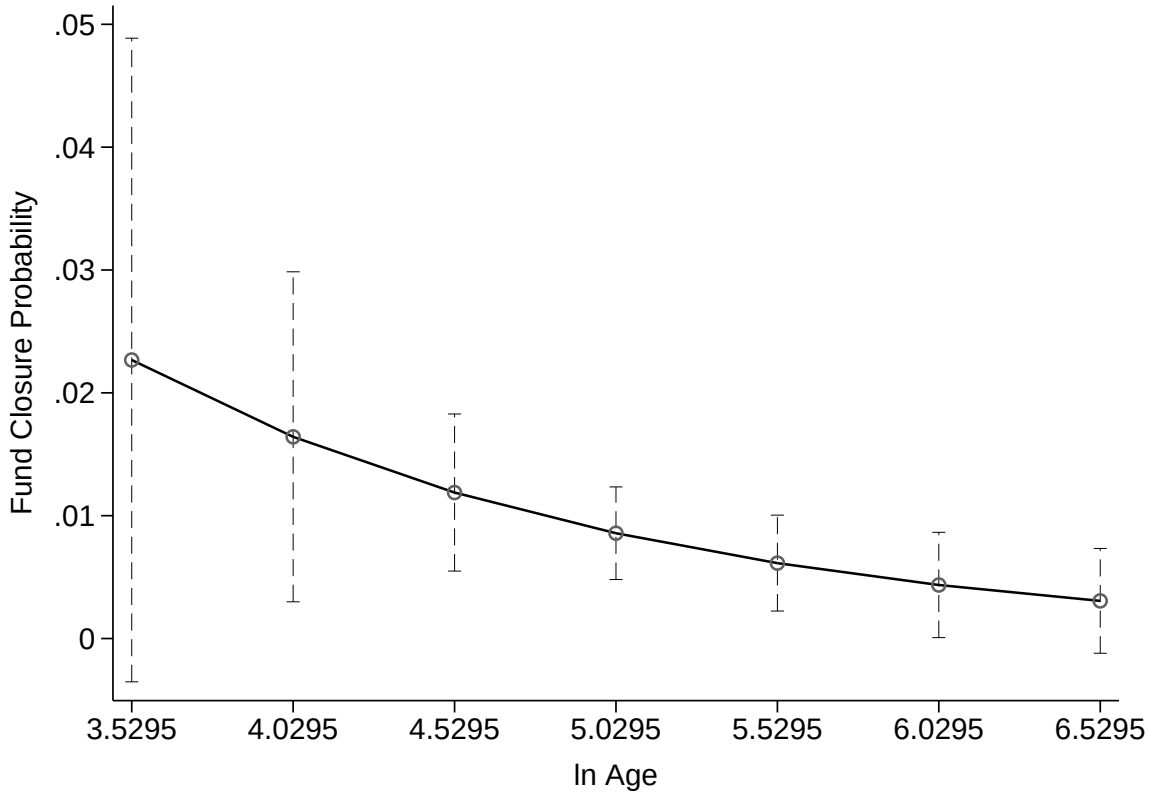
closure probability. Positive capital flows lead to a significantly lower closure probability of 0.7% to 0.5%.

In summary, both proxies are consistent with Hypothesis 1. Fund closure probability rises during times of higher fund run risk.

Next, we examine Hypothesis 2, whether fund closure probability is driven by economies of scale and scope. Our three proxy variables are age, the sale by bank dummy variable, and fund size.

We use the logarithm of fund age as an additional influential factor that affects fund closure probability. Older funds exhibit c.p. lower closure probability. The negative effect is significant in models I, III, and IV. The negative sign on the regression coefficient is in line with the literature. Older companies or funds are likely to obtain larger economies of scope in the organizational process because they have had more time to establish efficient processes and structures.

Figure 2.5: Effects of Fund Age on Fund Closure Probability



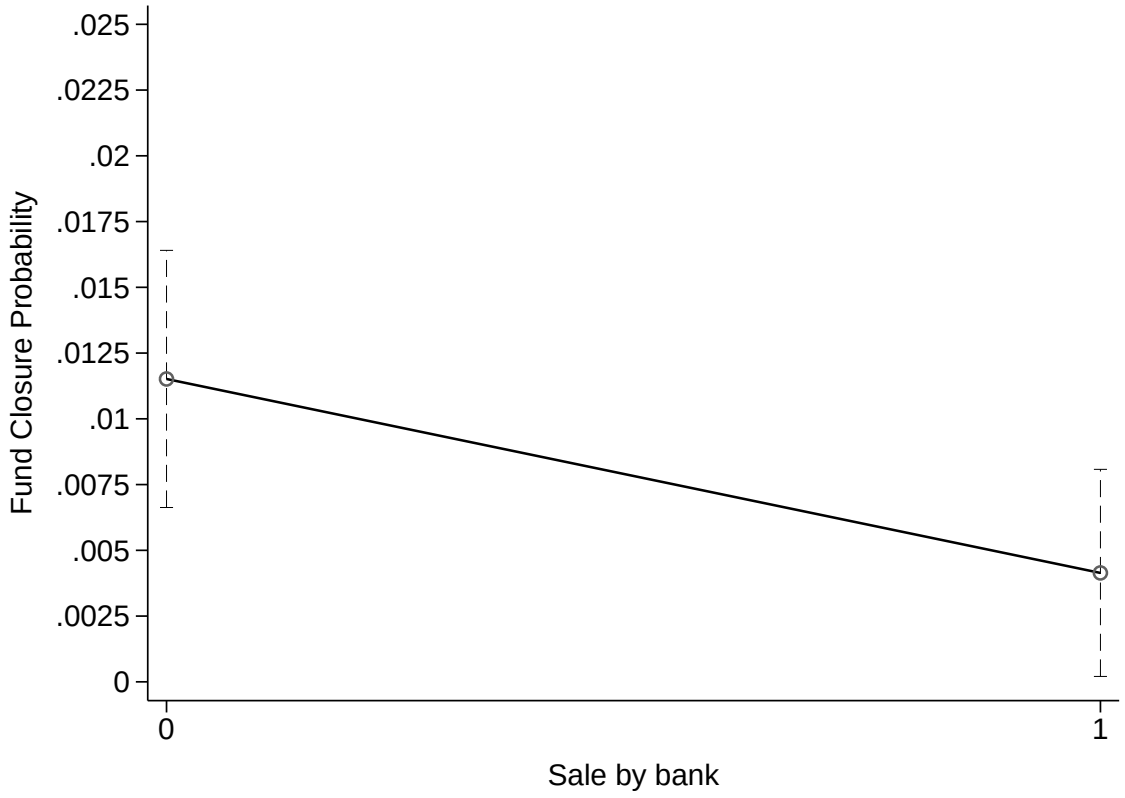
This figure compares how fund closure probability reacts to changes in the economy of scope and scale variable as proxied for by fund age. The dashed lines denote the 95% confidence interval.

Figure 2.5 shows how the marginal effects of logarithmic age affect fund closure probability. Age is varied over two standard deviations below and above the mean. Average fund age is about twenty years. A logarithmic fund age of 3.52 (i.e., two standard deviations below the mean) is associated with a closure probability of about 2%. In the case of a two-standard deviation variation above the mean (6.52), the closure probability decreases considerably to 0.5%.

Open-end real estate funds that use the retail distribution network of their issuing sponsor (bank) show c.p. lower fund closure probability. The negative sign is robust among all four model specifications. Nevertheless, we find a significant influence only in models II and III.

Figure 2.6 illustrates that funds without a distribution network exhibit a closure probability of about 1.25%. Those with a distribution network exhibit a considerably lower closure probability of 0.5%.

Figure 2.6: Effects of the Sale by Bank Variable on Fund Closure Probability



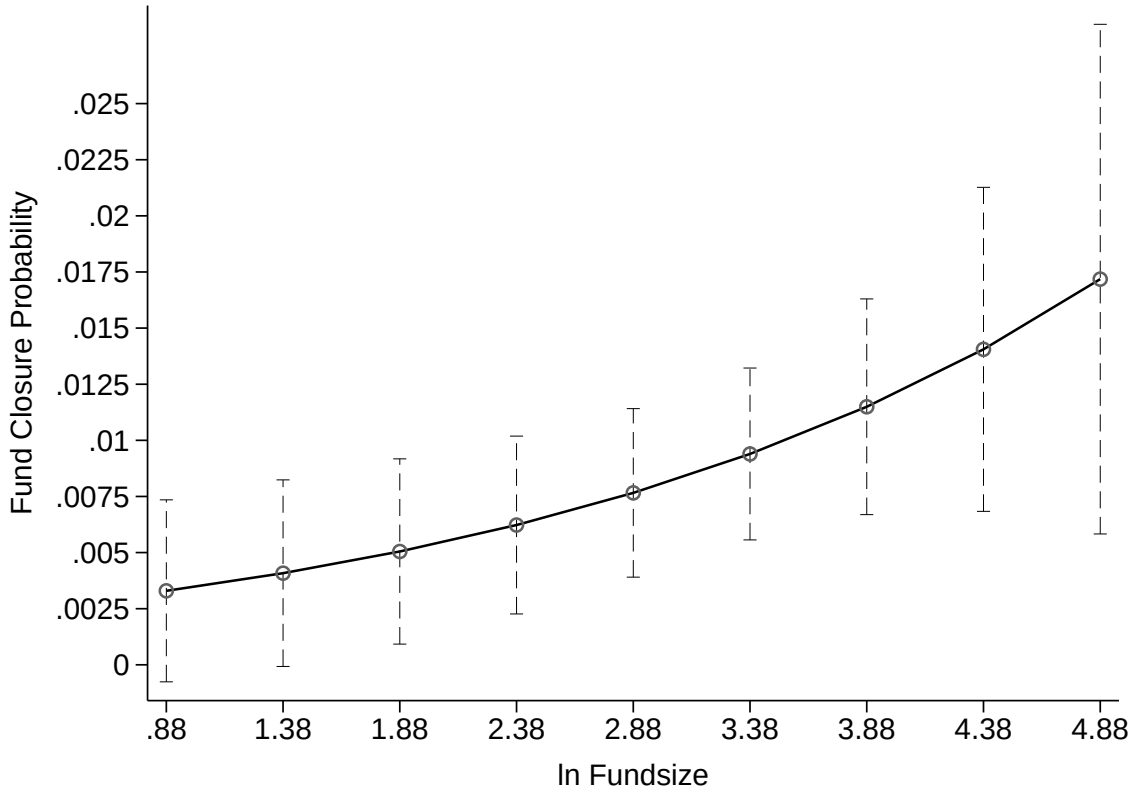
This figure compares how fund closure probability reacts to changes in the economy of scope and scale variable, as represented by the sale by bank variable. The dashed lines denote the 95% confidence interval.

Interestingly, larger funds exhibit c.p. a higher fund closure probability. This positive effect is significant for all four model specifications. Figure 2.7 illustrates the marginal effects of a variation in fund size on closure probability. We use the logarithm of fund size in the model specification. For example, for a logarithmic fund size of 0.88, the fund closure probability is about 0.25%; for a larger fund size of 4.88, the probability would be about 1.5%.

In summary, we find significant influence in two of our three proxies for economies of scope and scale on fund closure probability. Fund age and the sale by bank variables show the expected negative signs, and are statistically significant in the third model (III).

Next, to test for the presence of negative spillover effects from other fund closures (Hypothesis 3), we use the number of closures in each month of our sample period. The coefficient on the fund closure variable is positive and significant across all model specifications. As illustrated in Figure 2.8, the probability is almost zero if there are zero to

Figure 2.7: Effects of Fund Size on Fund Closure Probability



This figure compares how fund closure probability reacts to changes in the economy of scope and scale variable as proxied for by fund size. The dashed lines denote the 95% confidence interval.

three fund closures of other funds in the respective month. In months with more than three closures, the probability increases substantially by about 10% with every additional event. In October 2008, when nine funds were forced to close, the closure probability of the remaining funds was approximately 70%.

According to Table 2.4, the dependent variable is relatively strongly correlated with the fund closure variable at about +0.42. In summary, we find evidence that spillover effects affect closure probability.

We also test whether the share of institutional investors affects the closure probability of open-end real estate funds (Hypothesis 4). Model IV in Table 2.3 shows that a larger share of institutional investors significantly increases c.p. closure probability in the next month.

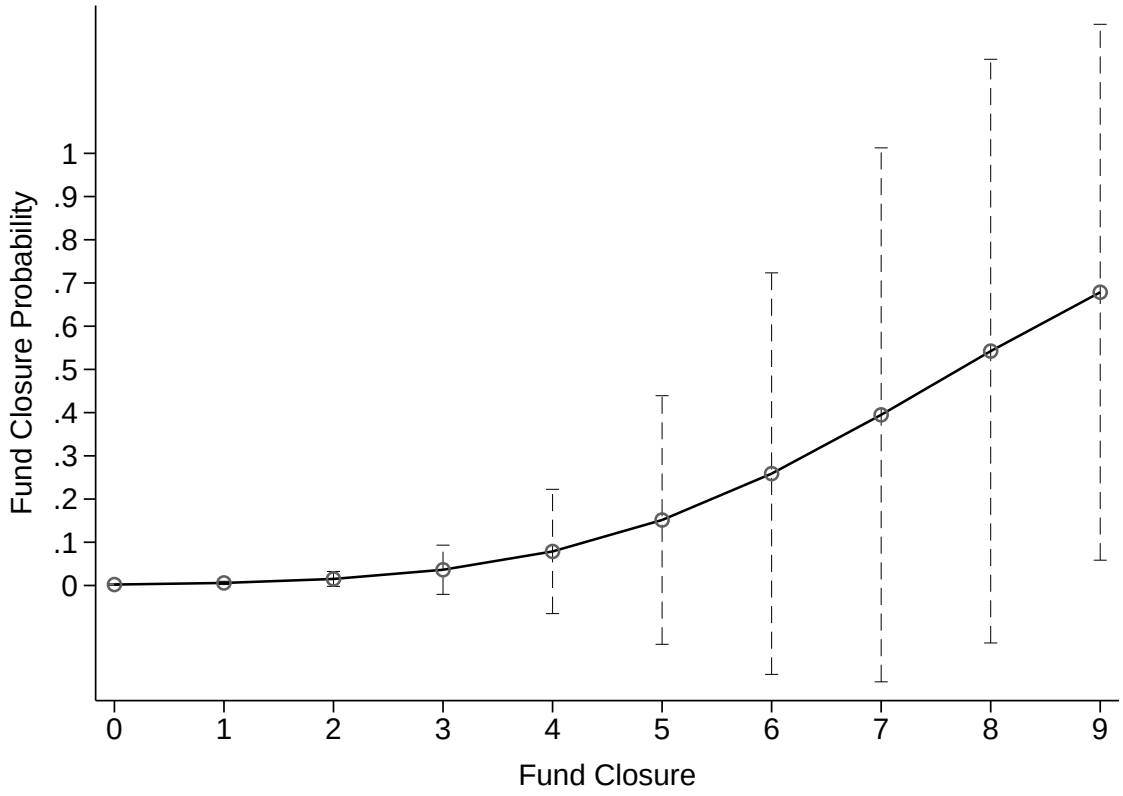
Figure 2.9 illustrates that a 0% share of institutional investors leads to a 0.75% fund closure probability, while an 11.5% share, which represents a two-standard deviation

Table 2.4: Corr. Matrix: Fund Specifics, Spillover, and Macroeconomic Variables

	Closure	$Liquidity_{i,t-1}$	$Individual\ Fund\ Flows_{i,t}$	$ln\ Fundsize_{i,t-1}$	$ln\ Age_{i,t}$	$Sale\ by\ bank_{i,t}$	$Institutional_{i,t-1}$	$TER_{i,t-1}$	$Total\ Return_{i,t-1}$	$\Delta\ Leverage_{i,t-1}$	$Fund\ Closure_{i,t}$	$Policy\ Uncertainty_{i,t}$	$VIX\ Europe_{i,t}$	$German\ bond\ 1Y_{i,t}$	$DAX30\ Dividend\ Yield_{i,t}$	$Individual\ EPRA\ TR_{i,t}$
Closure	1.00															
$Liquidity_{i,t-1}$	-0.04	1.00														
$Individual\ Fund\ Flows_{i,t}$	-0.17	0.09	1.00													
$ln\ Fundsize_{i,t-1}$	-0.02	-0.01	0.00	1.00												
$ln\ Age_{i,t}$	-0.05	-0.27	-0.14	0.39	1.00											
$Sale\ by\ bank_{i,t}$	-0.05	0.11	-0.05	0.34	0.11	1.00										
$Institutional_{i,t-1}$	0.14	-0.16	0.04	-0.55	-0.39	-0.29	1.00									
$TER_{i,t-1}$	0.03	0.04	0.08	-0.15	-0.20	0.14	0.15	1.00								
$Total\ Return_{i,t-1}$	0.05	0.24	0.04	0.13	0.06	0.10	-0.37	-0.14	1.00							
$\Delta\ Leverage_{i,t-1}$	0.08	-0.07	-0.02	-0.02	-0.02	-0.01	0.04	-0.04	-0.03	1.00						
$Fund\ Closure_{i,t}$	0.42	-0.03	-0.19	-0.03	-0.01	-0.01	0.06	0.02	0.00	0.05	1.00					
$Policy\ Uncertainty_{i,t}$	0.06	-0.13	-0.01	0.05	0.18	0.02	0.03	0.22	-0.17	-0.01	0.15	1.00				
$VIX\ Europe_{i,t}$	0.07	0.03	-0.01	-0.03	0.02	-0.05	0.11	0.02	-0.05	0.02	0.14	0.43	1.00			
$German\ bond\ 1Y_{i,t}$	-0.00	0.26	0.03	-0.08	-0.25	-0.03	-0.01	-0.20	0.22	-0.00	-0.03	-0.68	-0.27	1.00		
$DAX30\ Dividend\ Yield_{i,t}$	0.09	-0.19	-0.05	-0.08	0.05	-0.05	0.18	0.15	-0.08	0.03	0.18	0.46	0.62	-0.31	1.00	
$Individual\ EPRA\ TR_{i,t}$	-0.14	-0.05	0.03	0.02	0.00	-0.00	-0.01	-0.02	-0.07	-0.03	-0.28	-0.14	-0.11	-0.17	-0.21	1.00

This table shows the correlation coefficients between the dependent and independent variables of the panel regression model.

Figure 2.8: Effects of the Number of Fund Closures on Fund Closure Probability



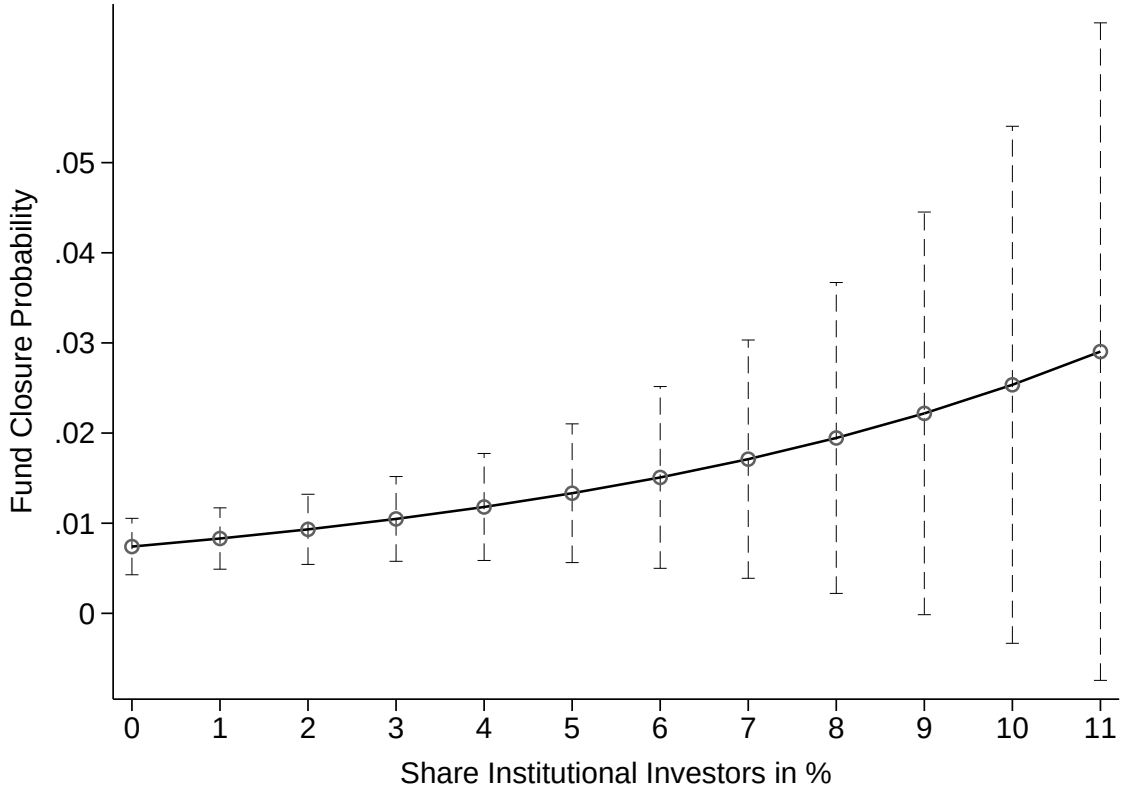
This figure compares how fund closure probability reacts to changes in the spillover variable as represented by the number of fund closures. The dashed lines denote the 95% confidence interval.

increase above the mean, exhibits a 2.5% closure probability.

Our regression results are in line with the general notion that having a higher share of institutional investors is tied to significant blockholder risk for the remaining retail investors. Professional fund investors hold and are able to redeem a high proportion of fund shares. This can lead to additional selling pressure on fund management, which can also increase closure probability due to decreasing liquidity ratios.

This fundamental effect becomes even stronger because institutional investors can redeem their shares suddenly regardless of fund performance. This could come as a surprise for remaining investors due to their short-term investment horizons. Retail investors who take this potential blockholder risk into account may be inclined to sell their own shares more rapidly compared to those in funds held mainly by private investors. Given that we lose 420 observations due to unavailable data, we test the influence of institutional share based on only 1,617 observations. Thus, although the results are relatively robust, they

Figure 2.9: Effects of the Share of Institutional Investors on Fund Closure Probability



This figure compares how fund closure probability reacts to changes in the share of institutional investors. The dashed lines denote the 95% confidence interval. The figure is based on the results of the fourth model specification (model IV).

should be interpreted with caution.

Furthermore, we use a set of fund-specific and macroeconomic control variables. We include TER, fund total return, and fund leverage ratio as fund-specific control variables in all model specifications (I-IV). Consistent with the literature, management fees (TER), as well as the leverage ratio, exhibit a significant and robust positive effect on closure probability across the model specifications. Note that higher leverage ratios amplify the effect of potentially negative property reappraisals, and could cause additional selling pressure on fund management. Moreover, if investors consider management fees too high, they are more likely to redeem their shares. The total return variable shows no consistent regression results across the model specification.

In models III and IV, we control further for macroeconomic environment. In particular, we test for the impact of two widely used uncertainty indicators, the VIX Europe and the

Policy Uncertainty Index Europe, to capture prevailing macroeconomic uncertainty. We also use short-term German government bond yields and the DAX 30 dividend yield to control for the return potential of alternative asset classes (i.e., bonds and stocks).

We then control for the total return of funds' target real estate markets. The control variables show no consistent or significant results across the different model specifications. This is potentially due to the considerable cross-correlation the variables exhibit with each other.

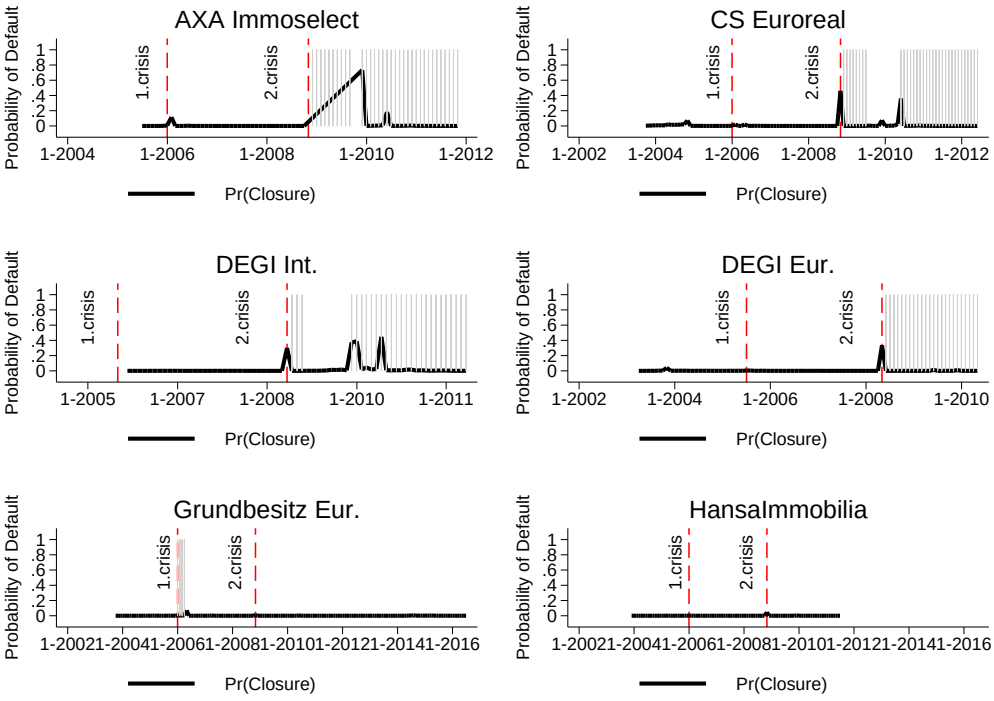
Table 2.4 shows that economic uncertainty is strongly correlated with the DAX 30 dividend yield (+0.46), and negatively correlated with the government bond interest rate (-0.68). In addition, stock market uncertainty shows a similar relationship with the DAX 30 dividend yield (+0.61) and the interest rate level (-0.22). The individual EPRA total return shows no strong correlation with any other macroeconomic control variables.

The regression results for the four model specifications are relatively robust. Model I, which includes solely fund-specific factors, shows a McFadden R-squared of 28.7%. The model fit significantly increases by adding the counting variable for the number of fund closures in the respective month. Hence, model II exhibits a McFadden R-squared of 53.0%. Model III further includes macroeconomic control variables in order to validate the regression results, which increases the model fit of about 4% to a McFadden R-squared of 56.8%. Model IV adds the share of institutional investors, and exhibits a McFadden R-squared of 67.5%.

We illustrate the model fit of our preferred model (III) by conducting an in-sample prediction of closure probability for all twenty-four funds. Figures 2.10 to 2.13 show the results for all distressed funds and for the remaining healthy funds, respectively. According to Figures 2.10 and 2.11, eight of the twelve distressed funds exhibited considerable predictive closure probability in October 2008, at the peak of the second fund crisis. The graphs show the prediction for every month in the sample period. Hence, we mark the periods after the actual fund closure event, because these predictions are only theoretical.

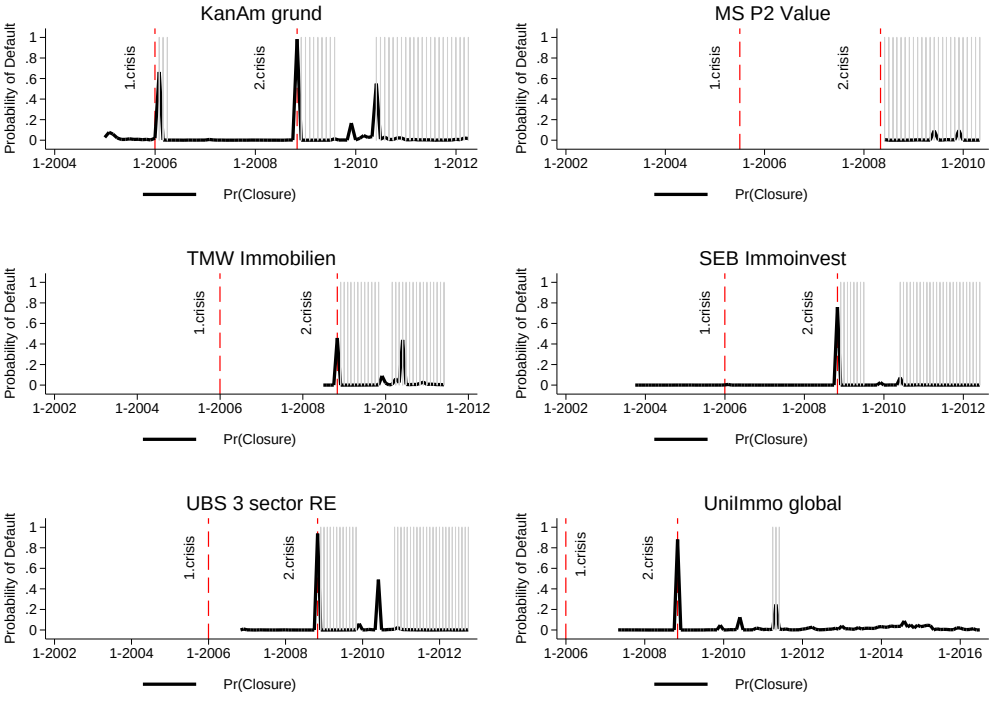
Figures 2.12 and 2.13 illustrate the significant closure probability of the remaining healthy

Figure 2.10: The Predicted Fund Closure Probability of Distressed Funds I



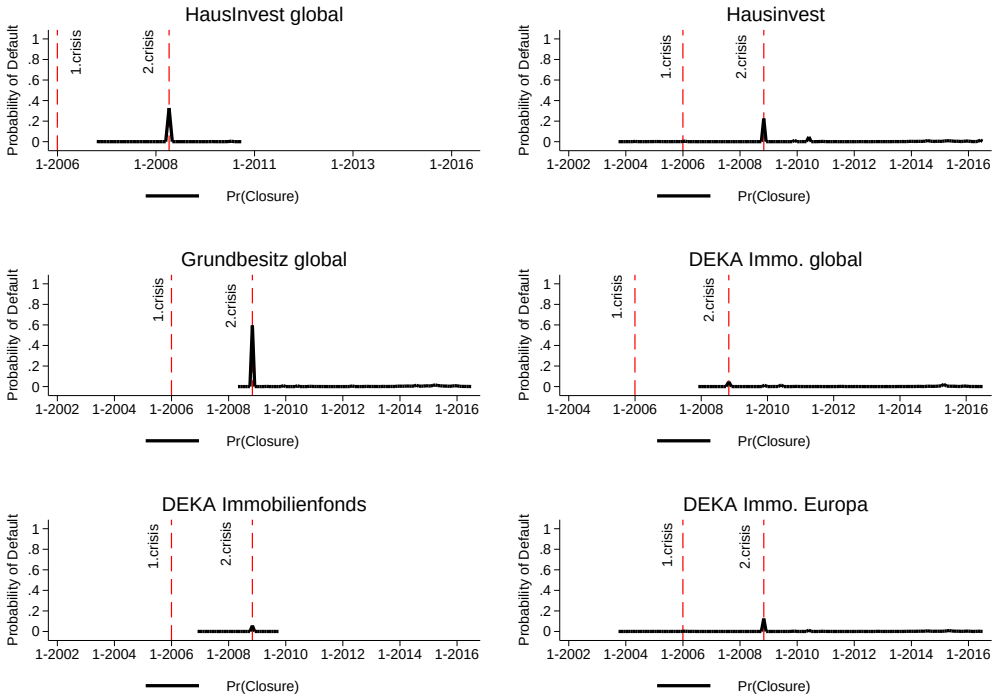
This figure shows the predicted fund closure probability of all distressed open-end real estate funds. It validates the predictive power of the panel logit regression. Most funds show their highest closure probability at the date of actual closure. Predicted fund closure probability after the actual closure date is only theoretical, and is therefore denoted as a dashed line.

Figure 2.11: The Predicted Fund Closure Probability of Distressed Funds II



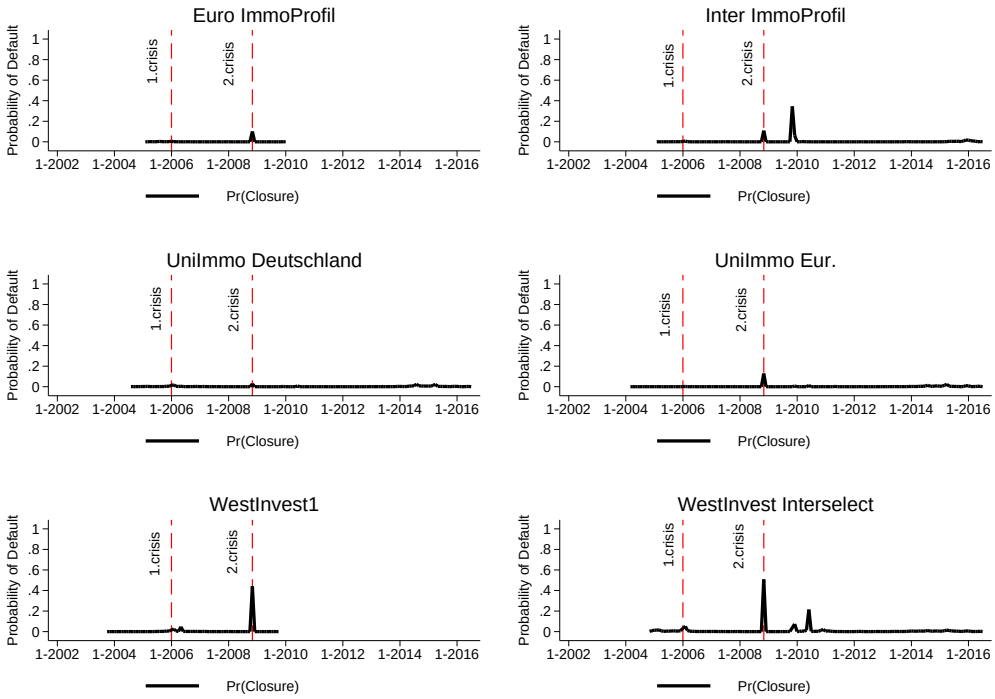
This figure shows the predicted fund closure probability of all distressed open-end real estate funds. It validates the predictive power of the panel logit regression. Most funds show their highest closure probability at the date of actual closure. The predicted fund closure probability after the actual closure date is only theoretical, and is therefore denoted as a dashed line.

Figure 2.12: The Predicted Fund Closure Probability of Healthy Funds I



This figure shows the predicted fund closure probability of all healthy open-end real estate funds. It validates the predictive power of the panel logit regression.

Figure 2.13: The Predicted Fund Closure Probability of Healthy Funds II



This figure shows the predicted fund closure probability of all healthy open-end real estate funds. It validates the predictive power of the panel logit regression.

funds. At the height of the crisis, in October 2008, half of all the healthy funds exhibited low closure probability. Only one of the twelve funds showed a closure probability higher than 50%. Overall, the model possesses high predictive power. Nevertheless, some funds that exhibit all the determinants of distressed funds remain open in the aftermath of a global financial crisis. This may indicate that simple bad luck sometimes plays a part in fund closures.

2.6 Conclusion

This study contributes to the literature on failure prediction models and liquidity transformation risk in several ways. We began by noting that about one-third of all open-end German real estate funds were forced to close during the first and second fund crises, in 2005/2006 and October 2008, respectively. This led to significant lower demand for fund shares by retail investors from 2008 through 2015. Second, we use fund-specifics, industrywide spillover effects, as well as macroeconomic control variables to analyze the most important factors driving fund closure probability. On the fund-specific side, we find that fund closure probability is driven by the degree of fund run risk. Funds with low liquidity ratios and capital outflows exhibit higher probability of closure. Fund management could reduce capital outflows by marketing the funds to a more diverse group of investors (i.e., focus on retail investors by using a bank to distribute their shares). It may also be possible to reduce the risk of fund closure by using a more conservative investment strategy with larger liquidity ratios. However, higher shares of cash and money market deposits come at the expense of lower returns. We also document that economies of scale and scope help decrease fund closure probability. We find evidence of negative spillover effects from the closure announcements of other funds. These effects are outside the control of fund management. We further find that having a larger share of institutional investors significantly increases fund closure probability. Ultimately, we find that fund management can prevent closures in part by following a more conservative fund strategy and by focusing on well-established funds that use distribution networks to sell shares. Nevertheless,

systematic closure risk is a somewhat inherent feature of the open-end structure.

Chapter 3

Analyzing the Performance of German Open-End Real Estate Funds

This study is the result of a joint project with Steffen Sebastian

3.1 Introduction

For decades, German open-end real estate funds have been considered as an preferred investment opportunity for retail investors. As a result, Germany has the largest market for open-end real estate funds in the world, with assets under management of about EUR 171 billion.[1]

Basically, an open-end real estate fund investment gives investors the chance to obtain significant returns from long-term direct real estate assets. Fund share prices (i.e., net asset values) are based on real estate asset values, which are regularly reevaluated.[2] According to the valuation method, fund prices exhibit less volatility than other listed investment vehicles, such as REITs.[3] Besides the significant return potential and lower volatility,

[1] BVI Statistics 06/2017. The overall sum can be divided between open-end real estate retail funds, with a share of EUR 91 billion, and open-end real estate special funds for institutional investors, with about EUR 80 billion.

[2] Downs et al. (2017); Weistroffer and Sebastian (2015); Fecht and Wedow (2014).

[3] Sun et al. (2015) illustrate the exceptionally high stock market volatility of REITs versus their direct real estate portfolios over the January 2007-December 2011 period.

fund investors also received the right to constantly buy and sell fund shares from/to fund management.

However, this liquidity transformation provided by fund management has actually caused significant "bank run" risk (Bannier et al. (2008); Weistroffer and Sebastian (2015)), which could lead to fund closures during times of high share redemptions. This risk became fully apparent since October 2008, when the closure and subsequent liquidation (i.e., forced selling of the entire real estate portfolio under time pressure) of ten German open-end real estate retail funds, worth EUR 28 billion, caused the most severe fund crisis in the history of open-end real estate funds. Seven of these funds were able to provide enough liquidity to reopen again for a short period of time. Nevertheless, all the funds closed again due to liquidity shortages.

After the maximum closing period of twenty-four months, which was determined by German investment law, all of these open-end real estate funds were forced to announce liquidations of their real estate portfolios.[4]

The open-end real estate fund crisis is also a current topic because the liquidation process of these distressed funds has continued through today. As of March 2017, approximately EUR 7 billion remains inaccessible to investors. Moreover, distressed fund shares are only traded on the secondary market, and exhibit on average considerable discounts to NAV.

This severe crisis was a shock for fund retail investors, since investments in open-end real estate funds were previously considered conservative. Therefore, the fund closures have created a high degree of uncertainty about the future of these investments for all fund investors, particularly for investors in distressed funds.

This study aims to diminish somewhat this overwhelming investor anxiety about investments in distressed funds, as well as in the remaining healthy open-end real estate funds. To that end, we analyze the determinants of open-end real estate fund performance and describe the current secondary market conditions for distressed fund shares.

[4] As a consequence of this crisis, the legal environment for open-end real estate funds has changed. Since July 2013, fund investors face a minimum twenty-four-month holding period for fund shares.

We use a panel dataset, which consists of twenty-four German open-end real estate retail funds. These twenty-four funds represent the population of the asset class of German open-end real estate retail funds.[5] The monthly dataset spans the August 2002-March 2017 period.

Existing discounts to NAV on the secondary market for fund shares reflect the capital markets' current price expectations for real estate assets. Therefore, significant discounts to NAV lower fund management's bargaining power during the liquidation process. Moreover, dissatisfied fund investors who face these high discounts to NAV are a further source of pressure on fund management. This pressure from current investors also weakens fund management's bargaining position. And, because the performance of distressed funds depends so heavily on the revenue from liquidating the real estate assets, such pressure could lower fund performance. Exceptionally large discounts to NAV also indicate greater uncertainty about the current asset valuation techniques, and about the liquidation process. Finally, we find that economies of scale and scope, as well as the development of fund target markets, also affects fund performance.

The remainder of this study is organized as follows. The next section presents a study on the secondary market for fund shares. We then show how our explanatory variables are linked to the literature on performance studies, followed by a section describing the data. The subsequent section explores the results of the panel model. The final section concludes.

3.2 Secondary Market for Open-End Real Estate Funds

Fund investors' capital in distressed funds is almost entirely constrained. Because all open-end real estate funds are listed, the only way to redeem shares is to sell them on the secondary market, where investors face tremendous discounts to NAV (up to 60%). Therefore, most fund investors remain invested, preferring to wait for the end of the liquidation

[5] We include only actual open-end retail funds, which provide a minimum investment opportunity for investors of less than EUR 10.000 per fund share. Hence, we exclude semi-institutional funds, which are also referred to as open-end real estate retail funds.

process, since the fund closure and liquidation do not in theory cause any financial loss for them. If fund management is able to sell all their real estate properties at NAV, investors would not suffer any losses from their distressed fund investments. In contrast, if fund management sells all their real estate properties under pressure, it could lead to "fire sales" or reveal potential asset overvaluations, which could cause significant losses for fund investors. Therefore, there is a great uncertainty surrounding the current asset valuation.

One measure of this uncertainty can be seen in the general secondary market conditions for German open-end real estate funds. Table 3.1 shows the fee structure of this market. Investors pay an initial charge of 5% of current NAV to purchase open-end fund shares. Some funds charge even higher fees, up to 5.5%. While fund investors thus face a 5% loss at the beginning of their investment, fund management does not generally charge for the redemption of fund shares (i.e., deferred load).

Table 3.1 shows the average monthly trading volume of fund shares as a percent of overall fund size. Distressed funds exhibit on average considerably higher monthly trading volume of about 0.20% of respective fund size compared to the remaining open-end real estate funds, which average about 0.02%.

To summarize, the trading volume of both distressed and healthy open-end real estate funds is relatively low. Hence, there is no well-established secondary market for open-end real estate fund shares in Germany. Current fund investors appear to value market prices (i.e., discounts to NAV) as too low, while new fund investors are cautious with their investments. The absence of a functional secondary market could be seen as a first indicator of investors' potential uncertainty about the open-end fund closure and liquidation process.

This is because a fund closure poses challenges for current investors, but opportunities for new ones, who may be able to purchase fund shares at a considerable discount to NAV on the secondary market. To new investors, a discount represents a hedge against reappraisals and "fire sales." Therefore, in addition to the current trading volume of dis-

Table 3.1: Overview Secondary Market Fund Fees

fund	Deferred Load %	Initial Charge %	Average Monthly Trade Volume %
AXA Immoselect	7.00	5.00	0.24
CS Eur.	0.00	5.00	0.20
DEGI Eur.	0.00	5.00	0.38
DEGI Int.	0.00	5.00	0.12
HansaImmobilia	-	-	0.01
KanAm grund.	0.00	5.50	0.26
MS P2 Value	0.00	5.50	-
UBS 3 Sector RE	3.00	5.50	0.10
SEB ImmoInvest	0.00	5.25	0.12
TMW Immobilien	0.00	5.00	-
DEKA Immo. Global	0.00	5.26	0.01
DEKA Immo.Fonds	-	-	0.01
DEKA Immo. Eur.	0.00	5.26	0.01
EURO ImmoProfil	-	-	0.01
Inter ImmoProfil	0.00	5.00	0.03
Grundbesitz Eur.	0.00	5.00	0.03
Grundbesitz Global	0.00	5.00	0.02
HausInvest Eur.	0.00	5.00	0.02
HausInvest Global	-	-	0.07
UniImmo D.	0.00	5.00	0.01
UniImmo EUR.	0.00	5.00	0.01
UniImmo Global	0.00	5.00	0.02
WestInvest 1	-	-	0.02
WestInvest Inter.	0.00	5.50	0.02

The table gives an overview of the stock market fees for all distressed open-end real estate retail funds. In detail, the table displays the deferred loan amount investors must pay if they decide to sell their shares to the management company. The third column shows the initial charge that must be paid by investors for buying fund shares. The fourth column displays the depository bank fee. After the liquidation period, determined by the German Financial Supervisory Authority, a depository bank assumes responsibility for any further liquidation of fund assets. The depository bank charges a fee to the investors for the administrative expenses. For four funds, there is no information about fund fees available due to mergers and completed liquidation processes.

tressed fund shares on the secondary market, analyzing the potential total return for new fund investors is also a significant part of investors' former and current uncertainty about distressed funds.

Due to the advanced the liquidation process, we can now calculate new investors' overall total returns for past fund investments. Table 3.2 gives an overview of the progress of the liquidation process for all distressed funds using three different calculation methods:

1) the reduction in overall fund size since closure,

2) the reduction in property numbers since closure, and

3) the reduction in property asset value since closure.

Figure 3.1 illustrates the total return potential for new fund investors for all funds that show an advanced liquidation process (i.e., a reduction in fund size of $>$90%). New in-

Table 3.2: Liquidation Progress since Closure in October 2008

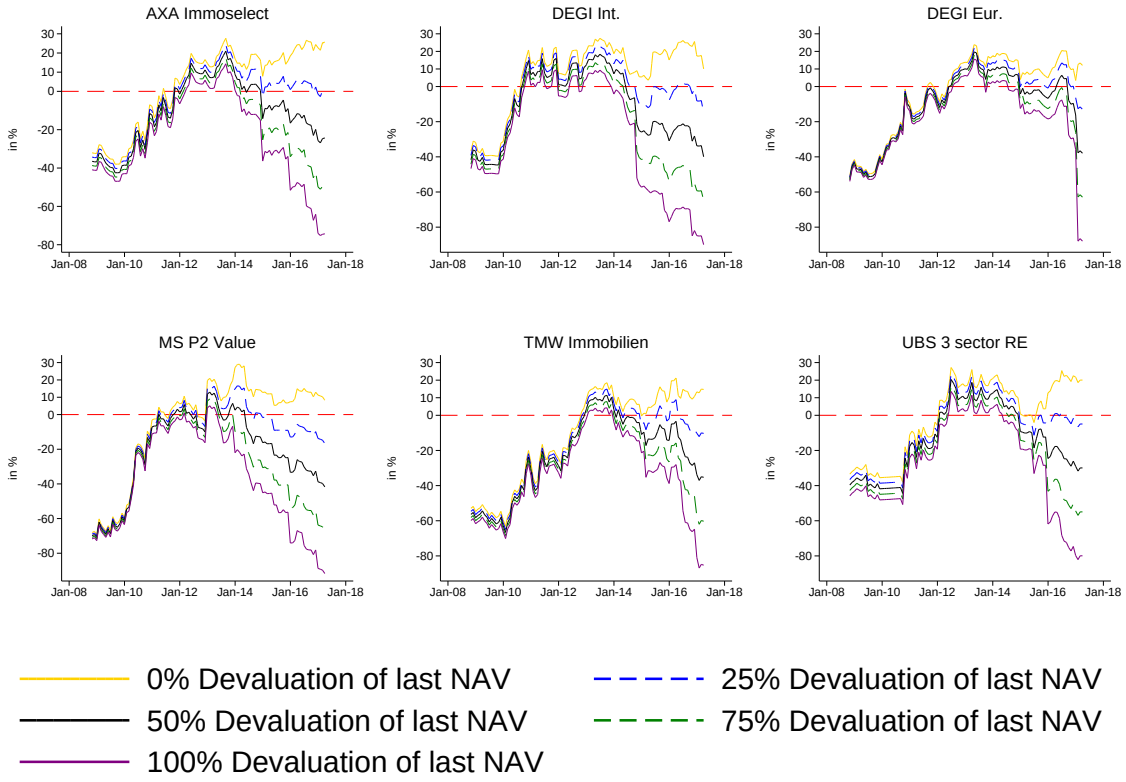
fund name	Reduction Fund size (%)	Reduction no. properties (%)	Reduction property assets (%)	as of
AXA Immoselect	93.11	88.24	94.91	03/17
CS Eur.	68.59	73.64	76.25	02/17
SEB ImmoInvest	68.94	54.68	55.25	03/17
KanAm grund.	75.49	91.67	97.18	03/17
DEGI Int.	92.42	95.12	97.32	12/16
DEGI Eur.	91.45	100	100	09/16
UBS 3 Sector RE	89.72	83.33	97.79	03/17
TMW Immobilien	94.29	100	100	03/17
MS P2 Value	97.13	100	100	03/17

The Table displays the reductions in fund size for all distressed real estate funds, calculated as the difference in fund size from October 2008 through March 2017. The third column shows the difference between the actual number of fund properties and the initial number in October 2008. The fourth column shows the difference between the actual funds' property asset values and the initial values in October 2008. For some funds, there is no current reporting available, so we use the latest available information.

vestors can buy fund shares with a significant discount to NAV on the secondary market. The graph shows the overall total return from the respective month of buying and the current NAV from March 2017. It also considers the sum of dividend payouts while holding the shares, as well as the costs of buying. Since the funds are not fully liquidated, there is a remaining NAV, which implies an uncertainty about the current asset worth of the remaining real estate properties. Therefore, we calculate several scenarios: 1) The current NAV is the market price and will be realized in the future, 2) the current NAV will show a 25% devaluation until the end of fund liquidation, 3) the current NAV will show a 50% devaluation until the end of fund liquidation, 4) the current NAV will show a 75% devaluation until the end of fund liquidation, and 5) in the worst case, the current fund shares (i.e., NAV) are worthless.

Table 3.2 shows that six funds exhibited advanced liquidations of at least 90% at the end of the sample period in March 2017. Figure 3.1 illustrates the potential total return for new investors for these funds. As per Equation 3.1, we can calculate the overall total return for new investors as the difference between buying fund shares at the secondary market price (MP) in the respective month and the current NAV value of these shares. In addition, we consider the sum of distributed extraordinary payouts due to real estate asset sales. As stated earlier, the purchase of fund shares is subject to a fee of 5% of current NAV. Therefore, we subtract these initial fees from the overall total return, as well

Figure 3.1: Total Return Potential for New Fund Investors I



as the sum of management fees (TER) charged in the respective holding period.

$$TR\ New\ Investors_{i,t} = \frac{(MP_{i,t} - NAV_{i,T}) + \sum Div_{\cdot t,T} - 5\% * NAV_{i,t} - \sum TER_{t,T}}{NAV_{i,t}} \tag{3.1}$$

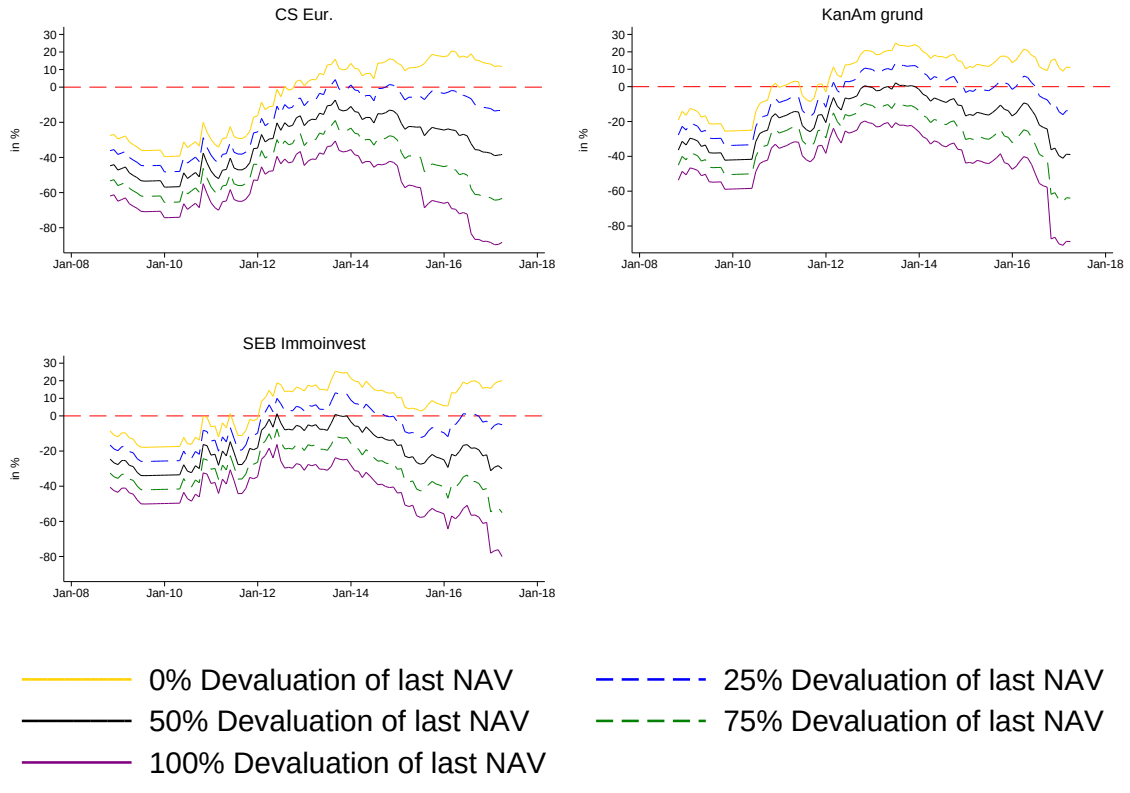
Because the fund liquidations have continued until now, we assume that the "true" values of the funds' remaining real estate properties will be lower than current NAVs reported by fund management. Hence, the remaining NAVs will face a devaluation through the end of the liquidation process. To account for this development, we use five different scenarios for further sales revenues, including a devaluation of the last NAV of 0% to a maximum of 100%. Due to the advanced liquidation process, the remaining NAVs of these six funds are relatively low and do not significantly change overall total return. Moreover, the assumed devaluation of the last NAV has the advantage of controlling for potential "cherry picking" by fund management. If management chooses a liquidation strategy, or is forced by market conditions to sell the best assets first and the worst last,

large devaluations of the last NAV would be appropriate.

Figure 3.2 illustrates the potential total returns for the remaining three funds, which are less than 90% through the liquidation process. Due to the significant extent of the remaining NAVs, the results differ substantially across the various devaluation scenarios. All three funds show predominantly positive total returns for new fund investors over the 2012-2014 period in the case of a maximum 25% current NAV devaluation. However, higher devaluations would lead to significant losses for new investors in the same period. The advancing liquidation process, associated with lower NAVs, will increase the validity of the total return potential for these three funds in the future.

Figure 3.1 shows that new fund investors who bought their shares on the secondary market and held them until March 2017 obtained significantly positive returns for all scenarios during the time of the largest discounts to NAV (2012 through 2014). Therefore, from an ex post perspective, these large discounts to NAV were excessive.

Figure 3.2: Total Return Potential for New Fund Investors II



The Figure illustrates the total return potential for new fund investors for funds that are not in the final stage of liquidation (i.e., a reduction in fund size of <90%).

To summarize, we observe indicators of high uncertainty about fund liquidation itself, and about funds' former and current real estate property valuations.

In addition to the analysis of the secondary market for open-end fund shares, identifying the influential factors of fund performance could help diminish the prevailing uncertainty about the liquidation process of distressed German open-end real estate funds.

3.3 Related Literature and Hypotheses

We use the literature on performance studies for mutual funds, REITs and open-end real estate funds to derive the influential factors on fund performance for open-end real estate funds.

3.3.1 Economies of Scale and Scope

First, we use fund size, age and the existence of a bank-owned distribution network for fund shares as proxies for the economies of scale and scope that affect fund performance.

Fund size is used in a vast array of research as an explanatory variable affecting fund performance. According to Morri and Lee (2009), larger Italian real estate mutual funds achieve better performance due to economies of scale. This is because larger funds can diversify their administrative expenses over several real estate assets. In contrast, Ferreira et al. (2013) mention that growing funds are constantly forced to find new productive investment projects, which generally increases risk of mistaken purchases. Grinblatt and Titman (1994) find no significant relationship between fund size and performance in their study on U.S. mutual funds over the 1974-1984 period. Although the current results are ambivalent, we expect larger funds to exhibit better performance due to economies of scale and scope.

Company age is also considered as an explanatory factor in fund performance. Morri and Lee (2009) illustrate that investment inexperience and initial costs can significantly

diminish the performance of younger funds. In contrast, Otten and Bams (2002), and Ferreira et al. (2013) find that newly issued funds perform better than more experienced ones. We include fund age as a proxy for economies of scale and scope, and expect that older funds will perform better.

Furthermore, one-third of all the open-end real estate funds considered here sell their fund shares via the distribution networks of their respective owners (i.e., banks).[6] Therefore, these funds have a more diversified customer target group (i.e., greater economies of scope) than those without such a channel. Hence, we include a dummy variable to indicate whether the fund is sold via a bank-owned distribution network. The potential influence of economies of scale and scope form our first hypothesis:

Hypothesis 1: *Fund performance increases with greater economies of scale and scope.*

3.3.2 Fund Management Skills

Next, we focus on the influence of fund management skills on fund performance. According to Ippolito (1989), higher fund fees are an indicator of high management quality and lead to better fund performance. Morri and Lee (2009) also find a positive influence of management fees on fund performance. However, in contrast, Carhart (1997) find that higher fees tend to diminish performance. Wermers (2000), in his study of U.S. equity mutual funds over the 1975-1994 period, find that fund managers are generally able to outperform the market. Nevertheless, these actively managed funds have lower net returns for investors than passively managed funds after considering expense ratios and transaction costs. According to Gil-Bazo and Ruiz-Verdu (2009), U.S. equity mutual funds, which tend to exhibit low gross fund performance overall, impose higher management fees. One explanation for this may be that fund management believes current fund investors are less sensitive to poor performance, and they can thus impose higher fees. To summarize, the influence of management fees is ambivalent. We use funds' total expense ratios as a proxy for fund management ability, and expect an increasing influence

[6] Hausinvest funds, DEGI funds, Grundbesitz funds, DEKA funds.

on fund performance.

Note that the regional and sectoral focus of fund management serves as an indicator of fund management skills. Morri and Lee (2009) find considerable influence of property type diversification on Italian open-end fund performance. Nevertheless, the authors found no evidence of any influence of country investment share on fund performance. Gallo et al. (2000), for the 1991-1997 period, note that U.S. mutual real estate funds perform better if fund management constructs a more diversified portfolio consisting of several property types.

Ferreira et al. (2013) show that funds can obtain higher returns by focusing their country investments on well-evolved economies that are also located close to their home markets. Moreover, Kurzrock et al. (2009), in their performance analysis of German open-end real estate funds from 2005 to 2007, show that funds with a stronger international investment focus exhibit additional transnational administrative costs that ultimately lessen fund performance.

Therefore, we include funds' target market index returns, weighted by portfolio country share, as an additional influential variable for management ability. This variable represents the management choice for regional diversification. It shows the market timing ability of fund management and controls for the development of funds' real estate investment markets. We also use the Herfindahl index for sectoral concentration of funds' real estate portfolios as a proxy for fund management's strategy to either specialize or diversify.

Subsequent to the liquidation announcement, funds are required to sell all real estate assets within three to five years. Afterward, they are forced by law to transfer management to a depository bank, which is now in charge of selling the remaining properties. Therefore, funds can have two different managements over time. We use a dummy variable to distinguish between the two, which enables us to further control for fund management ability. Our second hypothesis focuses on the impacts of fund management skill on fund performance:

Hypothesis 2: *Fund performance increases with increasing fund management ability.*

3.3.3 Open-End Fund Status

The closure and liquidation of an open-end real estate fund force fund management to sell the entire real estate portfolio. However, distressed funds face different time constraints. First, there is a maximum closure period of twenty-four months , after which the initial fund management will be forced to sell the entire portfolio within three to five years. Hence, potential buyers of real estate properties are aware of distressed fund managements' time pressure, which could lead to "fire sales" due to a loss in bargaining power. The distressed status itself could also affect fund performance, because the forced sale of an entire portfolio could reveal existing overvaluations of the real estate fund assets. Such overvaluations could be caused by appraisers' misjudgments, or by smoothing effects due to the standard appraisal methods.

This asset overpricing thus emerges before the fund closure, and could theoretically be present for distressed, and healthy open-end real estate funds. Hence, negative reappraisals of the real estate portfolio may become necessary for all open-end real estate funds during times of future fund closures. We use funds' distressed status to control for a loss in bargaining power due to the legally mandated time constraint in the selling process, as well as for potentially imminent overvaluations caused by the common appraisal methods in the NAV calculation.

After controlling for these effects, the considerable discount to NAV on the secondary markets for fund shares further illustrates the extent of investor mistrust in current funds' real estate asset valuations. The lack of trust in the valuation methods arises first after closure, primarily because fund investors were able to sell their shares to guaranteed NAV by fund management prior to closure. Using the distressed status dummy variable, we control for existing overvaluations, whereas the discount to NAV is considered as the market expectation of the real estate asset values and can be rational and/or irrational. If the capital markets consider the real estate assets too expensive, potential buyers could use that against fund management in the selling process. Thus, existing high discounts to NAV also tend to lower fund managements' efforts in the liquidation process because

of a loss in their bargaining power.

The discounts to NAV also serve as a measure of the pressure on fund management. Current fund investors face considerably lower market prices for their fund shares, as well as greater uncertainty about their actual losses at the end of the liquidation process. In addition, the entire liquidation process lasts for several years. Therefore, fund investors often accuse fund management of mismanagement. As a consequence, fund management may prefer short-term over long-term sales revenue by selling the best real estate assets first at no or little discount (i.e., "cherry picking"), and distributing the earnings to investors in order to alleviate current pressure. However, this strategy could also increase current discounts to NAV. Fund investors may try to exit the fund before the remaining inferior real estate assets are sold, which could lead to further negative devaluations of NAV, and significant losses for current fund investors. Because almost no fund managers were able to sell all real estate assets by the end of the determined liquidation period, the management of funds was transferred to a depository bank, which is now in charge of selling the remaining properties. Therefore, short-term sales revenues could be a preferable strategy for initial fund management, as further negative reappraisals of the remaining assets would be realized under the responsibility of the depository bank.

We analyze whether distressed funds perform worse than the remaining healthy funds due to current discounts to NAV on the secondary market and to the stigma of failure. This leads to our third hypothesis:

Hypothesis 3: *Funds' discounts to NAV lower fund performance*

3.3.4 Control Variables

A fund's liquidity ratio serves as a further fund-specific control variable. Interest rates for cash and money market deposits are historically low. Therefore, larger cash reserves are associated with lower fund performance. Downs et al. (2016) find evidence that the risk of a liquidity shortage significantly affects the flow-performance relationship of open-end real estate funds.

We use funds' leverage ratios as an additional control variable affecting fund performance.

Warther (1995) studies U.S. mutual funds over the 1984-1993 period, and finds that fund flows have a significantly positive effect on subsequent fund performance on a macro level. However, in contrast, Frazzini and Lamont (2008) study mutual funds over the 1980-2003 period, and find that past fund flows serve as a proxy for investor sentiment and decrease subsequent fund returns. We include the lagged funds' capital flows to control for the flow-performance relationship.

3.4 Data, Methodology and Sample Description

3.4.1 Data Sources

Our monthly panel model dataset consists of twenty-four open-end real estate funds from August 2002 through March 2017. The dataset includes the statistical population of German open-end real estate retail funds. It begins in August 2002 (because five funds were issued after that time). In addition, a significant change in the investment law was announced in January 2002. We obtain fund-specific variables from funds' monthly fact sheets and from published half-year and annual reports. The data on capital inflows come from the German Investment and Asset Management Association (BVI), which represents the vast majority of the German mutual fund industry. Market prices are provided by the Hamburg-Hannover stock exchange. EPRA/NAREIT provide the growth of the funds' target real estate markets.

3.4.2 Research Design and Variable Definitions

Our dependent variable is the Sharpe ratio (the risk-adjusted total return) of fund i at the end of month t. According to Morri and Lee (2009), the standard deviation is the preferable risk measure for Italian real estate mutual funds because most fund investors

invest in only a single fund. Standard deviation allows us to control for unsystematic, as well as systematic, risk.[7] Therefore, we use the Sharpe ratio as a suitable proxy for fund performance, because investors in open-end real estate are mainly retail investors without diversified fund investment strategies. We estimate the following panel regression model:

$$\begin{aligned} Sharpe\ Ratio_{i,t} = \alpha &+ \beta_1 \Delta\ ln\ Fundsize_{i,t-1} + \beta_2\ ln\ Age_{i,t} \\ &+ \beta_3\ Sale\ by\ bank_{i,t} + \beta_4\ TER_{i,t-1} \\ &+ \beta_5\ Individual\ EPRA\ IR_{i,t} + \beta_6\ HHI\ Portfolio_{i,t} \\ &+ \beta_7\ Depository\ Bank_{i,t} \\ &+ \beta_8\ Distress_{i,t-1} + \beta_9\ Discount\ to\ NAV_{i,t-1} \\ &+ \beta_{10} \Delta\ Leverage_{i,t-1} + \beta_{11}\ Liquidity_{i,t-1} + \beta_{12}\ Fund\ Flows_{i,t-1} \\ &+ v_{i,t} \end{aligned} \tag{3.2}$$

Our panel regression model is estimated with heteroscedasticity- and autocorrelation-robust clustered standard errors (i.e., Huber-White sandwich estimator).[8]

The fact sheets provided by fund management are published with a time lag, so the fund-specific variables fund size and TER are one month behind. The discount to NAV, the distressed status dummy variable, the leverage ratio, the liquidity ratio and fund flows also exhibit a one-month lag in the model framework. The variables age, sale by bank, Herfindahl index and depository bank dummy variable are included with no lag, since these status variables exhibit less volatility over time. A part of the real estate portfolio is reappraised each month. Therefore, we expect that considerable changes in the monthly fund target markets index returns will affect the respective fund performance within one month. Hence, we include the Individual EPRA/NAREIT country index return variable with no lag. In addition, we use the first difference of fund size and leverage (Δ) to obtain stationarity for all variables.

[7] Redman and Manakyan (1995), Ooi and Liow (2004).

[8] In addition, we use an IV and a GMM estimator for HAC standard errors as provided by Schaffer (2010) to validate the results of our preferred Huber-White sandwich estimator. The Schaffer method confirms our results.

The *Sharpe Ratio* represents the annual risk-adjusted fund performance. First, we calculate total return by taking the percentage change in monthly net asset value. We also consider the dividend payments distributed to investors. Next, we subtract the risk-free twelve-month EURIBOR interest rate from the total return, and divide the results by the individual fund's standard deviation.

Fund size represents the absolute difference in the logarithm of fund size, measured in EUR 100 million.

ln Age is the logarithmic fund age in months.

Sale by bank is a dummy variable that equals 1 if a fund uses a bank-owned distribution network.

TER shows the fund management costs proportional to the respective fund size.

Individual EPRA IR is the weighted monthly index return of the fund's real estate target markets provided by EPRA/NAREIT. In detail, the monthly index returns of the particular fund target markets are weighted with the country investment share of the overall fund portfolio.

HHI Portfolio denotes the fund's sectoral focus as represented by the Herfindahl concentration in office, retail, hotel and residential investments.

Depository Bank is a 0/1 indicator variable that equals 1 if the fund is managed by a depository bank.

Distress is a 0/1 dummy variable that equals 1 if the fund is closed or under liquidation.

Discount to NAV is calculated as the percentage between the current stock market price and the respective Net Asset Value of the fund shares.

Leverage denotes the absolute difference in the percentage between debt and gross asset value.

Liquidity is the liquidity ratio, which consists of the percentage between fund cash and gross asset value.

Individual Fund Flows shows the fund's capital flows, which are calculated as the monthly change in net capital flows compared to the respective fund size.

3.4.3 Descriptive Statistics

Table 3.3 provides an overview of the summary statistics for all variables.

Table 3.3: Overview Summary Statistics

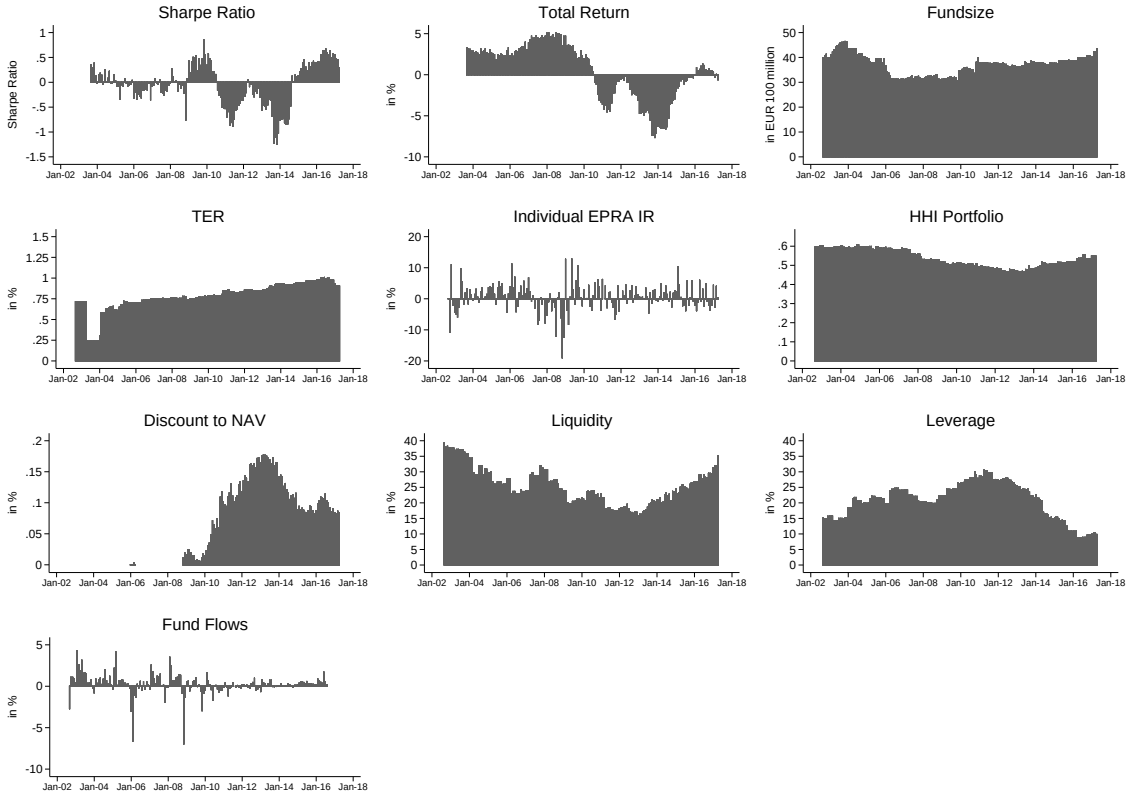
	Mean	Std.Dev.	Min	Max	Obs
Sharpe Ratio	-0.051	1.146	-4.867	4.454	3261
Total Return	0.006	0.069	-0.452	0.489	3262
Fund size	36.76	32.238	0.46	144.388	3566
Age	241.639	168.546	25	608	3879
Sale by bank	0.34	0.474	0	1	3872
TER	0.008	0.003	0	0.015	3217
Individual EPRA IR	0.005	0.05	-0.274	0.387	3519
HHI Portfolio	0.539	0.129	0.21	0.914	3247
Depository Bank	0.051	0.219	0	1	3966
Distress	0.225	0.418	0	1	3919
Discount to NAV	0.061	0.127	-0.021	0.598	3696
Leverage	0.21	0.123	0	0.690	3469
Liquidity	0.251	0.135	0.003	0.997	3492
Fund Flows	0.002	0.035	-0.566	0.77	3373

The Table provides an overview of the mean, standard deviation, minimum and maximum and the number of observations for all variables.

The average annual total return is 0.6%. According to Table 3.3, the MS P2 value fund has the lowest annual total return of -45.2%, while the Inter ImmoProfil fund exhibits an annual total return of +48.9%. Figure 3.3 shows a significantly negative average total return for open-end real estate funds over the October 2008-January 2014 period. The subsequent average total return exhibits considerable positive development through March 2017.

Fund size ranges from a minimum of EUR 46 million to a maximum of EUR 14.43 billion, with an average of EUR 3.67 billion. The Deka Immobilien Europa fund is the largest, while the UBS 3 sector Real Estate fund has a minimum of EUR 46 million as of March 2017.

Figure 3.3: Summary Statistics



The Figure illustrates the average progression of the dependent and independent variables from 2002:8 through 2017:3.

Although distressed funds shrink due to the liquidation of their real estate portfolios, the remaining funds were able to expand due to the increasing demand for fund shares. According to Figure 3.3, average fund size has increased since 2011, from EUR 3 billion to about EUR 4 billion as of March 2017.

The mean of the sales by bank dummy variable of 0.34 shows that 34% of all open-end funds use a bank-owned distribution network to sell their fund shares, since almost no fund changed its distribution network over time.

And funds' expense ratios ranged from 0% to 1.5% of average annual fund size, with an average of 0.8%. The SEB Immoinvest fund had a total expense ratio of 0% from August 2002 through March 2004. Figure 3.3 illustrates that the average total expense ratio increases significantly over time, from 0.75% in 2008 to 0.9% at the end of our sample period.

As the Individual EPRA Index return shows, the funds' weighted target markets on aver-

age exhibit a monthly index return of 0.5%. The Euro Immo Profil fund had the lowest weighted target market return of -27.4% at the height of the global financial crisis in October 2008. After an additional large negative return in November 2008, the German EPRA/NAREIT real estate index, which represents the main investment market for the Euro Immo Profil fund, began a significant recovery, however. Therefore, the Euro Immo Profil fund also showed the largest positive development in its target market return of +38.7%. This high volatility illustrates the considerable uncertainty about the impact of the financial crisis on the real estate markets in October 2008 and the subsequent time period. According to Figure 3.3, open-end real estate funds on average have exhibited predominantly positive development of their target market returns since 2010. This is especially noteworthy when compared to the large negative index returns during the global financial crisis.

The HHI Portfolio variable on average shows a sectoral concentration of 0.54. Open-end funds mainly invest in office buildings. According to Figure 3.3, the average sectoral concentration for open-end real estate funds has increased substantially, from 0.47 to almost 0.55 since the beginning of 2013.

Moreover, because fully half of all the open-end real estate funds considered here are still open, thus showing a discount to NAV of 0%, the interpretation of the overall mean across funds and time is biased. Figure 3.3 shows that the average discount to NAV of almost 20% in 2013 had decreased dramatically to about 10% by the end of the sample period. Without the remaining healthy funds, the average discounts would thus be about twice as high.

The leverage ratio exhibits high heterogeneity. At the end of the sample period, five distressed funds exhibited leverage ratios of zero, with an average across all funds and time of 21%. Furthermore, we detect lower leverage ratios over time because distressed funds repay their property-associated loans according to the advanced fund liquidation.

The TMW Immobilien Welt fund had a 0.3% cash reserve in May 2016, despite the fact that open-end real estate funds are required to hold cash reserves of at least 5% of real

estate property values. A lower liquidity ratio is only valid for a short period of time. Five funds opened after August 2002, and, therefore, had liquidity ratios of almost 100%, since their capital was not invested in real estate. Hence, we include these funds only after twenty-four months of existence. However, note that the liquidity ratios also significantly increased after 2012 due to the progressing liquidation of ten of the funds in the dataset, which were forced to sell their entire real estate portfolios and return the earnings to investors. Thus, the distressed DEGI Europa fund had a maximum liquidity ratio of 99.7% in September 2016 because the fund had sold all of its real estate assets.

The funds' average capital net flows are 0.2%. Newly issued funds tend to have unusually high capital inflows when they first open. This is another reason we exclude the first years of a fund's existence. In addition, fund mergers can lead to tremendous changes in capital flows. Hence, we exclude these special events from our dataset (n=5).

Table 3.4 illustrates the cross-correlation between all variables. The Sharpe ratios exhibit a significantly negative correlation with the discount to NAV of -0.47 and with the dummy variable indicator for the distress status of -0.42. This could be an indicator of endogeneity if the worst-performing funds ultimately close, and, therefore, also exhibit poor performance during the closure periods. Nevertheless, according to Table 3.5, the average performance of currently distressed funds during the pre-crisis period from August 2002 to September 2008 was 4.6%, compared to 3.0% on average for the remaining healthy funds. Therefore, distressed funds were not the worst-performing open-end real estate funds during the pre-crisis period.

On the other hand, closed funds may have overvalued their real estate portfolios to generate excess total returns and attract new fund investors. This may be why investors seem to have less trust in these "exceptional" well-performing funds during times of market turmoil. Overvaluations could lead to large share redemptions and even to fund closures. Nevertheless, the differences in pre-crisis performance are relatively low. Hence, it seems that the closed funds are neither the worst-performing nor the most overvalued in their real estate portfolios. There is thus no evidence of endogeneity.

Table 3.4: Corr. Matrix

	$Sharpe\ Ratio_{i,t}$	$\Delta\ ln\ Fundsize_{i,t-1}$	$ln\ Age_{i,t}$	$Sale\ by\ bank_{i,t}$	$TER_{i,t-1}$	$Individual\ EPRA\ IR_{i,t}$	$HHI\ Portfolio_{i,t}$	$Depository\ Bank_{i,t}$	$Distress_{i,t-1}$	$Discount\ to\ NAV_{i,t-1}$	$\Delta\ Leverage_{i,t-1}$	$Liquidity_{i,t-1}$	$Fund\ Flows_{i,t-1}$
$Sharpe\ Ratio_{i,t}$	1.00												
$\Delta\ ln\ Fundsize_{i,t-1}$	0.15	1.00											
$ln\ age_{i,t}$	0.01	-0.08	1.00										
$Sale\ by\ bank_{i,t}$	0.09	0.05	0.10	1.00									
$TER_{i,t-1}$	-0.11	-0.03	-0.18	0.02	1.00								
$Individual\ EPRA\ IR_{i,t}$	0.04	0.02	0.00	-0.01	-0.01	1.00							
$HHI\ Portfolio_{i,t}$	0.04	0.07	-0.36	0.02	0.14	0.02	1.00						
$Depository\ Bank_{i,t}$	-0.19	-0.16	0.00	-0.17	0.23	0.01	0.07	1.00					
$Distress_{i,t-1}$	-0.42	-0.18	-0.09	-0.38	0.30	0.04	-0.08	0.43	1.00				
$Discount\ to\ NAV_{i,t-1}$	-0.47	-0.14	-0.07	-0.33	0.29	0.03	-0.12	0.35	0.87	1.00			
$\Delta\ Leverage_{i,t-1}$	0.02	-0.09	-0.01	0.02	-0.05	-0.03	0.00	-0.02	-0.03	-0.07	1.00		
$Liquidity_{i,t-1}$	0.04	0.01	-0.21	0.09	0.05	-0.04	0.18	0.30	-0.15	-0.19	-0.03	1.00	
$Fund\ Flows_{i,t-1}$	0.10	0.58	-0.13	-0.04	0.06	0.02	0.07	-0.02	-0.07	-0.04	-0.08	0.08	1.00

The Table shows the correlation coefficients between the dependent and independent variables of the panel regression model.

Table 3.5: Pre-Crisis Period: Healthy vs. Distressed Funds

	Mean Healthy	Mean Distressed
Sharpe Ratio	-0.197	0.192
Total Return	0.030	0.046
Fundsize	39.934	30.144
Age	244.508	149.547
Sale by bank	0.454	0.267
TER	0.006	0.008
Individual EPRA IR	0.001	-0.001
HHI Portfolio	0.563	0.617
Leverage	0.190	0.238
Liquidity	0.282	0.316
Fund Flows	-0.001	0.015

The Table shows the pre-crisis (August 2002-September 2008) comparison between healthy funds and funds subsequently closed and/or liquidated.

Table 3.5 compares all the explanatory variables for healthy and distressed funds during the pre-crisis period from August 2002 through September 2008. Funds that subsequently closed exhibited lower average fund size, were younger, and had higher management fees and higher leverage ratios. They were also less likely than healthy funds to have a bank-owned distribution network. However, to the contrary, they showed on average larger liquidity ratios, as well as larger capital inflows. Considering all the explanatory variables, there is no further evidence that the distressed funds actually performed worse than the healthy funds on average, since the differences in most explanatory variables were not severe.

In addition, the dummy variable for distress status and the discount to NAV show a strong positive correlation of +0.87. Without the distress status, there is no discount to NAV. Nevertheless, we observe premia to NAV for distressed funds, which explains the absence of a perfectly positive correlation. The discount to NAV and the depository bank dummy variable also show a significant positive correlation of about +0.35. Fund management is typically transferred to the depository bank after the liquidation period. This is considered

by law to be a sale of the entire real estate portfolio, which leads to additional taxes for fund investors. Thus, this should increase discounts to NAV.

3.5 Results

Table 3.6 shows the results of our regression model specifications (I-III). The first model includes the indicators for economies of scale and scope represented by fund size, age and the dummy variable for the existence of a bank-owned distribution network (I). The second model adds the influential factors for fund management ability, represented by the total expense ratio, the individual EPRA index return, sectoral concentration and a control variable for the potential influence of a fund management change (II). The third model displays two further indicator variables for the influence of a fund's distress status on fund performance. All three model specifications also control for the leverage ratio, the liquidity ratio and the fund's capital net flows.[9] Our preferred model, III, has 2,722 observations and exhibits a 22.3% goodness of fit.

3.5.1 Economies of Scale and Scope

First, we test the potential influence of economies of scale and scope on fund performance (Hypothesis 1). Fund size shows a stable, increasing and significant influence on funds' Sharpe ratios (models I, II and III). Considering the logarithm, recalculating the regression coefficients shows that an increase in the absolute difference of fund size by EUR 100 million would lead on average and c.p. one month later to an increase in the Sharpe ratio by 1.395%. The positive influence indicates that larger funds are able to realize large-scale real estate investments and use economies of scale in their administration.

Next, we use fund age as a further proxy for economies of scale and scope. The regression results are not stable across our different model specifications. Nevertheless, our

[9]The legal fund environment (i.e., selling restrictions on the real estate properties) shows no significant influence on fund performance.

Table 3.6: Explaining Funds' Sharpe Ratios (i.e., Risk-adjusted Total Returns)

	(I)	(II)	(III)
$\Delta\ ln\ Fund\ size_{i,t-1}$	1.523***	1.649***	1.395***
	(0.383)	(0.506)	(0.384)
$ln\ age_{i,t}$	-0.200	-0.184	0.524**
	(0.269)	(0.356)	(0.242)
$Sale\ by\ bank_{i,t}$	0.874***	0.767***	-0.167
	(0.210)	(0.243)	(0.133)
$TER_{i,t-1}$		6.902	14.76
		(41.14)	(32.08)
$Individual\ EPRA\ IR_{i,t}$		0.833*	1.114**
		(0.476)	(0.449)
$HHI\ Portfolio_{i,t}$		1.036	0.714
		(0.827)	(0.582)
$Depository\ Bank_{i,t}$		-0.226	-0.164
		(0.236)	(0.259)
$Distress_{i,t-1}$			-0.326**
			(0.141)
$Discount\ to\ NAV_{i,t-1}$			-4.023***
			(0.383)
$\Delta\ Leverage_{i,t-1}$	0.413	0.178	-0.992
	(0.716)	(0.994)	(0.774)
$Liquidity_{i,t-1}$	0.0327	-0.0164	-0.766*
	(0.416)	(0.506)	(0.414)
$Fund\ Flows_{i,t-1}$	0.900	0.687	0.426
	(0.783)	(0.903)	(0.805)
Constant	0.673	0.113	-2.606*
	(1.438)	(2.079)	(1.440)
Observations	3,119	2,723	2,722
R-squared	0.046	0.063	0.223
Number of funds	24	24	24

The Table displays the results of the performance regression. Robust standard errors are in parentheses. Asterisks denote significance as follows: *** p<0.01, ** p<0.05, * p<0.1.

preferred model (III) shows a positive and significant influence of age on risk-adjusted fund performance. A 1% increase in fund age exhibits on average and c.p. a 0.524% higher Sharpe ratio. Therefore, we find that fund age can proxy for the influence of the economics of scale and scope on fund performance. Older funds seem to have developed more efficient administration than newly issued funds.

We next test the influence of a fund's bank-owned distribution network for fund shares on performance. We find no significant effect in our preferred model (III). But we find a positive and significant influence of the sale by bank variable on fund performance in models I and II. The active advertisement of fund shares by fund sponsors (i.e., large German banks), and the positive diversification effect of the wide target group of bank customers, should theoretically enhance fund performance. Nevertheless, we cannot confirm a positive or significant influence of a bank-owned distribution network as a proxy for economies of scale and scope on fund performance.

To summarize, we find predominantly positive effects of economies of scale and scope on fund performance.

3.5.2 Fund Management Skills

We test for the influence of fund management ability on fund performance (Hypothesis 2). First, we find no significant influence of the total expense ratio on subsequent fund performance. On the one hand, higher management fees decrease overall fund performance; on the other hand, they could signal fund management quality. The reason for the insignificance of the total expense ratios could be that management fees are relatively stable across time.

Fund management target market mix, represented by the weighted funds' target market monthly index return, shows a stable and significant positive influence on fund performance in model II, as well as in our preferred model, III. Funds with a 1% higher target market index return exhibit on average and c.p. a significantly higher subsequent Sharpe ratio of about 1.114%. A well-chosen target market mix serves as an indicator of fund management ability, although it is possible that fund managers could invest in poor-performing real estate assets even in a high-performing real estate market environment.

Note that the level of specialization or diversification depends on fund management strategy. Hence, we can use the level of concentration as an additional proxy for fund management skill. Nevertheless, our proxy variable, the Herfindahl index for sectoral concen-

tration (HHI portfolio), shows a positive but insignificant influence on fund performance. Funds, which invest mainly in one asset class are more specialized and should be able to obtain better investment choices. On the contrary, specialization causes less diversification, which lead to higher risk.

As we noted earlier, distressed funds by law must transfer management to a depository bank if they are not able to sell their entire real estate portfolios during the determined liquidation time period. As of March 2017, we find that a plethora of funds have been managed by depository banks for several years. Therefore, it is feasible to test the influence of a management change as a proxy for fund management ability on fund performance. Both model specifications show a negative but insignificant influence of a management change on fund performance.

Besides the significant influence of target market mix, we find that management fees, sectoral concentration and the influence of a different fund management have no significant influence on fund performance. Considering several proxies for management ability, we are in line with the literature on performance studies that shows the influence of management ability on fund performance is not clear. These results strengthen the theory that external factors, besides fund management skill and economies of scale and scope, considerably affect the performance of open-end real estate funds, and especially of distressed funds.

3.5.3 Open-End Fund Status

According to Hypothesis 3, we can use the discount to NAV as an additional influential variable on fund performance. We can also use a fund's distress status variable to control for the influence of the time constraint in the liquidation process, as well as for potential asset overvaluations due to the calculation of funds' net asset values. The lagged dummy variable for distress status shows a significantly negative influence on subsequent fund performance (model III). A distressed fund exhibits c.p. a 0.326-point lower subsequent Sharpe ratio. Hence, the distress status itself lowers fund performance. This effect may be

attributable to the loss in bargaining power in the real estate sales process from the mandated time constraint for the entire fund liquidation. Moreover, distressed funds seem to exhibit significant asset overvaluations caused by the appraisal methodology. These overvaluations were revealed by the closure and the forced real estate asset liquidation. The extent of fund investors' mistrust in the appraisal methods is represented by the discount to NAV. In addition to existing overvaluations, excessive discounts to NAV may also be due to fund investors' uncertainty over the liquidation process and irrational influences. The discount to NAV measures the loss in bargaining power of fund management because of the lower real estate asset valuations by market participants. In addition, dissatisfied fund investors may increase selling pressure by suing the fund for mismanagement. Therefore, the discount to NAV also measures the extent of this pressure by fund investors. In line with this theory, we note that a 1% higher discount to NAV leads on average and c.p. to a 4.023% lower Sharpe ratio in the subsequent month.

3.5.4 Control Variables

We control for the liquidity ratio, the leverage ratio and funds' capital net flows across all model specifications. The liquidity ratio significantly influences fund performance, but the leverage ratio and the fund flows do not. These results hold across all model specifications.

A 1% increase in the liquidity ratio decreases c.p. and on average the fund's subsequent Sharpe ratio in our preferred model (III) by 0.766%. The capital held in money market deposits and cash could not be invested in real estate assets. Since liquidity shows a lower interest yield than real estate, funds with higher liquidity ratios display lower overall fund performance. Nevertheless, better performance comes at the cost of higher risk for the real estate investment compared to the relatively safe money market deposits.

3.6 Conclusion

This study contributes to the literature on performance studies for mutual funds, as well as to that on open-end real estate funds in general. Due to the advanced liquidation process of distressed funds, it is now feasible to analyze the secondary market conditions for distressed fund shares. We show that the tremendous discounts to NAV for distressed funds during the 2012-2014 period were too high. The uncertainty about the liquidation process may have motivated exaggerated discounts to NAV of up to 60%.

We also find a significantly negative influence of the discount to NAV on fund performance. Overly large discounts can be considered a measure of uncertainty about current valuation methods and about the liquidation process. Significant discounts also put pressure on fund management, and, therefore, lead to a loss in bargaining power during the sales process.

But the distress status itself also lowers fund performance. Because distressed open-end real estate funds were not the worst-performing funds prior to their closure, the fund closure events reveal serious overvaluations of funds' real estate assets. This could theoretically also be a problem for the remaining healthy open-end real estate funds. Moreover, the time constraint for fund liquidation can lower fund management's bargaining power. Ultimately, we find that fund performance depends on economies of scale and scope (i.e., fund size and age), as well as on the development of funds' target real estate markets.

Chapter 4

The Discount to NAV of Distressed Real Estate Funds

This study is the result of a joint project with Michael Heinrich, René-Ojas Woltering, and Steffen Sebastian

4.1 Introduction

Open-end real estate funds, besides REITs and closed-end funds, represent one of the most significant real estate investment vehicles worldwide[1], with Germany being the largest market. As of December 2016, this asset class had investments totalling about EUR 145 billion.

Investors in these funds trade directly with the fund or its sponsor, which sells and redeems shares on a regular basis. Price per share is determined by the sponsor, and is based on the market value of all assets and liabilities. Each month, independent appraisers reappraise one-twelfth of the entire portfolio.[2] Due to their NAV-based pricing system, open-end real estate funds are usually less volatile than REITs or real estate stocks, which are subject to stock market risk. This, however, comes at the cost of increased liquidity

[1] See Downs et al. (2017) for a recent overview.
[2] See Weistroffer and Sebastian (2015) and Fecht and Wedow (2014).

risk. The discrepancy between the daily liquidity of fund shares and the illiquidity of the underlying direct property investments is referred to as "bank run" risk (Bannier et al., 2008; Weistroffer and Sebastian, 2015). To maintain the "buy-back" guarantee, open-end real estate funds tend to hold high cash reserves. In Germany, at least 5% of a fund's NAV must be held in cash or liquid assets. In practice, average liquidity ratios tend to fluctuate between 20% and 30% (see Downs et al. (2017)), although these reserves may prove inadequate during times of market turmoil.

A recent example of what havoc market turmoil can wreak can be seen with the Brexit referendum in the U.K. on June 23, 2016. The decision to leave the European Union came as a surprise to many investors, and led to massive redemptions from U.K. open-end real estate funds. As a result, seven public U.K. funds, representing half the total open-end real estate fund assets under management, were forced to suspend share redemptions.[3]

However, the German open-end fund industry was hit even harder in the aftermath of the 2008 global financial crisis. Starting in October 2008, the month after the Lehman Brothers bankruptcy, ten public German open-end real estate funds had to suspend share redemptions.[4] None of these funds could raise enough liquidity to permanently stay open and fulfill all the redemption requests. Thus, each one had to liquidate its portfolio and pay out the proceeds to investors.[5]

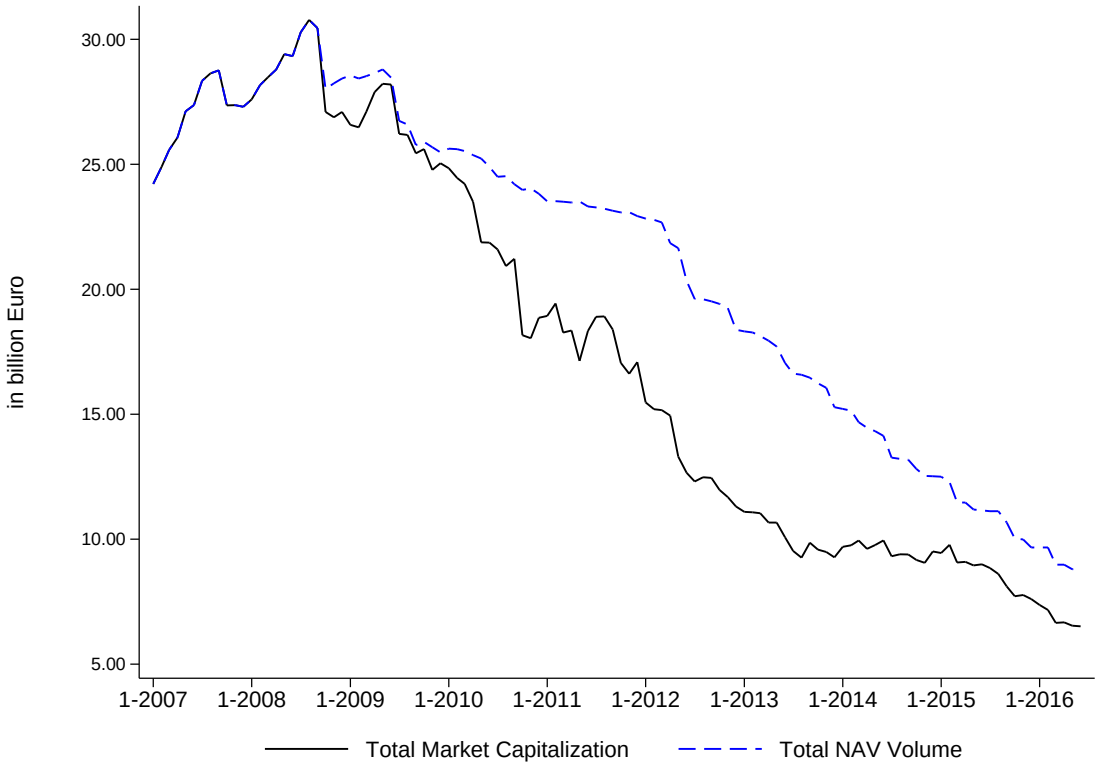
Besides waiting for the stepwise liquidation of fund assets, German open-end real estate fund investors have the option of selling their shares on the secondary market. This option is available both for funds in a liquidation phase, as well as those under share redemption suspensions. In this study, we refer to both types as "distressed" open-end real estate

[3] M&G Property Portfolio, Henderson UK Property PAIF, Standard Life UK Real Estate Fund, Aviva Investors Property trust, Columbia Threadneedle UK Property Authorised Investment Fund (PAIF), Canada Life UK Property Fund, Aberdeen UK Property Fund.

[4] This study focuses solely on retail funds. We exclude semi-institutional funds, which are primarily intended for institutional investors. They are legally classified as retail funds, but the minimum investment begins at EUR 10.000. Consequently, semi-institutional funds do not fit our framework, where the supply and demand of fund shares on the secondary market, and, hence, ultimately the discount to NAV per share, is determined by the unwillingness of retail investors to go through the liquidation process. Moreover, we exclude the UniImmoGlobal fund, which was forced to close only from March to June 2011 due to devaluations of real estate assets in Japan after the Tohoku earthquake and tsunami.

[5] The next section provides some regulatory background on the liquidation regime of German open-end real estate funds and an overview of the recent crisis.

Figure 4.1: Total NAV Volume and Total Market Capitalization



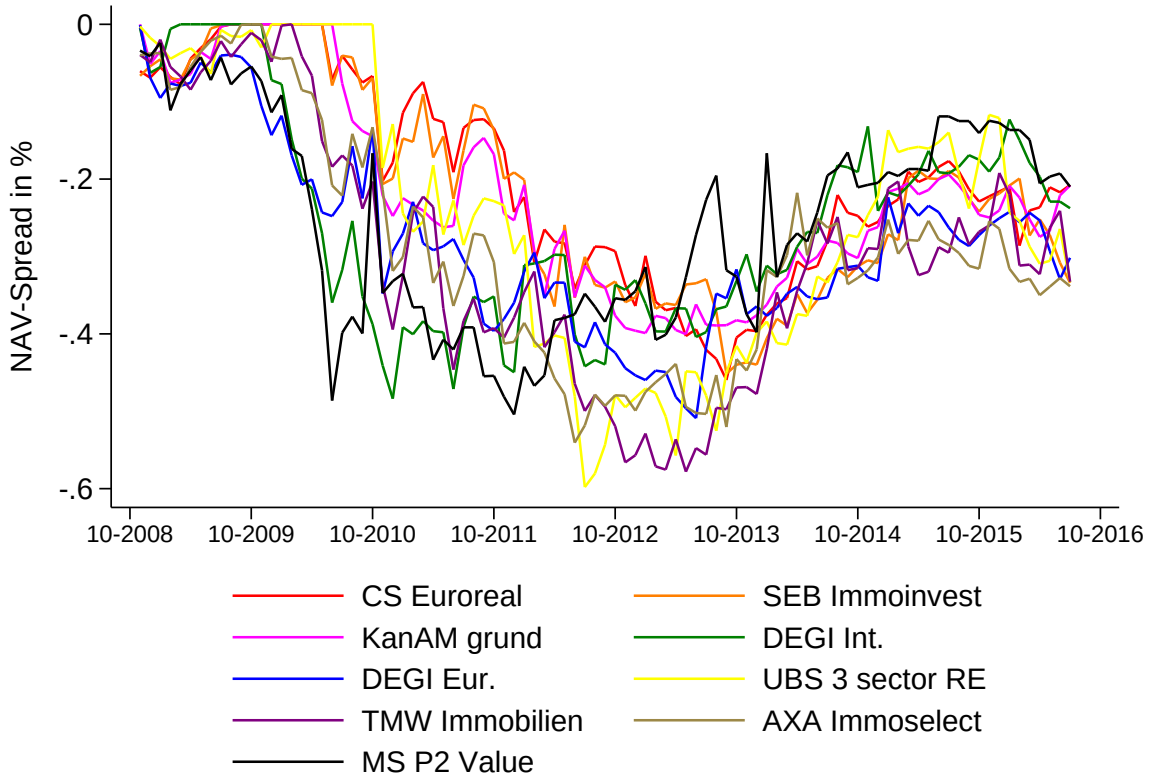
This figure shows total NAV volume and total market capitalization of all distressed open-end real estate funds from 2007:1 to 2016:6. The above figure illustrates the absolute deviation between NAV and market prices, while the below figure shows the relative deviation. Total market capitalization is defined as the sum of the fund-specific stock market prices weighted by the total number of shares of each fund. Total fund volume is calculated as the sum of the total number of fund shares multiplied by the NAV of each fund.

funds. Although the fund companies continue to regularly publish NAVs per share, the price per share on the secondary market becomes a function of supply and demand.

The principles of supply and demand suggest that secondary market prices should be lower than NAV if a large number of investors choose not to wait for the liquidation process to proceed. Due to the increasing supply of fund shares, market prices must fall below NAV to realign supply and demand. Furthermore, the loss of the "buy-back" guarantee, as well as the shift from a relatively stable appraisal-based pricing system to more volatile transaction-based share prices, justifies a risk premium.

Figure 4.1 confirms this intuition. A comparison of the NAV-based total fund size of all distressed real estate funds (blue line) and their total market capitalization based on secondary market share prices (black line) reveals that investors engaging in secondary market trading on average accept substantial discounts to NAV.

Figure 4.2: Discount to NAV



This figure shows the development of the discount to NAV for each fund from 2007:1 to 2016:6. The discount to NAV indicates the negative deviation between the fund's NAV and the secondary market price in percent.

Beyond these general considerations, however, little is known about the specific factors that explain the discount to NAV of distressed open-end real estate funds. Figure 4.2 shows that the discounts of distressed real estate funds differ substantially across funds. Therefore, we aim to identify the fund-specific factors behind the heterogeneity of NAV spreads across funds. In addition, and despite the different closing dates, the individual discounts to NAV tend to be highly correlated between funds. Thus, we explore whether the correlations of NAV discounts are driven by marketwide sentiment.

Our goal is to answer these questions by providing a comprehensive analysis of the factors that explain discounts to NAV of distressed open-end real estate funds. NAV discounts have already been extensively studied in the context of closed-end funds (e.g., Lee et al. (1991); Pontiff (1996); Chay and Trzcinka (1999) and of publicly traded REITs or real estate operating companies (REOCs) (e.g., Barkham and Ward (1999); Brounen and ter Laak (2005); Patel et al. (2009). The major difference between these strands of the

literature and this study is that the discounts to NAV of closed-end funds or REITs may theoretically persist forever. In contrast, the forced liquidation of the funds in our sample ensures investors actually receive payouts. This enables us to study NAV discounts in a new setting. On the one hand, it is an advantage that funds are liquidated and investors are paid. However, on the other hand, a "forced liquidation" may result in a poorer bargaining position for selling property, which by itself may justify a discount to NAV.

Understanding what drives NAV discounts of distressed open-end real estate funds is relevant for all market participants. The magnitude of the discount to NAV is not only relevant for existing investors, for whom it represents a loss of shareholder value, but also for potential new investors, for whom it may represent an investment opportunity. Fund families may also be concerned about discounts to NAV. Their prestige may be damaged if investors not only suffer liquidity constraints, but also high discounts to NAV on the secondary market. Moreover, regulators may be interested in fostering an environment where discounts to NAV are as small as possible.

Our empirical study is based on a monthly panel of nine distressed open-end real estate funds in Germany. It covers the complete crisis and post-crisis periods, from October 2008, when the first funds suspended share redemptions, through June 2016.[6]

Our set of explanatory variables is comprised of fund-specific, external variables and control variables. We use the leverage ratio, the liquidity ratio, management fees, extraordinary payouts, economic growth of target markets, and tenancy of fund properties to explain the fund-specific, or idiosyncratic, part of the NAV discount. External variables are used to capture the systematic component. Here, we use closures of other funds and total number of funds in liquidation. Both variables can also be interpreted as spillover effects from other real estate funds. Moreover, we control for the total amount of net fund flows to all real estate funds that continue to sell and redeem shares. We also include macroeconomic uncertainty indices, which have become increasingly popular as a means to account for the rising degree of economic uncertainty in the aftermath of the global

[6] Nine of the ten closed retail funds were relatively comparable to each other. However, the HansaImmobilia Fund was liquidated without adhering to the closing period of twenty-four months. We exclude that fund from our dataset.

financial crisis. We control for funds' past performance, size, and share of institutional holdings.

Using fixed-effects panel regressions to explain the discount to NAV, we provide evidence that fundamental, fund-specific variables play a substantial role. In particular, we find that the discount to NAV increases with rising leverage ratios, and decreases with the ratio of cash holdings. This is consistent with the idea that the risk of distressed real estate funds depends primarily on whether appraisal values are reliable. This risk increases (decreases) with rising leverage (liquidity). We also find that the discount to NAV is related to potential conflicts of interest between investors and fund management. It increases concurrent with management fees, and is smaller for funds with higher extraordinary payouts, suggesting the benefit of investor-friendly behavior. We find evidence of industrywide spillover effects because the discount to NAV increases when other funds announce liquidations. Finally, we provide evidence that the discount to NAV is related to our proxies for investor sentiment. We find that discounts to NAV decrease with the total level of capital flows into the open-end fund industry, and increase with the degree of macroeconomic uncertainty.

The remainder of this study is organized as follows. Section 4.2 provides an overview of the German open-end fund crisis and some regulatory details. Section 4.3 describes our set of explanatory variables and how they relate to the extant literature. Section 4.4 describes our data, while our regression results are in section 4.5. Section 4.6 concludes.

4.2 The German Open-End Fund Crisis and Regulatory Background

When a German open-end real estate fund suspends share redemptions, it tries to sell enough properties to increase its liquidity reserves, and reopen and ultimately fulfill all redemption requests. Funds that fail to reopen within twenty-four months are forced to liquidate their portfolios and pay out the proceeds to investors.

Selling properties within a particular time frame can be difficult, however, especially during, e.g., times of low transaction activity in the real estate markets, such as during the aftermath of the 2008 global financial crisis. Lower asking prices can help increase the probability of a sale. However, in order to avoid "fire sales", the German legislature enacted sale price restrictions tied to appraisal values. During the first twelve months following share redemption suspensions, funds are thus not permitted to sell properties below their most recent appraised values. After the first twelve months, the funds may sell properties at a discount of up to 10% relative to the last appraised value.

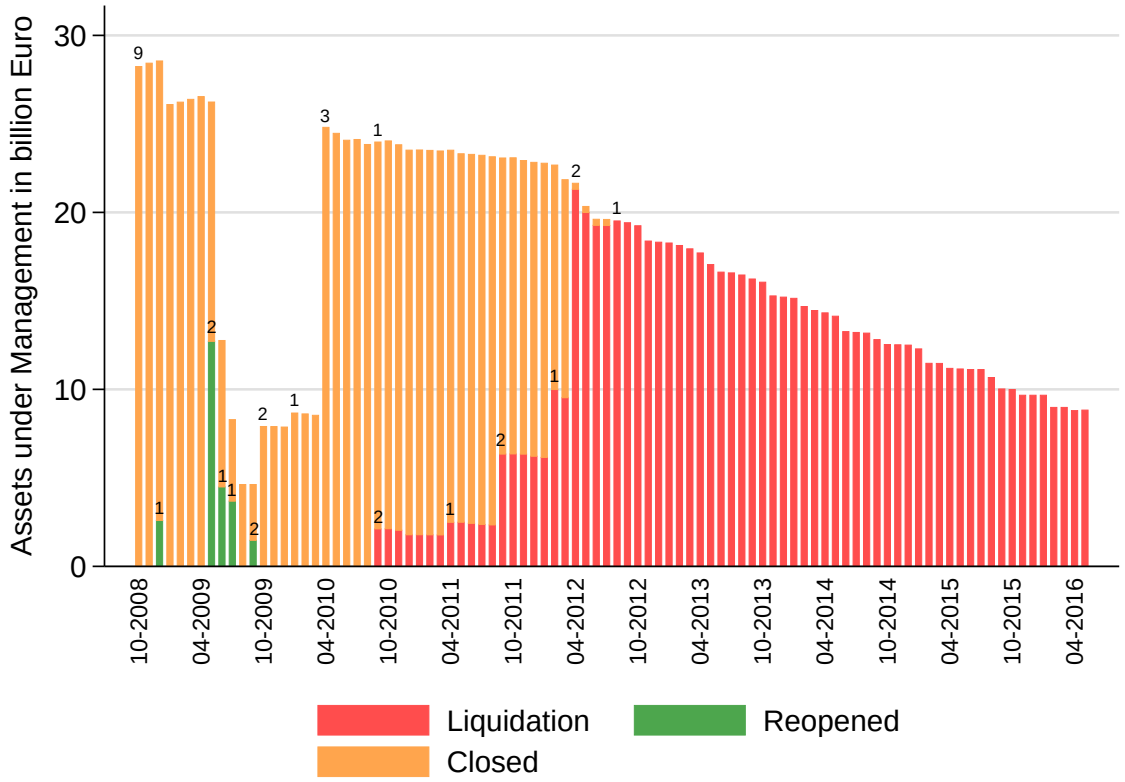
These legal restrictions may be viewed as overly burdensome for distressed real estate funds that are attempting to reopen. However, funds are allowed to reappraise their properties prior to transactions, which effectively enables fire sale prices. However, large discounts of transaction prices relative to previous appraisal values can destroy trust in a fund's appraisal values. And a "vicious circle" may result if a lack of confidence in a fund's published NAVs leads to higher redemption requests when the fund attempts to reopen.

The liquidation process is overseen by the Federal Financial Supervisory Authority (BaFin), which determines an individual time line for every fund (typically between three and five years). Subsequently, the investment company is no longer in charge of managing further liquidations. Rather, a third-party depository bank is tasked with selling the entire real estate portfolio.[7] Funds in liquidation may sell properties at discounts of up to 20% during the first twelve months of the liquidation process. Twelve months later, discounts of up to 30% are authorized. After the determined liquidation date, the fund's management is transferred to a depository bank, which can sell the assets without restrictions. This event also leads to an extraordinary tax burden for all investors, because a land transfer tax applies.

Figure 4.3 provides a detailed overview of the number and total fund size of German open-end real estate funds that either suspended share redemptions (orange bars), or were already in the process of fund liquidation (red bars). The graph also shows the

[7] As a consequence of the open-end real estate fund crisis, the regulatory regime was modified several times. However, our analysis is unaffected by these changes because all the funds in our analysis were liquidated under the prior investment laws (InvG, effective from 1/1/2004 -7/22/2013).

Figure 4.3: Overview Open-Ended Fund Crisis



This figure shows the number and the total fund size of the German open-end real estate funds, that either suspended share redemptions (orange bars) or were in the process of fund liquidation (red bars). The graph also shows the number and the total fund size of any reopenings (green bars).

number and total fund size of reopenings (green bars). The crisis began in October 2008, when nine funds with total assets under management of EUR 28 billion suspended share redemptions. The reopening of seven of these funds over the following twelve months indicated a recovery. However, these reopenings proved unsustainable. Through May 2010, the total fund size of funds that had suspended share redemptions had returned to previous levels of around EUR 27 billion, but the first fund liquidations were announced in October 2010. As of August 2012, all previously suspended funds had entered the liquidation phase.[8] The shrinking fund volume over time shown in Figure 4.3 is due to two effects: 1) distributions to investors facilitated by property disposals, and 2) falling property appraisal values following impairments. As of June 2016, EUR 10 billion of invested capital was yet to be distributed to shareholders under liquidation.

[8]Table 4.1 provides the exact dates of all the major events for the distressed real estate funds in our sample.

Table 4.1: Overview of Distressed Open-End Real Estate Funds

fund	first closure	second closure	notice liquidation	depository bank
CS Euroreal A	10/30/08 - 06/29/09	05/20/10	05/21/12	04/30/17
SEB ImmoInvest	10/29/08 - 06/02/09	05/06/10	05/07/12	04/30/17
KanAm Grundinvest	10/28/08 - 07/08/09	05/06/10	03/01/12	12/31/16
AXA Immoselect	10/28/08 - 08/28/09	11/19/09	10/20/11	10/20/14
DEGI International	10/31/08 - 01/31/09	11/17/09	10/25/11	10/15/14
DEGI Europa	-	10/31/08	10/01/10	09/30/13
UBS (D) 3 Sector RE	10/31/08 - 10/31/09	10/06/10	09/05/12	09/05/15
TMW Immobilien	10/28/08 - 10/31/09	02/08/10	05/31/11	05/31/14
Morgan Stanley P2 Value	-	10/30/08	10/26/10	09/30/13

This table provides an overview of the relevant events for all distressed public open-end real estate funds, particularly date of first closure, reopening date, date of their second closure, date of liquidation announcement, and date of the depository bank taking control of the liquidation process.

4.3 Related Literature and Hypotheses

To the best of our knowledge, this is the first study to address NAV discounts of distressed funds in general, and distressed real estate funds in particular. While there is no extant literature that relates directly to our work, our research questions are related to the literature on the closed-end fund puzzle.

In essence, the basket of stocks held by these funds trades for less than the combined market value of the individual stocks held in the portfolio (Cherkes (2003)). Thus, even in the presence of professional fund management, the pooling appears to reduce the portfolio's worth. According to Lee et al. (1991), closed-end fund discounts are the result of private investor sentiment, or what are referred to as noise traders. An irrational downturn in investor sentiment leads to larger discounts. Therefore, holding a closed-end mutual fund portfolio can result in larger risk, or uncertainty, than holding the underlying fund's assets.

Our research is also related to the literature on the discounts (or premia) to NAV of publicly traded REITs or REOCs.[9] It is not uncommon for REITs to trade at a premium to their NAV, but they also frequently trade at discounts to NAV. Similarly to closed-end funds, Barkham and Ward (1999) find evidence that supports the noise trader hypothesis for listed property companies in the U.K.

[9]In contrast to common stocks and mutual funds, there is no public market for the real estate assets alone.

The difference between these two strands of the literature and this study is that distressed real estate funds are forced to sell off their property portfolios and pay out the proceeds to investors. Open-end real estate funds can be seen as a mixed form between listed and direct real estate. While REITs are as liquid as common stocks, open-end real estate funds are only liquid as long as investors can redeem their shares to the fund or the sponsor of the fund. On the other hand, the shares of "closed" open-end real estate fund can be traded on the secondary markets, often at substantial discounts. In this context, the discount to NAV of distressed open-end real estate funds can be interpreted as the price of reduced liquidity and uncertainty regarding the appraisal values of the fund's properties.[10] This enables us to study how investors price the risks associated with the forced liquidation of a direct-property portfolio.

Figure 4.2 shows that the discounts to NAV of distressed real estate funds are heterogeneous across funds, which suggests they are driven by fund-specific, or idiosyncratic, variables. Our first three hypotheses and the respective proxy variables reflect these potential internal factors. Figure 4.2 also reveals that the discounts to NAV are correlated between the funds over time. Lee et al. (1991) document that this is true of closed-end funds as well, which indicates that NAV discounts may be affected by either industrywide or macroeconomic sentiment. Hypotheses 4 and 5 reflect these potential external factors.

4.3.1 Financial Leverage

The anticipation of lower transaction prices compared to current appraisal values is a potential rational explanation for substantial discounts to NAV. The effect of lower appraisal values or transaction prices on a fund's NAV is amplified further by the amount of financial leverage used by a fund. For example, if investors anticipate that the next appraisal round will reveal a 10% decrease in property values, then a leverage ratio of 50% would justify a 20% discount to NAV, assuming all the fund's assets are invested in real estate. Thus, the leverage ratio risk may be reflected in a lower market price relative to the NAV

[10] Schweizer et al. (2013).

per share. Bond and Shilling (2004) and Brounen and ter Laak (2005), using data on European public property companies, find that leverage is positively correlated with NAV discounts. Likewise, the discount to NAV of distressed open-end real estate funds may also increase with the leverage ratio.

Mirroring this principle, we find that the opposite effect may occur when a fund has high cash reserves. Because distressed real estate funds may be forced to sell their portfolios, they tend to exhibit rising liquidity ratios until they pay out proceeds to investors. In contrast to the appraisal values of the properties, a fund's liquid assets generally have little to zero market or appraisal risk, and can be considered safe for investors. Consistent with the idea that investors appreciate higher liquidity ratios, Fecht and Wedow (2014) find that lower liquidity ratios are associated with higher redemptions. Therefore, we expect a negative relationship between the liquidity ratio of a fund and its discount to NAV. The potential impact of the fundamental risk associated with the degree of financial leverage employed by a fund leads to Hypothesis 1:

Hypothesis 1: *The discount to NAV increases (decreases) with the leverage (liquidity) ratio of a fund.*

4.3.2 Conflicts of Interest

According to the closed-end fund literature, management costs are an important, but ambivalent, determinant of NAV discounts. For example, if the expected return on the equity portfolio of a closed-end fund is 7%, fund fees of 1.5% per year can considerably reduce that return after fees. Gemmill and Thomas (2002) document that small closed-end funds, which often display large management costs, exhibit larger discounts to NAV. On the other hand, Lenkey (2015) shows that the relation between NAV discounts and management fees is not stable due to two opposing effects 1) larger fees reduce shareholder value 2) larger fees increase management abilities.

During normal times, investors in open-end real estate funds can "vote with their feet," and sell their shares back to the fund if they believe management's fees are excessive. This

would decrease assets under management and hence fee income, thereby incentivizing fund managers to act in line with investor interests. In contrast, investors in distressed real estate funds do not have the option to redeem their shares to the fund, and are fully exposed to the fees set by management. They can only choose to sell their shares on the secondary market, where assets under management remain unaffected. This potential conflict of interest between fund management and investors can have an effect on NAV discounts if investors in expensive funds are more inclined to sell their shares on the secondary market.

A similar conflict of interest arises because fund managers of distressed real estate funds maximize fee income by delaying the liquidation process. During normal times, investors in open-end real estate funds receive an annual dividend. When a distressed fund is in the process of liquidating, however, investors receive additional "extraordinary" payouts from the stepwise liquidation of the fund's real estate assets, often on a semiannual basis. Here, large payouts may signal that fund management is acting in the interest of investors, and is interested in a speedy liquidation process. Accordingly, distressed funds with higher payout ratios are expected to trade at lower discounts to NAV compared to their peers with smaller payout ratios. Furthermore, investors in funds with large NAV discounts may appreciate payouts, because the dividend yields are considerably higher when calculated with respect to discounted share prices rather than NAVs. Consistent with this idea, the literature on the closed-end fund puzzle finds that low dividend payouts lead to larger discounts to NAV (Pontiff (1996); Gemmill and Thomas (2002); Cherkes (2003); and Malkiel and Xu (2005)). The potential conflict of interest between fund management and investors leads to our second hypothesis concerning the discount to NAV of distressed real estate funds:

Hypothesis 2: *The discount to NAV increases when the fund management does not act in the interest of fund investors.*

4.3.3 Portfolio Quality

The anticipation of lower transaction prices than current appraisal values is a potentially rational explanation for substantial discounts to NAV. Recent research suggests that GDP may be a useful variable to forecast future direct real estate prices. Using a global sample of office property prices, De Wit and van Dijk (2003) find that GDP positively influences direct real estate prices. Accordingly, NAV discounts may be smaller if the fund's assets are located in countries with positive GDP developments.

Another measure of the quality of a fund's property portfolio is average tenancy rate. Wurtzebach et al. (1991) find that high office vacancy rates (or low tenancy rates) are associated with decreasing commercial real estate returns in the U.S. Hence, higher tenancy rates may be perceived as a signal of the quality of a fund's property portfolio, as well as more stable cash flows and property values. In other words, we posit that funds with higher tenancy rates are less likely to devalue their properties in the near future. We thus expect a negative relationship between a fund's tenancy rate and its discount to NAV. Taken together, our two proxies for fund portfolio quality lead to Hypothesis 3:

Hypothesis 3: *The discount to NAV decreases with a fund's property portfolio quality.*

4.3.4 Spillover Effects

Figure 4.2 shows the correlation of NAV discounts between funds over time, and suggests the presence of a systematic component simultaneously affecting the NAV discounts of all funds. The financial fragility of open-end real estate funds exhibits some striking similarities to the banking sector. Spillover risk (where problems from one bank can spread to others within the system) is a prime concern for authorities and a rationale for regulating the financial system. For example, Aharony and Swary (1983) find that large bank failures can lead to falling prices for solvent bank stocks if the failures are caused by systemwide banking problems.

In the context of distressed real estate funds, negative spillover effects may arise from

the announcement of another fund's closure or liquidation. Such an announcement by other funds may increase doubts over the future development of the overall asset class. Investors in distressed real estate funds who speculated on a successful reopening may see their hopes vanish with the announcement of another fund's suspensions of share redemptions. Similarly, the announcement of another distressed real estate fund entering the liquidation phase may imply that the last chance for a successful reopening has passed. As a result of negative industry news, the share prices of distressed funds may fall even further, thereby increasing the discount to NAV. This leads us to Hypothesis 4:

Hypothesis 4: *The discount to NAV increases due to negative spillover effects from the announcement of other fund's closures or liquidations.*

4.3.5 Sentiment

Our next hypothesis aiming to explain the systematic component of NAV discounts relates to industrywide or macroeconomic sentiment. In particular, we focus on variables that proxy for industrywide sentiment toward the asset class. If investor sentiment reflects investor behavior toward an asset class, we expect there to be an effect on the returns of the underlying securities. The returns on the secondary market may then directly impact a widening or a compression of the discount to NAV.

Indro (2004) finds a high correlation between aggregate equity fund flows and other measures of investor sentiment, such as the bullishness of individual investors or newsletter writers. This suggests that fund flows can be a useful proxy for investor sentiment. Consistent with the hypothesis that investor sentiment affects returns, Warther (1995) finds a strong relationship between aggregate flows into equity mutual funds and contemporaneous returns of the securities held by these funds. Similarly, Ben-Rephael et al. (2012) find that monthly aggregate shifts between bond funds and equity funds are positively correlated with contemporaneous aggregate stock market excess returns.

In addition to industry-specific sentiment, the returns and NAV discounts of distressed real estate funds may also be driven by macroeconomic sentiment. Two popular uncer-

tainty indices are used commonly in the literature. First, the Economic Policy Uncertainty Index of Baker et al. (2015) features prominently in a plethora of research (e.g., European Central Bank (2013), European Commission (2013), and International Monetary Fund (2014)).[11] Second, the implied volatility index (VIX), which proxy for stock market uncertainty, measure anticipated (implied) stock market risk based on the difference between stock prices and stock price futures (e.g., Baker et al. (2015); Bekaert et al. (2013)). This measure is important because the funds are subject to common stock market risk after the event of closing. The expected impact of sentiment on the discount to NAV of distressed funds is summarized in Hypothesis 5:

Hypothesis 5: *The discount to NAV increases with improving investor sentiment.*

4.4 Data, Methodology and Sample Description

4.4.1 Data

Our sample consists of the population of all nine distressed German open-end real estate funds.[12] Table 4.1 provides an overview of the funds, as well as their closure, reopening, and liquidation dates.

Our panel dataset covers the October 2008 through June 2016 period. The starting point coincides with the closure of the nine funds. Subsequently, substantial divergences between secondary market prices and NAVs emerged, which led to the NAV spreads examined in this study.

Following Lee et al. (1991) and Barkham and Ward (1999), we calculate the discount to NAV as the difference between current NAV and the contemporary fund's market price divided by current NAV. NAVs are published daily for each fund by the fund management (KVG); market prices are provided by the Hamburg-Hannover stock exchange.

[11] The full list can be found at: www.policyuncertainty.com/research.
[12] As noted earlier, we exclude the HansaImmobilia fund and the UniImmoGlobal fund.

Our fund-specific variables are hand-collected from the monthly fact sheets found on the individual fund websites, as well as from funds' semiannual and annual reports. Note that several funds are managed by depository banks that no longer provide monthly fact sheets. Their annual and semiannual reports are also less detailed. Hence, our explanatory variables are somewhat less up-to-date toward the end of the sample.

The share of institutional owners per fund comes from Morningstar Direct. We also collect industrywide data on fund flows from the German Investment and Asset Management Association (BVI), which collects data about net flows directly from its members and represents the vast majority of the German mutual fund industry. The dataset includes the monthly net flows of forty-eight public and semi-institutional German open-end real estate funds in our sample period.[13] Data on GDP come from the OECD.

4.4.2 Research Design and Definition of Variables

We use a panel regression model to examine the determinants of NAV discounts for distressed real estate funds. Our unbalanced panel consists of 708 fund-month observations. The key variable of interest is the discount to NAV of fund i at the end of month t, which is calculated as follows:

$$Discount\ to\ NAV_{i,t} = \frac{Stock\ market\ price_{i,t}}{NAV\ per\ share_{i,t}} - 1 \tag{4.1}$$

[13] Since 2013, according to the German Central Bank, extraordinary payouts of distressed funds have been considered as capital outflows (BVI (2016)). In contrast, all extraordinary payouts of distressed funds are set equal to zero in order to standardize the calculations for both healthy and distressed funds.

For the purpose of our empirical tests, we estimate the following panel regression model:

$$\begin{aligned} Discount\ to\ NAV_{i,t} = \alpha &+ \beta_1\ \Delta\ Leverage_{i,t-1} + \beta_2\ \Delta\ Liquidity_{i,t-1} + \beta_3\ \Delta\ TER_{i,t-1} \\ &+ \beta_4\ Extraordinary\ Payouts_{i,t} \\ &+ \beta_5\ Economic\ Growth\ Target\ Markets_{i,t-1} + \beta_6\ \Delta\ Tenancy_{i,t-1} \\ &+ \beta_7\ Flows\ Asset\ Class_t + \beta_8\ Event\ Fund\ Liquidation_t \\ &+ \beta_9\ Event\ Fund\ Closure_t \\ &+ \beta_{10}\ Policy\ Uncertainty\ Index\ Europe_t + \beta_{11}\ VIX\ Europe_t \\ &+ \beta_{12}\ \Delta\ Perform_{i,t-1} + \beta_{13}\ \Delta\ Fund\ Size_{i,t-1} \\ \beta_{14}\ &\Delta\ Institutional_{i,t-1} + \beta_{15}\ Fund\ Reopening_{i,t} \\ &+ v_{i,t} \end{aligned} \tag{4.2}$$

We separate our key explanatory variables into fund-specific, external, and control variables, as follows.

Leverage is the leverage ratio of the fund, calculated as the ratio of the fund's debt relative to it's gross asset value (GAV).

Liquidity is the liquidity ratio, measured as the ratio of the fund's cash equivalents to GAV.

TER represents annual management costs as a percent of fund volume. Because investors can no longer "vote with their feet," we expect to find higher fees associated with higher NAV discounts.

Extraordinary payouts are defined as total fund-specific payouts in a given month relative to a fund's NAV. Similarly to the TER ratio, this variable aims to capture the degree of investor friendliness of a fund's management. A negative correlation between this variable and the discount to NAV would indicate a lower degree of conflicts of interest between investors and fund managers, leading to a smaller NAV discount.

Economic Growth Target Markets is a fund-specific GDP growth measure. This variable

aims to capture the anticipated price development of a fund's real estate portfolio. It is calculated as the weighted sum of monthly GDP growth in the individual funds' target country markets.

Tenancy represents the proportion of rented to overall space of the real estate fund's assets. This variable is used to proxy for a fund's portfolio quality. As with the previous variable, which captures the GDP development of the fund's underlying property markets, a higher portfolio quality or better outlook is expected to lead to a smaller discount to NAV.

Event Fund Closure is a 0/1 indicator variable that captures the announcement that at least one other real estate fund has suspended share redemptions.

Event Fund Liquidation is a dummy variable that indicates another fund is unable to re-open and has begun the liquidation process. Both events may lead to a deterioration in investor sentiment. A positive relationship between these events and the discount to NAV would generally confirm the spillover hypothesis. We also include closure or liquidation announcements from semi-institutional funds.

Flows Asset Class are the total net fund flows (newly bought fund shares less redemptions) into all healthy open-end real estate funds. Here, we also include flows into semi-institutional funds. While only normally functioning open-end real estate funds can have net flows, we use this variable to capture general investor sentiment toward the asset class.

Policy Uncertainty Index Europe aims to capture the degree of political uncertainty in Europe. To construct this Index, Baker et al. (2015) first select two influential newspapers for each European country, such as, e.g., "Le Monde" and "Le Figaro" for France, or "Handelsblatt" and "Frankfurter Allgemeine Zeitung" for Germany, etc. Next, the authors count the number of articles that include the terms "uncertain," "uncertainty," "economic," or "economy," and at least one policy-relevant item. The count is scaled by the overall number of articles in each newspaper.

VIX Europe is the Euro Stoxx 50 Volatility Index (VSTOXX), commonly referred to as VIX.

This is our second measure of macroeconomic uncertainty. This index measures the anticipated (implied) stock market risk based on the difference between stock prices and stock price futures. Both macroeconomic indices are normalized (i.e., the mean was subtracted, and all values subsequently divided by their standard deviations). This transformation allows us to not only interpret the sign and statistical significance of the respective regression coefficients, but also to compare the magnitudes of both coefficients. Our set of control variables consists of a fund's past performance, fund size, and share of institutional owners, as well as a dummy variable indicating whether the distressed real estate fund of interest already experienced a suspension of share redemptions and subsequent reopening.

Performance is the appraisal-based rolling twelve-month performance according to BVI. This variable basically reflects the NAV performance. On the one hand, high returns are indicative of solid fund performance. On the other hand, it may signal that the fund has not yet adjusted its appraisal values to reflect lower market values. This would imply that NAV per share is expected to fall in the future, thereby justifying a larger discount.

Fund Size is measured in billions of Euros. The Federal Financial Supervisory Authority (BaFin) of Germany determines an individual liquidation horizon for each fund. Larger funds tend to receive more time to liquidate their portfolio compared to smaller ones. Therefore, on the one hand, fund size could be interpreted as a proxy for expected liquidation time. Hence, we would expect a positive relationship between fund size and NAV discounts. On the other hand, larger funds with longer liquidation horizons might use an optimized market timing strategy for their property disposals, and could enjoy better bargaining positions.

Institutional shareholders represents the share of institutional shareholders as provided by Morningstar Direct. Here, too, the expected effect is ambivalent. German open-end real estate funds are predominantly held by retail investors. Thus, due to their low price volatility and relatively high and stable yields compared to money market interest rates, conventional wisdom suggests that institutional investors exploited open-end funds as a cash substitute prior to the fund crisis. We use share of institutional ownership to

test whether it has an effect on the discount to NAV. Once open-end real estate funds become distressed, their share prices on the secondary market show substantial price volatility. Therefore, investors are likely to reevaluate their optimal risk exposure to the asset class, and could potentially decide to sell their shares. This could lead to further price pressure on the secondary market, and hence larger discounts to NAV. Consistent with this idea, Larrain et al. (2017) examine the effect of a regulatory constraint, which forced pension funds to fire sale their Chilean stock holdings. The authors find that those stocks with the highest selling pressure lost 4% compared to other stocks. Alternatively, a large percent of well-informed institutional investors may signal high fund quality, and could be associated with lower discounts to NAV. Evidence in the related literature is mixed. Barclay et al. (1993) find that closed-end funds with large blockholders display larger discounts. In contrast, Morri and Benedetto (2009) find that Italian closed-end real estate funds with large blockholders tend to exhibit smaller discounts to NAV.

Fund Reopening is a dummy variable that indicates whether a distressed real estate fund has already reopened previously, and hence suspended share redemptions for a second time. Investors may perceive such funds as less likely to achieve another reopening, thus leading to larger discounts to NAV.

Our regression results are estimated using cross-sectional fixed effects and heteroscedasticity-robust standard errors.

Fund-specific variables generally enter the regression model with one lag, because the monthly fact sheets are published with a time lag. Also, investors need time to adjust their decision making process subsequent to changes in key fund indicators. However, we include extraordinary payouts, net capital inflows, dummy variables, and uncertainty indicators without any lag. Extraordinary Payouts, the closure or liquidation of one or more specific open-end real estate funds, is generally a comprehensive event that would be extensively reported in the media. Therefore, we would expect both institutional and private investors to recognize the enormity of such an event, and adjust their investment strategies within one month. Moreover, uncertainty is a prevalent condition. In addition to the economic interpretation, the statistical significance of the coefficients, as well as the

overall fitness measures like the AIC criteria, support the chosen lag structure as explained above.

Due to the non-stationarity of the leverage ratio, the liquidity ratio, TER, the tenancy rate, performance, fund size, and the share of institutional investors, these variables enter the regression with their first differences (Δ).

4.4.3 Descriptive Statistics

Table 4.2 shows some descriptive statistics on the dependent and explanatory variables. The Table reveals that the average discount to NAV of distressed real estate funds is 26.7% with a standard deviation of 13.3%.

The independent variables are separated into three categories: fund-specific, external variables, and control variables. The average leverage ratio of all funds is 24.8%. Figure

Table 4.2: Overview Summary Statistics

	Mean	Std.Dev.	Min	Max	Obs
Discount to NAV	0.267	0.133	0.000	0.598	783
Fund Specific Variables					
Leverage	0.248	0.157	0.000	0.690	837
Liquidity	0.200	0.142	0.003	0.828	837
TER	0.009	0.002	0.003	0.015	837
Extraordinary Payouts	0.012	0.05	0.000	0.565	837
Economic Growth Target Markets	0.001	0.006	-0.031	0.013	836
Tenancy	0.893	0.077	0.595	1.000	815
External Variables					
Event Fund Liquidation	0.129	0.335	0.000	1.000	837
Event Fund Closure	0.129	0.335	0.000	1.000	837
Flows Asset Class	0.215	0.651	-4.358	1.693	837
Policy Uncertainty Index Europe	174.315	47.613	91.379	394.635	837
VIX Europe	26.400	8.832	14.392	60.677	837
Control Variables					
Perform	-0.045	0.086	-0.389	0.086	816
Fund Size	2.140	1.970	0.069	6.598	837
Institutional	0.111	0.092	0.003	0.368	792
Fund Reopening	0.671	0.470	0.000	1.000	837

This table provides an overview of the mean, standard deviation, minimum, maximum, and the number of observations for all variables.

4.4 shows that the average leverage ratio diminishes considerably over time. This effect is to be expected, because funds repay their loans from the proceeds from property disposals. There is also a substantial heterogeneity of leverage ratios across funds. The DEGI International fund reports a leverage ratio of 0% in June 2014, the Morgan Stanley P2 value fund exhibits a leverage ratio of 69% at the beginning of 2014.

The liquidity ratios also show considerable heterogeneity. The TMW Immobilien Weltfonds fund displays a liquidity ratio of 0.3% in May 2016, which is below the regulatory threshold of 5.0% and is allowed for only a short period of time. However, this fund exhibit a significantly low liquidity ratio over the entire sample period. In contrast, the UBS 3 Sector Real Estate fund has a liquidity ratio of 21.6% at the closing date, which rises as high as 82.8% by September 2015. Note that fund strategies partially cause these substantial differences. During the sample period, DEGI International fund liquidated a significant portion of its assets without substantial extraordinary payouts until October 2014. On average, the liquidity ratio amounts to about 20.0%. Figure 4.4 illustrates the considerable increase in average liquidity ratios over time due to high sales proceeds beginning in Q3 2012.

The average total expense ratio is 0.9%. The KanAm Grundinvest fund has the highest management fees at the end of the sample period in 2016 with 1.5%, while the AXA Immoselect fund exhibits the lowest fees at 0.3% in October 2008.

The average payout ratio is only 1.2%. The UBS 3 Sector Real Estate fund made an extraordinary payment of about 56.5% of its respective market value in December 2015. Other funds distributed their payouts more evenly over the sample period, however, the management of AXA Immoselect fund continuously distributed about 3%-4% of its respective market value per share from 2008 through 2013. Figure 4.4 illustrates the significant increase in extraordinary payouts due to the accelerating liquidation process, which began in Q3 2012.

The average GDP growth rate of the fund's target markets is 0.1% and it ranges from -3.1% to +1.3%. While there is little heterogeneity across funds regarding this measure,

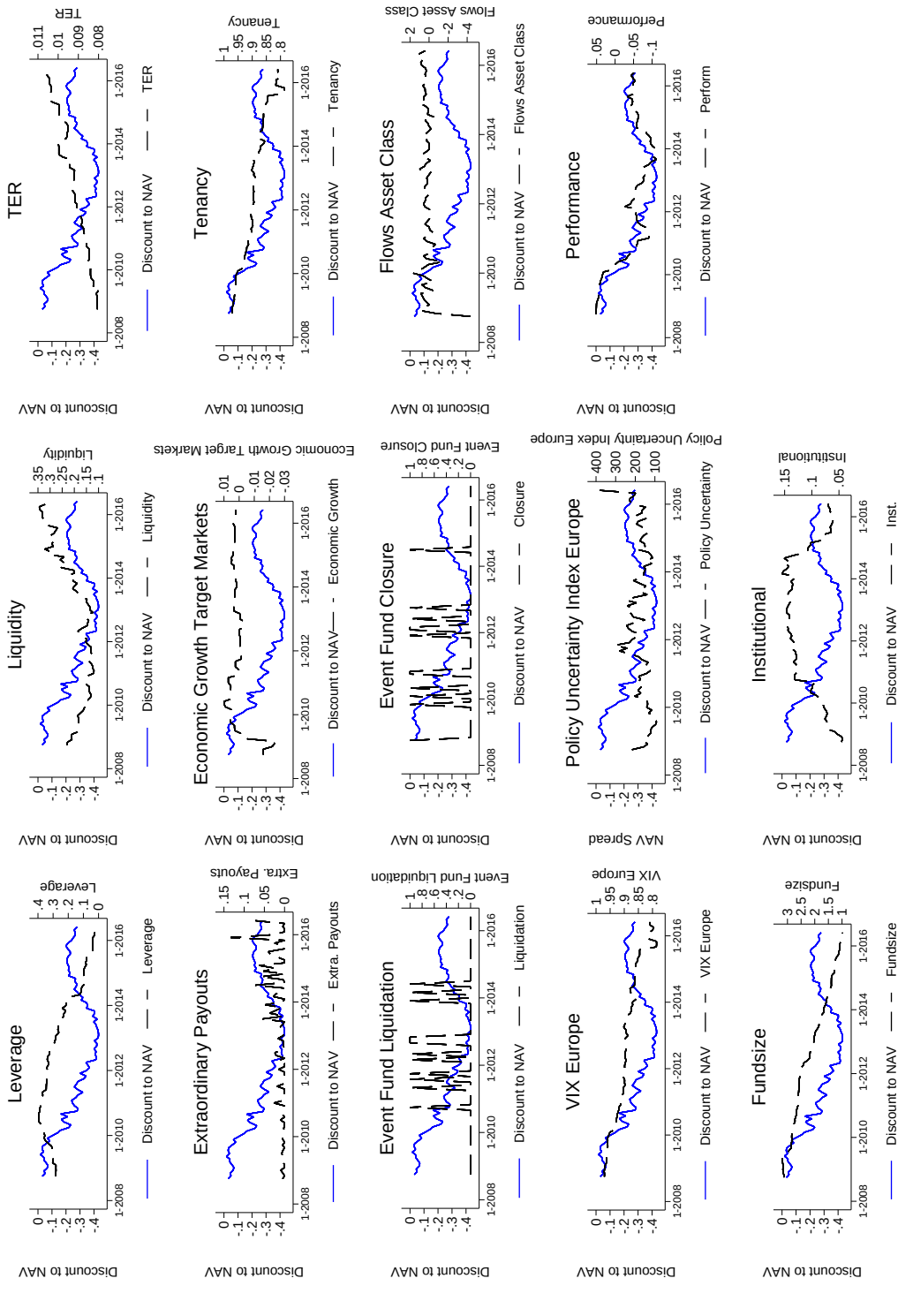


Figure 4.4: Discount to NAV, Fund Specifics, External and Control Variables

Figure 4.4 illustrates the average progression of the fund-specific, external and control variables for all distressed real estate funds in contrast to the average course of the discount to NAV from 2008:10 to 2016:6. The first two rows show the development of the fund-specific factors. The third row shows the three industry-wide spillover variables. The fourth row includes the two macroeconomic uncertainty indicators. The control variables are displayed afterwards.

Figure 4.4 shows a substantial time variation that is attributable to the economic rebound following the global financial crisis.

The average tenancy rate is 89.3%. Table 4.2 shows that the Morgan Stanley P2 Value fund exhibited a tenancy rate of 100% over the June-December 2013 period, while TMW Immobilien Weltfonds fund reported only 76% to 69% during the same period.

On average, a closure or a liquidation occurred in 12.9% of the periods. Consistent with the spillover hypothesis, Figure 4.4 shows that closures and liquidations tend to cluster together over time.

The average asset class capital inflows are EUR 215 million per month. The funds experienced strong capital inflows of about EUR 1.69 billion in January 2010, and rather extreme capital outflows of EUR 4.36 billion in October 2008.

Figure 4.4 shows that the implied stock market volatility, as measured by VIX Europe, tends to decline over time. In contrast, the Political Uncertainty Index increases during the middle of our sample period, when many funds entered the liquidation phase.

Table 4.3 shows a positive correlation on an aggregate level between the absolute level of the NAV discount and the European Policy Uncertainty Index (general uncertainty) of (+0.36). However, on the other hand, we observe an inverse relationship between the absolute level of the discount to NAV and the VIX (stock market uncertainty) of (-0.45). Although both uncertainty indices share two peaks, in 2008 (global financial crisis) and 2012 (European debt crisis), they appear uncorrelated in general.

The rolling twelve-month performance of the funds (based on NAVs) averages -4.5%, and it ranges from -38.9% to +8.6%. Just as with overall economic development, the variance of this variable is driven mainly by the time dimension, namely, the global financial crisis.

Fund size ranges from EUR 69 million to EUR 6.6 billion. The UBS 3 Sector Real Estate fund is the smallest fund, with an average size over the entire sample period of EUR 321.0 million. The CS Euroreal A fund is the largest, with an average of EUR 5.0 billion. Despite the negative time trend, the time dimension explains only a small part of the

Table 4.3: Corr. Matrix: Fund-Specifics, External Variables, and Control Variables

	Discount to NAV	Leverage	Liquidity	TER	Extra- payouts	Economic Growth	Tenancy	Event Fund Liq.	Event Fund Closure	Flows Asset Class	Policy Uncertainty	VIX Eur.	Perform	Fund Size	Inst.	Fund Reopening
Discount to NAV	1.000															
Leverage	0.072	1.000														
Liquidity	-0.210	-0.473	1.000													
TER	0.155	-0.108	0.097	1.000												
Extra- payouts	-0.041	-0.143	0.199	0.071	1.000											
Economic Growth	0.219	-0.052	0.030	0.050	0.049	1.000										
Tenancy	-0.261	0.477	-0.132	-0.031	-0.127	-0.163	1.000									
Event Fund Liq.	0.236	0.129	-0.090	-0.006	-0.032	-0.042	-0.000	1.000								
Event Fund Closure	0.036	0.195	-0.096	-0.070	-0.021	-0.000	0.118	0.246	1.000							
Flows Asset Class	0.058	-0.153	0.071	0.081	0.018	0.157	-0.124	-0.103	-0.343	1.000						
Policy Uncertainty	0.367	-0.050	0.012	0.101	0.036	-0.037	-0.190	0.136	0.094	-0.065	1.000					
VIX Eur.	-0.457	0.202	-0.050	-0.166	-0.101	-0.564	0.272	-0.107	0.074	-0.117	0.097	1.000				
Perform	-0.560	0.095	0.041	-0.148	-0.098	-0.180	0.446	-0.102	0.074	-0.014	-0.149	0.340	1.000			
Fund Size	-0.253	0.154	-0.246	-0.492	-0.121	-0.066	0.191	0.015	0.077	-0.078	-0.075	0.190	0.397	1.000		
Inst.	0.358	0.237	-0.040	0.210	0.020	0.037	0.027	0.123	0.037	-0.018	0.069	-0.184	-0.291	-0.565	1.000	
Fund Reopening	0.325	-0.031	-0.206	0.143	0.005	0.347	-0.238	-0.004	-0.067	0.100	0.158	-0.336	-0.015	0.221	0.054	1.000

This table shows the correlation coefficients between all variables of the panel regression model.

overall variance of the fund size variable. Institutional shareholders on average represent 11.1% of all fund investors. The UBS 3 Sector Real Estate fund reports an institutional share of up to 37%, while the DEGI Europa never exceeds more than 5%.

According to Table 4.3, the discount to NAV shows a relatively strong negative correlation with the fund size (-0.25) and fund performance (-0.56) variables. Furthermore, the NAV discounts show a relatively strong positive correlation with the share of institutional investors (0.35).

4.5 Results

Table 4.4 contains the panel regression results, which are estimated using cross-sectional and time-fixed effects, as well as the heteroscedasticity-robust standard errors.[14] Model I employs only fund-specific explanatory variables, which are used to test Hypotheses 1-3. The control variables, used in all models, are also fund-specific. In models II and III, we subsequently introduce further explanatory variables that are external to the funds. Model II includes two industrywide variables, which enables us to test the spillover hypothesis (Hypothesis 4). Finally, model III also incorporates macroeconomic variables in order to test Hypothesis 5.[15] The standard errors of the regression coefficients are in parentheses.

Our initial analysis focuses on the impact of a fund's financial leverage on its discount to NAV. We find that the discount to NAV increases with the leverage ratio. An increase in the absolute difference of the leverage ratio by 1% leads on average and c.p. to a 0.089% larger discount to NAV in the next period. Mirroring this principle, the liquidity ratio has a negative effect on the discount to NAV. A rise in the lagged absolute difference

[14] Time-fixed effects enable us to control for any unobserved time effects. However, the time dummies also cause identical regression coefficients for the fund-specific variables across all three specifications. In the next chapter, we describe a possible method by which to confirm the goodness of fit for each model specification.

[15] In untabulated results, we also control for the time to liquidation date and the legal fund environment, e.g., the selling restrictions of the real estate properties. We find no significant influence of these regulatory variables on the discount to NAV. We also find no significant influence of regional or sectoral diversification (Herfindahl index) on the discount to NAV.

Table 4.4: Explaining the Discount to NAV

	(I)	(II)	(III)
Fund Specific Variables			
Δ $Leverage_{i,t-1}$	0.0898*	0.0898*	0.0898*
	(0.0475)	(0.0475)	(0.0475)
Δ $Liquidity_{i,t-1}$	-0.139**	-0.139**	-0.139**
	(0.0588)	(0.0588)	(0.0588)
Δ $TER_{i,t-1}$	-1.702	-1.702	-1.702
	(5.059)	(5.059)	(5.059)
$Extraordinary\ Payouts_{i,t}$	-0.273***	-0.273***	-0.273***
	(0.0643)	(0.0643)	(0.0643)
$Economic\ Growth\ Target\ Markets_{i,t-1}$	0.193	0.193	0.193
	(1.936)	(1.936)	(1.936)
Δ $Tenancy_{i,t-1}$	-0.116	-0.116	-0.116
	(0.0919)	(0.0919)	(0.0919)
External Variables			
$Event\ Fund\ Liquidation_{i,t}$	-	0.249***	0.148***
	-	(0.045)	(0.0343)
$Event\ Fund\ Closure_{i,t}$	-	0.028	0.00218
	-	(0.034)	(0.0682)
$Flows\ Asset\ Class_{i,t}$	-	-	-0.0308*
	-	-	(0.0142)
$Policy\ Uncertainty\ Index\ Europe_{i,t}$*	-	-	0.0377***
	-	-	(0.00727)
$VIX\ Europe_{i,t}$*	-	-	-0.0133
	-	-	(0.0142)
Control Variables			
Δ $Perform_{i,t-1}$	-0.0788	-0.0788	-0.0788
	(0.127)	(0.127)	(0.127)
Δ $Fund\ Size_{i,t-1}$	0.00239	0.00239	0.00239
	(0.0377)	(0.0377)	(0.0377)
Δ $Institutional_{i,t-1}$	0.478**	0.478**	0.478**
	(0.167)	(0.167)	(0.167)
$Fund\ Reopening_{i,t}$	0.0283	0.0283	0.0283
	(0.0361)	(0.0361)	(0.0361)
Constant	0.0540**	0.0908***	0.129**
	(0.0198)	(0.0263)	(0.0408)
Observations	708	708	708
R-squared	0.735	0.735	0.735
Number of funds	9	9	9

This table shows the fixed-effects panel regression results. Model (I) contains the particular influence of the fund-specific variables. Model (II) adds the industry-wide variables to test the spillover hypothesis. Model (III) is the main model, which also includes industry-wide and macroeconomic proxies for investor sentiment. Policy Uncertainty and VIX Europe Variables are standardized with zero mean and a standard deviation of one. Robust standard errors are in parentheses, *** $p<0.01$, ** $p<0.05$ and * $p<0.1$.

of the liquidity ratio by 1% leads on average and c.p. to a 0.139% lower discount to NAV. This is plausible, given that a larger share of cash and short-term money market positions represents money saved for fund investors. Therefore, larger liquidity ratios diminish risk, which is primarily related to the appraisal values of the real estate portion of the fund. In summary, both of our proxies are consistent with Hypothesis 1. The discount to NAV is driven by a fund's financial leverage, since it increases (decreases) with its leverage (liquidity) ratio.

Next, we examine whether NAV discounts are related to potential conflicts of interest between fund management and investors. We find no significant influence of management costs (TER) on the NAV discount. Extraordinary payouts, on the other hand, play an important role. A 1% higher payout leads on average and c.p. to a 0.273% lower discount. This result is consistent with Hypothesis 2. If fund management regularly pays out high amounts of liquidity, rather than holding cash or properties to maximize their fee income, this signals a certain amount of investor friendliness. The practice of extraordinary payouts at time of closing, however, differs considerably among funds in the dataset. Some closed funds effect constant substantial payments on a semiannual or annual basis. Others pay more irregularly or infrequently. A history of regular distributions increases trust in fund management, and could influence investors to remain invested.

To test Hypothesis 3, we have two variables that proxy for a fund's portfolio quality. First, real estate funds are more likely to be able to sell assets for reasonable prices in good-performing countries than in countries locked in recession. Investors are informed about the target market mix through monthly, semiannual, and annual fund reports. Moreover, investors receive continuous information about economic development via the media. Both sources of information should theoretically lead to higher demand on the secondary market for funds invested in more prosperous markets. Nevertheless, we find no significant influence of the Economic Growth variable on the discount to NAV. Our second proxy for fund portfolio quality is average tenancy rate. On average, higher quality properties should be associated with larger tenancy rates, and vice versa. However, the coefficient on the tenancy rate is not statistically significantly different from zero. Hence,

we find no evidence for Hypothesis 3, i.e., NAV discounts do not appear to be driven by a fund's portfolio quality. A possible explanation for this result could be that a fund's portfolio quality is already sufficiently reflected in its NAV. Hence, investors would not need an additional risk premium, and this would be reflected in lower share prices.

Our regression results in model II provide support for the spillover hypothesis. In the case of another distressed real estate fund failing to reopen and subsequently announcing its liquidation, the discount to NAV for all distressed funds rises c.p. and on average by 0.249%. This effect remains significant, although somewhat weaker, in model III, when further external variables are included in the regression model. The announcement of other fund liquidations may lead to diminished hope, and is likely to further deteriorate investor trust in this asset class. The announcement of other fund closures, on the other hand, does not appear to significantly impact the NAV discount.

We have three proxy variables to test whether NAV discounts are driven by investor sentiment. First, we use capital inflows into all open-end real estate funds to examine the impact of investor sentiment toward the specific asset class on NAV discounts. Model III documents a significant relationship between asset class net flows and the discount to NAV. Larger fund flows into the overall asset class c.p. and on average diminish the discount to NAV. Second, we use the European Policy Uncertainty index, which measures overall macroeconomic uncertainty. An increase in this Index leads c.p. and on average to a larger NAV discount. In contrast, when we use the VIX to measure specific stock market risk, we find no significant effect between the VIX Europe and the NAV discount.[16] In conclusion, we find evidence for Hypothesis 5, when our proxy for investor sentiment is based on fund flows and political uncertainty.

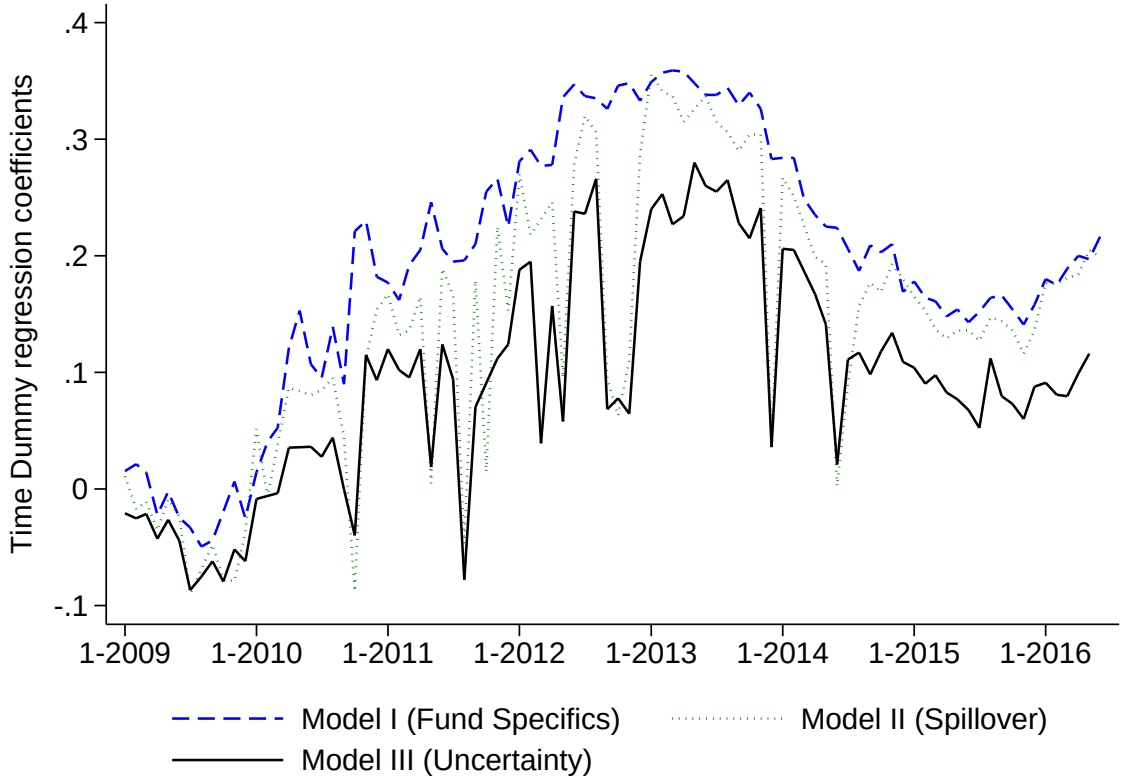
Regarding our control variables, we find a positive relationship between the share of institutional investors and the discount to NAV. An increase in the absolute difference of the share of institutional investors by 1% leads on average and c.p. to a 0.478% larger discount in the next period. Past performance, fund size, and the dummy variable

[16] In untabulated results, we find a positive relationship between the VIX Europe and discounts to NAV when we run the regression without the Political Uncertainty Index.

indicating a former fund closure are all statistically insignificant.

In order to determine the goodness of fit of our models, we use the time dummy coefficients of the three model specifications (I-III). Because the dummy variables have no economic interpretation, we consider the coefficients to be the unexplained, yet time-specific, components of the discount to NAV. Figure 4.5 illustrates how the unexplained (unsystematic) time effects diminish after we incorporate additional time-dependent variables into the model. The figure shows the progression of the time dummy coefficients over ninety periods from January 2009 to June 2016 (ninety-three periods in total, minus three periods for the lag structure).

Figure 4.5: Development of Time Dummies



This figure shows the regression coefficients of the time dummies for the ninety periods from January 2009 through June 2016 (note there is a loss of three periods at the beginning due to the preferred lag structure). The regression coefficients of these dummy variables represent the unexplained but time-specific component of the discount to NAV. The progression of each line near zero indicates a better fit of the model compared to the other model specifications, as there is less unexplained variance left.

The time dummy coefficients of model I exhibit considerably positive signs over time. Moreover, the parabolic progression indicates a time trend that we can account for by using the monthly time dummies in the regression model. This parabolic progression can also be seen in the development of the discount to NAV, which increases after the indi-

vidual closure dates for each fund to a maximum in mid-2012, and significantly decreases thereafter by about 20%-30% until June 2016. Model II exhibits a less distinct time trend. Model III, which includes all variables, has the best fit and, therefore, the least distinct time trend of the dummy regression coefficients.

4.6 Conclusion

This study examines the discounts to NAV of distressed open-end real estate funds. The stock market prices of distressed real estate funds are up to 60% lower than their NAVs. These discounts can be interpreted as a compensation for the valuation risk associated with the fund liquidation process and a sudden decrease in liquidity.

Open-end real estate funds differ fundamentally from mutual funds, because the underlying properties are not traded on a stand-alone basis in public markets as in the case of stocks. Accounting for the specific environment of open-end real estate funds, this study contributes to the literature on NAV discounts, as well as to the empirical literature on liquidity crises of open-end real estate funds in general.

To explain the major factors driving the NAV discounts of distressed real estate funds, we categorize the explanatory variables into internal or fund-specific variables, and into industrywide or macroeconomic variables that are external to the funds. Overall, we find notable differences between the individual funds (cross-sectional heterogeneity), but the variance of the discount is also driven considerably by time-dependent factors. On the fund-specific side, we provide evidence that the discount to NAV is related to the degree of financial leverage employed by the funds. Funds with high liquidity ratios and/or low leverage ratios tend to be associated with lower NAV discounts. This suggests that a more conservative strategy by fund management may help decrease the discounts. Moreover, we find that funds with higher payout ratios trade at lower NAV discounts. This is consistent with our hypothesis that funds paying out more to investors are signaling greater investor friendliness. However, some factors are not under the control of fund manage-

ment. For example, we find evidence of negative spillover effects from the liquidation announcements of other funds. Furthermore, we find evidence that NAV discounts are driven by investor sentiment, as evidenced by the impact from fund flows into the asset class and the degree of macroeconomic uncertainty.

Chapter 5

Conclusion

In summary, fund closure risk, fund performance, and funds discount to NAV were considerably influenced by fund-specific factors. Among other internal variables, significant capital inflows, a large liquidity ratio, and a low leverage ratio diminish funds closure probability, as well as discounts to NAV for distressed fund shares. Nevertheless, a larger share of money market deposits comes at the cost of a lower fund performance. Moreover, economies of scale and scope lead on one hand to a decreasing fund closure probability and on the other hand to an increase in fund performance.

In addition, external, uncertainty-related, variables also affect fund closure risk, fund performance, and discounts to NAV. This is a significant finding, since these outside factors are out of fund managements control and responsibility. These external effects are a measure of investors general mistrust in the current real estate asset valuation, and the extant of their prevailing uncertainty about the funds future. This uncertainty led to large capital outflows, and as a consequence to the closure of several funds. Already closed funds, which lost the majority of their reputation, also show the impact of uncertainty related factors on their secondary market discounts. Moreover, these discounts to NAV, as well as the distress status itself lower the bargaining position for the fund management in the portfolio sales process, which subsequently diminish fund performance.

As long as the fund management is able to reliable guarantee the "buy-back" of fund

shares to net asset value, fund investors do not question the quality of the funds current real estate asset valuation. Whereas in times of overall financial turmoil combined with upcoming fund closures (i.e., negative spillover effects), open-end fund investors can completely lose trust in their fund investment. If there are no factors, which have a calming effect on them, like large liquidity ratios or the existence of a leading bank as the funds sponsor, these fund investors tend to withdraw their invested capital. This is especially true for funds, which exhibit a large share of institutional investors, since fund investors also have to be concerned about blockholder risks. Negative spillover effects also affect discounts to NAV of distressed fund shares. Moreover, there is a significant influence of investor sentiment proxied by capital inflows into the asset class and general macroeconomic uncertainty on funds discount to NAV.

In times of large uncertainty, investors do not always act rationally, which can be seen in the exaggerated discounts to NAV up to 60% in the period from 2012 to 2014. Most fund investors and market participants simple overstate the fund investors imminent losses, which would arise subsequent to fund closure or liquidation announcements. This creates a profitable investment opportunity for other potential fund investors, which could buy distressed fund shares on the secondary market to reasonable prices.

Open-end real estate funds are crucial for German private investors, since these indirect investment vehicles mitigate significant risks associated with direct real estate investments. Therefore, and due to the current low interest rates, German open-end real estate funds show strong capital inflows since 2015. Nevertheless, in succession of this fund crisis, there was and still is a large uncertainty about an investment in open-end real estate funds, and particularly in distressed fund shares.

The purpose of this thesis is to diminish this uncertainty by identifying the major influential factors, which led to the open-end real estate fund crisis and affect all topics related to this special event. The new legislative environment with a minimum holding period for fund shares of twenty-four months and a notice period of twelve months diminish the likelihood of further fund closures. Due to this new law regime, the fund management provides a liquidity transformation for fund investors only on a limited basis, which

significantly decrease the liquidity transformation risk. Nevertheless, funds, which were forced to close later on, were on average not the worst-performing funds or differ on average substantially from the remaining healthy funds. Hence, further fund closures are not impossible, even though less likely, since the intrinsic closure risk of the open-end structure persists for all remaining German open-end real estate funds.

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