Non-listed real estate fund returns: closed-end versus open-end funds

By: J.W. (Jurriaan) Postema s3533778

Final version, 14 April 2020

MSc Thesis Real Estate Studies University of Groningen

Supervisor: dr. X. (Xiaolong) Liu

ABSTRACT

Globally, the vast majority of real estate assets under management (AUM) are incorporated in non-listed funds. These funds have either a closed-end (finite) or open-end (infinite) structure, but the liquidity between the two is fundamentally different. Open-end funds support redemptions during their lives, providing investors with more liquidity. Conversely, closed-end structures offer stability for managers and investors alike. This research aims to address a gap in the existing academic literature by researching the ways in which the fundamental distinction between fund structures influences returns. To do so, an INREV panel dataset, covering quarterly return data of 563 funds over the period 2000–2019, is studied using pooled OLS, between estimator, and random effects models. Based on the existing academic literature, four structure-related variables are indicated: fund structure, redemptions, capital commitments, and years until termination. Several control variables are also indicated. The regression results reveal that fund structure does not influence return significantly; open-end and closed-end funds do not produce significantly different returns. Redemptions have a positive impact on returns, but, during the subprime crisis of 2007–2009, redemptions impacted returns negatively. This is especially true for closed-end funds. Capital commitments are found to positively impact the performance of open-end funds only. For closed-end funds, a more distant termination date leads to a higher fund return. Both structures react similarly to increased age (negatively), a multi-country investment strategy (negatively), and higher gearing levels (positively). This last effect is more substantial for closed-end funds. Yield distributions positively affect fund return, especially for open-end funds during periods of economic prosperity. Size is a significant (positive) driver for closed-end funds only. The results do not indicate that open-end structured funds bear a substantially higher risk to investors. However, the risk of a run on redemptions is always present, and managers and investors should take this into account when opting for an open-end structure. These research findings provide a better understanding of the non-listed real estate market and may support future portfolio allocation and investment decisions. The research adds to the current fundamental debate in the industry on the suitability of the open-end fund format for illiquid assets as real estate.

Keywords: non-listed real estate funds, open-end funds, closed-end funds, panel data, pooled OLS, between estimator, random effects (RE), INREV.

This research was supported by INREV, the European Association of Investors in Non-Listed Real Estate Vehicles

COLOPHON

Document:	**Master's thesis in Real Estate Studies**
Title:	**Non-listed real estate fund returns: closed-end versus open-end funds**
Version:	**Final version**
Author:	**J.W. (Jurriaan) Postema**
Student number:	**s3533778**
E-mail address:	**j.w.postema@student.rug.nl**
	https://www.linkedin.com/in/jurriaanpostema/
First supervisor:	**dr. X. (Xiaolong) Liu**
Second assessor:	**prof. dr. ir. A.J. (Arno) van der Vlist**
Date:	**14 April 2020**
Word count:	**16,243**
Institution:	**University of Groningen, the Netherlands, Faculty of Spatial Sciences, MSc Real Estate Studies**

This research was supported by INREV, the European Association of Investors in Non-Listed Real Estate Vehicles

Disclaimer: *"Master theses are preliminary materials to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the author and do not indicate concurrence by the supervisor or research staff."*

TABLE OF CONTENTS

1. INTRODUCTION

Today, the real estate market has become globally interdependent. Investors with various profiles from all over the world are seeking opportunities for entering real estate asset classes in both mature and emerging markets. According to the information presented in the Financial Times (2019), the non-listed real estate investment industry has demonstrated increasing investment volumes in recent years. By the end of 2018, the worldwide value of real estate AUM reached an all-time high of €2.8 trillion. The lion's share of this (82.2%) is accounted for by non-listed real estate (INREV, 2019b).

The open-end[1] structure of some non-listed real estate funds has lately been the subject of much debate. A particularly striking example is Brexit, which caused a sharp increase in investor redemption demand. This resulted in a wave of open-end fund closures and showed the potential instability of the open-end fund structure (Citywire, 2019b). In a Citywire (2019b) article, Fitch Ratings states that "Funds are unlikely to be able to meet a surge in redemptions by selling assets, given the illiquid nature of commercial properties." Therefore, some fund experts consider illiquid assets such as real estate to be unsuitable for open-end formats and are speculating about the end of this fund structure, in favor of the closed-end[2] structure. Other fund experts see only the advantages, from an investor's perspective, of a more liquid and open-end format and speculate on a prosperous future for open-end real estate funds (PERE, 2019). The non-listed real estate industry calls for going back to the basics by conducting more research on the drivers of fund returns in order to gain awareness of the advantages and disadvantages of different fund types (Citywire, 2019a).

The existing academic literature on the non-listed real estate sector is relatively limited. The field has developed during the last 10 to 15 years due to the increasing quantity and quality of non-listed real estate data. As the quality of non-listed real estate research improves, conclusions from some earlier studies are being questioned. Because previous studies experienced difficulties in obtaining individual fund returns, the robustness of findings is questionable (Kaplan & Schoar, 2005; Tomperi, 2010; Delfim & Hoesli, 2016). The literature emphasizes that data sets comprised of individual fund returns, which are tracked over a more extended period and with higher frequency (e.g., quarterly instead of annually), produce the most robust results. Recently, scholars have focused on finding drivers for non-listed real estate fund returns. Researched factors include fund size, gearing or leverage, defined strategy, age, fund sequence, management costs, and specialization in geography or sector (Alcock, et al., 2013; Delfim & Hoesli, 2016; Farrelly & Stevenson, 2016; Fisher & Hartzell, 2016; Tomperi, 2010; Fuerst, et al., 2014).

[1] An open-end fund format is defined as a fund with a variable and unlimited amount of capital and an infinite life, where investors can purchase or redeem shares from the fund during its lifetime (INREV, 2019d).
[2] A closed-end fund format is defined as a fund with a fixed amount of capital and a finite life, with the redemption of shares only at the end of the fund's life (INREV, 2019d).

Fundamentally, illiquidity risk in non-listed funds is a central issue for investors (Brounen, et al., 2007; Fuerst & Matysiak, 2013; Wiley, 2014). In non-listed real estate funds, the underlying asset is illiquid. More importantly, because non-listed shares are not publicly traded on a stock exchange, the shares are also illiquid (Brounen, et al., 2007). However, to provide some liquidity for investors, some non-listed funds are operating based on an open-end structure where investors can purchase or redeem units during the life of the fund. Closed-end and open-end funds have different characteristics, which may result in different return patterns (Bers & Madura, 2000; Wiley, 2014). Additionally, Pagliari Jr. et al. (2005) argue that investors' platform choice is mostly influenced by factors such as transparency, control, governance, and liquidity rather than by the expected return.

The key differentiating mechanism at work regarding a non-listed fund's structure is the difference in liquidity. Somewhat surprisingly, the liquidity challenges that exist for both investors and managers remain relatively untouched in the academic research. However, one of the distinguishing features of non-listed funds is their structure (Farrelly & Stevenson, 2016). Thus, despite the growing body of knowledge on the subject of non-listed fund drivers, this is a gap in the existing literature. The effect of a fund's structure on its return can be more clearly defined. It is interesting to establish whether the two different fund structures produce similar returns and examine how both structures react to the same return drivers. Fund structure may drive return differently. This is because open-end funds are under the near-constant threat of a redemption run, but capital is locked up for a predetermined amount of time in closed-end funds. Therefore, the two types of fund may be managed differently and react to return drivers conversely.

This research contributes to the existing literature on non-listed real estate return drivers by investigating the return of closed-end funds versus the return of open-end funds. The objective of this research is to identify whether and how the performance of closed-end non-listed real estate funds differ from their open-end counterparts. The study aims to increase the body of knowledge on the functioning of the non-listed real estate market and its mechanisms and will thus be relevant for fund managers and investors as they make investment decisions.

1.1 Research questions

The central research question is as follows:

How does the open-end or closed-end fund structure influences the return of non-listed real estate funds?

Three sub-questions are formulated to answer the main research question:

1. *What is the theoretical relationship between fund characteristics and return?*

This sub-question is answered by executing a broad literature review on private equity and private equity real estate return. The aim is to identify the variables that potentially influence the return of funds and should be included in the model. Additionally, the variables that distinguish the specific differences between the two fund structures are indicated.

2. *How is the return of a non-listed real estate fund influenced by its finite or infinite nature?*
3. *How do funds with different structures react to the same return driver?*

The second sub-question examines the structure-specific factors that influence the return of closed-end funds and open-end funds. The effect on return is estimated based on the variables identified in sub-question 1. Sub-question 3 estimates how both fund structure types react to non-structure specific factors.

The research applies a quantitative research method with panel regressions. The dataset used for this research is provided by INREV (the European Association for Investors in Non-Listed Real Estate Vehicles) and consists of the historical quarterly return of individual funds in the INREV Vehicles Universe. The dataset covers the time period from the second quarter of 2000 to the second quarter of 2019 and includes data on 563 different funds, of which 258 are closed-end and 305 are open-end.

The remainder of the thesis is structured as follows:

- Chapter 2 provides a comprehensive overview of prior academic research related to the research topic. Different return drivers are identified, including both those that are specifically structure-related and those that are not necessarily structure-related. Based on the theoretical analysis, a conceptual model is compiled and several hypotheses are formulated. Sub-question 1 is answered in this chapter.
- Chapter 3 is a methodological chapter. The statistical models are formulated, the different estimation techniques and sensitivity tests are explained, the data and the data cleaning process are described, and the variables are operationalized.
- The results of the research are reported in Chapter 4. They are then used to assess the hypotheses formulated in Chapter 2. The regression results provide the necessary information to answer sub-questions 2 and 3.
- Chapter 5 provides a conclusion, while Chapter 6 discusses the wider implications of the research.

2. THEORY AND HYPOTHESES

The academic literature on the return of non-listed real estate, as an asset class, is less extensive than the literature on direct and public real estate. As mentioned in the introduction, research into the returns on non-listed real estate funds has increased during the last 10 to 15 years. There is also a large amount of academic research closely related to non-listed real estate investing. This includes research on other forms of private equity investment such as venture capital funds or mutual funds. Relevant studies in other private equity fields are included in this chapter.

2.1 Underlying mechanisms in fund structures

One of the most striking characteristics of open-end funds is that they face the near-constant risk of a liquidity crisis, which can be caused by a run on redemptions (Bannier, et al., 2007). Sebastian and Tyrell (2006) describe the effect of such a crisis in the case of RODAMCO. In the late 1980s, a run on redemptions caused a severe drop in the funds' reserves, and it was not able to meet redemption demand. As a result, the fund has been forced to transform into a listed closed-end fund. Glenn and Patrick (2004) explain that the constant prospect of redemptions and the possibility of capital commitments mean that open-end funds are susceptible to hot money, the industry term for capital that is actively chasing as high as possible profits, while closed-end funds are resistant to this phenomenon.

Open-end fund managers are aware of the risk of a redemption run. Consequently, to some extent, funds prepare themselves for a liquidity crisis. They do this in three key ways: First, open-end funds have the self-imposed constraint of a limitation on the allowed leverage level. Second, open-end funds hold a higher percentage of their assets in readily marketable reserves, such as cash or bonds, than closed-end funds in case of high redemption demands (Bers & Madura, 2000). Third, some open-end funds are permitted to delay redemption up to a predefined time in order to avoid bankruptcy. The application of these methods is outlined in the individual funds' institutional frameworks and the legal regulations set by the domicile country or the country of operation (Bannier, et al., 2007; Maurer, et al., 2004; Sebastian & Tyrell, 2006).

From the investors' point of view, the liquidity of non-listed open-end real estate shares is attractive and serves as an instrument for controlling management behavior (Sebastian & Tyrell, 2006). Consequently, non-listed closed-end real estate funds are considered illiquid, as the invested capital is locked up until the termination of the fund. This typically occurs after seven to 10 years (Farrelly & Stevenson, 2016). After a closed-end fund is launched, it aims to accumulate its predefined capital by selling the preset number of shares at the preset price. Typically, there is a substantial amount of time between the formation date and the initial closing, resulting in a certain amount of uncalled capital at the beginning years of the fund.

In conclusion, depending on the exact institutional design of each open-end fund, this form of non-listed real estate provides investors with substantially more liquidity than closed-end non-listed funds. Open-end fund shares may be redeemed or issued at any time during the life of a fund and are, therefore, as liquid as listed stocks (Maurer, et al., 2004). Past and present liquidity crises show that, in many countries, open-end funds may struggle (e.g., Germany, the Netherlands, Switzerland, and Australia), thus raising questions about the stability and survivability of the open-end structure in the longer term (Sebastian & Tyrell, 2006). Factors that substantially differ across the structures are liquidity, redemptions, capital commitments, marketable reserves, and lifespan.

2.2 Structure-related factors influencing fund return

Liquidity is the first fund structure-related factor that could explain a fund's performance. Delfim and Hoesli (2016) investigate the risk factors for the returns in European non-listed real estate funds, listed real estate funds, and direct real estate by applying panel regression techniques with random effects. The authors address the issue of liquidity by using vehicle structure as a proxy for liquidity. The results, however, contradict earlier findings in the private equity literature (e.g., Bers and Madura (2000). Delfim and Hoesli (2016) state that open-end funds produce a higher return and have lower return volatility than closed-end funds both over the whole sample and during the subprime crisis. They conclude from these findings that the superior return of open-end funds is driven by their larger size and broader diversification. Furthermore, they indicate that an open-end structure allows greater flexibility in capital allocation, and this flexibility produces higher returns. However, Delfim and Hoesli (2016) do not substantiate this assumption.

Franzoni et al. (2012) create a four-factor model to research the diversification benefits of private equity, as an asset class, compared to public investments. Specifically, they examine whether private equity returns are affected by liquidity risk. One of their findings is that the compensation for liquidity risk in private equity is a significant factor in explaining the risk premium compared to listed investments. Thus, illiquidity may be a cause for outperformance.

Redemptions and **capital commitments** are two other structure-related factors. Glenn and Patrick (2004) note that open-end mutual funds have the potential for redemption during their lifetime, resulting in a higher percentage of cash reserves. This, in turn, results in underperformance. Wiley (2014) suggests that higher managerial discretion (e.g., the power to suspend redemptions) is associated with higher returns. However, the effects of redemptions on fund return have not been studied. Harris et al. (2014) study the return of buyout funds and venture capital (VC) funds, both of which are forms of private equity, based on the public market equivalent (PME) method of Kaplan and Schoar (2005). They have found that capital commitments result in lower subsequent fund returns. This result indicates that stability in the value of capital commitments improves the return of a fund, which is in line with the findings concerning capital outflows (Glenn & Patrick, 2004).

A fourth structure-related factor is the number of **marketable reserves** that is held by a fund. Previous literature shows that funds with higher liquidity hold a higher percentage of marketable reserves to meet redemption obligations compared to funds with lower liquidity. Case (2015) finds that open-end real estate funds underperform closed-end funds. He estimates that open-end real estate funds hold more substantial cash reserves to meet redemptions than closed-end real estate funds. They also underperform the market because these reserves are not invested into income-generating assets. In both private equity research (Glenn & Patrick, 2004) and public real estate research (Chaudhry, et al., 2004), findings are similar.

The fifth and last structure-related factor is the **years until termination**. The importance of controlling this factor is highlighted by Kandel et al. (2011), who investigate the conflict of interest between fund managers and investors in closed-end venture capital funds. The authors observe that fund managers started taking on bad projects in the final years before the end of the fund, resulting in lower returns and penalizing investors. Poor decisions, according to Kandel et al. (2011), include the continuation of bad projects, halting the monitoring of good projects, and postponing projects. Following this reasoning, a shorter period of time until termination may lead to a lower expected return. Since open-end funds do not have a predefined termination date, a fund can only be terminated after a situation where it is forced to stop, via a collective agreement, or as otherwise documented in a fund's legal framework. One reason for termination may be to avoid the collapse of the fund in the event of a liquidity crisis (Sebastian & Tyrell, 2006). Termination may also occur following a shareholder's decision.

2.3 Other factors influencing fund return

Controlling for **fund size** is a widespread practice in both private equity and in listed and non-listed real estate research. Fund size is nearly always found to have a significant impact on return. The literature suggests that funds ought to have a decent size in order to benefit from scale-related advantages. Thus, small funds are found to underperform larger funds. In contrast, funds that are excessively large suffer from diseconomies of scale. Funds that are too large tend to have problems finding sufficiently large projects due to the limited availability of such projects (Chaudhry, et al., 2004; Chen, et al., 2004; Farrelly & Stevenson, 2016; Fuerst & Matysiak, 2013; Fuerst & Matysiak, 2013; Harris, et al., 2014; Ro & Ziobrowski, 2011; Tomperi, 2010). Interestingly, Delfim and Hoesli (2016) have found that the optimal size for non-listed real estate funds is €2.3 billion in gross asset value (GAV).

The **gearing** or leverage of a fund is another factor influencing return. The maximum leverage a fund is allowed to exercise, as formally indicated in the vehicle documentation, is closely related to its strategy. In direct, listed, and non-listed real estate research, higher levels of gearing are found to negatively impact returns (Alcock, et al., 2013; Baum & Farrelly, 2009; Brounen, et al., 2007; Case, 2015; Chaudhry, et al., 2004; Delfim & Hoesli, 2016; Fuerst, et al., 2014; Patel & Olsen, 1984; Pagliari Jr, 2016). Other studies, however, indicate that gearing has a positive impact on return. Van den Heuvel and Morawski (2013) have discovered that leverage positively affects returns both during boom periods and during recovery phases. Fuerst and Matysiak (2013) indicate a positive effect, with higher gearing resulting in a higher return. However, in both studies, the observed results are based on data collected over a short period of time. Thus, as with fund strategy, funds with high gearing may outperform in the short term but underperform in the long term.

Investment style is another relevant indicator for fund performance. In the case of non-listed real estate funds, investment style is classified as core, value-add, or opportunity (Pagliari Jr, 2016). Overall, the academic literature indicates that opportunity funds outperform in the short term, as they are highly correlated with the macroeconomic environment. In the long term, core funds outperform. The effect is nearly always significant (Anderson, et al., 2016; Brounen, et al., 2007; Case, 2015; Delfim & Hoesli, 2016; Fisher & Hartzell, 2016; Fuerst & Matysiak, 2013; Pagliari Jr, 2016).

Another hypothesized factor influencing fund returns is the **specialization** of a fund. A fund may specialize either by sector or by geography. The existing academic literature on listed and non-listed real estate does show an impact, but this impact is usually small and insignificant. A common hypothesis is that the most specialized funds (i.e., single-country and single-sector) outperform diversified funds. However, definite proof has not been found for either single-country or single-sector specialization (Farrelly & Stevenson, 2016; Fisher & Hartzell, 2016; Patel & Olsen, 1984; Ro & Ziobrowski, 2011; van den Heuvel & Morawski, 2013).

Delfim and Hoesli (2016) indicate that **age** influences the returns of closed-end funds only. They determine that closed-end fund returns "increase during the first part of a fund's lifetime and tend to decrease in the second part" (Delfim & Hoesli, 2016, p. 205). The natural breaking point occurs at around six to seven years, after which the returns become lower. Phalippou and Gottschalg (2008) indicate that private equity funds experience a learning curve and therefore suggest that reliable return measurements can only be done for funds that reached a certain maturity. In the literature, this phenomenon is also known as a J-curve effect. Fuerst et al. (2014) indicate that this occurred up to the first three years after the vintage year. Real estate funds generally draw capital commitment for multiple years, and Hahn et. al. (2005) argue that an accurate return measurement is only possible after five years.

Another factor influencing fund return is its **vintage year**, as fund return is partially influenced by the macroeconomic environment (Pagliari Jr, 2016). Funds established in a slowed economic environment tend to outperform funds established at the top of the economic cycle. This finding makes sense because capital appreciation of assets bought at lower prices associated with economic downturns is more likely than capital appreciation of assets purchased at peak prices. The vintage year effect is found in both private equity and non-listed real estate literature (Harris, et al., 2014; Kaplan & Schoar, 2005; Tomperi, 2010).

Fund **sequence** is another factor influencing return. Previous studies indicate that follow-up funds from successful managers outperform other funds, although past returns are not a guarantee of future success. Hahn et al. (2005) prove that the past return of a non-listed real estate fund accounted for 20–25% of the subsequent return. However, many studies also show that the effect of past success erodes over time. Thus, earlier funds from emerging managers have a higher return than later funds (Aarts & Baum, 2016; Bond & Mitchell, 2010; Farrelly & Stevenson, 2016; Kaplan & Schoar, 2005; Tomperi, 2010).

A constant and steady **dividend payout** is found to contribute positively to fund returns. This is the case for both open-end and closed-end mutual funds (Glenn & Patrick, 2004). Bond and Mitchell (2010) investigate the ability of public real estate fund managers to consistently deliver superior returns and prove that yield is a significant indicator of future fund return. The conclusions in non-listed real estate literature are similar; Fuerst and Matysiak (2013) demonstrate that portfolio yield distribution has a significant and positive effect on return. Another factor influencing fund return is **management expenditures**. In both non-listed and listed real estate and private equity literature, the consensus is that management expenses negatively impact fund return (Baum & Farrelly, 2009; Case, 2015; Chen, et al., 2004; Hahn, et al., 2005; Maurer, et al., 2004; Patel & Olsen, 1984; van den Heuvel & Morawski, 2013; Wiley, 2014). Wiley (2014) mentions that previous literature indicates that return-related fees are positively related to returns but he does not measure this himself.

The market return, the return across asset classes, and the overall **(macro)economic environment** are all thoroughly researched topics. These factors are mainly found to act as significant positive drivers for fund return. The importance of macroeconomic development is demonstrated by the fact that most studies of both listed and non-listed real estate and private equity include factors as inflation, growth of gross domestic product (GDP), or long-term interest rates in their models (Delfim & Hoesli, 2016; Maurer, et al., 2004; Phalippou & Zollo, 2005; Tomperi, 2010). A comprehensive way to capture the market effect on fund returns is via a weighed market return (WMR) variable, as demonstrated by Fuerst and Matysiak (2013) and Fuerst et al. (2014).

A deeper understanding of the behavior of non-listed real estate fund returns in the broader economic perspective aids in the selection of appropriate variables. Research by Harris et al. (2014) shows that, on average, private funds outperformed public investments. In contrast, Pagliari Jr et al. (2005) prove that returns on public real estate and private real estate narrows over time. Phalippou and Zollo (2005) argue that non-listed fund return is pro-cyclical, similar to the return of public real estate investment trusts (REITs). Real estate market shocks tend to take place in the public real estate market first and the private market second (Hoesli & Oikarinen, 2012; Yunus, et al., 2010). A possible explanation is the higher liquidity in the public market. Alcock et al. (2013) prove that unlisted funds systematically underperform their underlying market. This finding is in line with a study by Anderson et al. (2016), who find out that real estate private equity returns are closely related to direct real estate in the long term. Delfim and Hoesli (2016) conclude that listed, non-listed, and direct real estate “broadly react the same to macroeconomic risk factors, although our analyses suggest that non-listed real estate is more akin to direct real estate than it is to securitized real estate” (Delfim & Hoesli, 2016, p. 190).

2.4 Conceptual model and hypotheses

Figure 1 depicts the estimated conceptual model, which is estimated based on the literature review. In accordance with previous research findings, four hypotheses are formulated. Research by Case (2015), Chaudhry, et al. (2004), Franzoni et al. (2012), and Glenn and Patrick (2004) indicate that closed-end funds realize a higher return than open-end funds, which is linked to the lower liquidity of the closed-end structure. This effect is seen in both private equity funds and in listed and non-listed real estate funds. Delfim and Hoesli (2016) apply the variable fund structure in their research as a proxy for liquidity but find out that closed-end funds are outperformed by open-end funds. Despite this last finding, the first hypothesis is as follows: *Closed-end funds produce higher returns than open-end funds.*

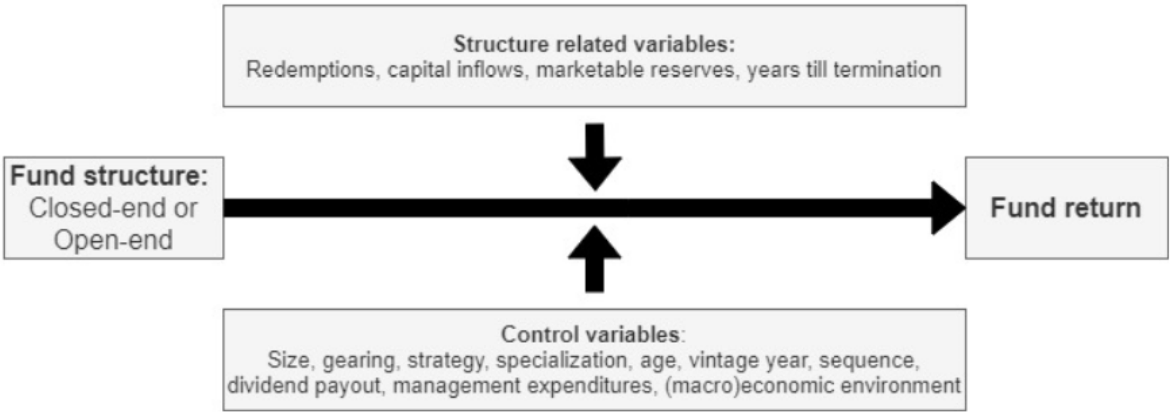


Figure 1: Conceptual model explaining the relationship between a fund and its return

Glenn and Patrick (2004) note that redemptions may influence fund return negatively. Wiley (2014) indicates that fund managerial power to suspend redemptions is associated with higher returns. The ability to time the actual capital outflow of a redemption enhances the return, while uncontrolled (run-on) redemptions decrease return. Notably, “An open redemption plan is at risk of later becoming constrained” (Wiley, 2014, p. 230). Therefore, the second hypothesis is as follows: *The higher the value of redemptions, the lower a fund’s return.*

A stable pool of capital is found to be advantageous for fund returns. Harris et al. (2014) indicate that capital inflows negatively affect returns. Therefore, the third hypothesis is as follows: *The higher the value of capital commitments, the lower a fund’s return.*

Kandel et al. (2011) prove that fund managers start making bad decisions the closer their fund approaches its termination date. As open-end funds do not have a pre-specified termination date, the fourth hypothesis is as follows: *For closed-end funds, a more distant termination date leads to a higher fund return.*

The corresponding null hypothesis for hypotheses 1 to 4 is that there is no difference or no effect. As indicated in the literature review, other factors than the structure related variables also influence the fund return. These factors serve as control variables because they are not directly tied to fund structure. The expected effect of those control variables on fund returns are identified in Appendix A.

3. DATA AND METHODOLOGY

This chapter first describes the characteristics of the dataset that is applied in this research. Thereafter, a brief overview of panel data characteristics is provided. The panel model for this research is estimated, and an approach for testing the robustness and the sensitivity of results is formulated. In section 3.3, all variables included in the estimated model are operationalized. Finally, the descriptive statistics of the cleaned dataset are presented.

3.1 The dataset

The data for this research is provided by INREV, the leading platform in the European unlisted real estate industry. The dataset contains quarterly return data reported by the vehicles included in the INREV Index. Funds also report financial data, such as their net asset value (NAV) and GAV, gearing levels, distributed returns, capital growth, redemptions, and capital calls. The dataset also includes the characteristics of each fund; these include the fund structure, year of the first closing, investment strategy, target country, and target sector. Figure 2 depicts the total returns of the closed-end and open-end funds in the INREV Quarterly Index (INREV, 2019a). A notable observation in the graph is that both structures experience a sharp drop in returns during the financial crisis from 2007 to 2009. The drop is more severe for closed-end funds. Over the full sample period, the average total return of closed-end funds is 0.4% with a standard deviation of 6.3%, while open-end funds have an average return of 1.1% with a standard deviation of 3.6%. On average, open-end funds appear to outperform closed-end funds, and their returns are less volatile. This is in line with the findings of Delfim and Hoesli (2016).

Table 1: Observations per year by fund structure (raw dataset)

Year of reporting	Observations by fund structure		Year of reporting	Observations by fund structure	
	Closed-end	Open-end		Closed-end	Open-end
2000	12	65	2010	600	695
2001	31	126	2011	663	727
2002	52	153	2012	672	771
2003	64	174	2013	717	825
2004	83	211	2014	699	852
2005	128	245	2015	696	859
2006	204	301	2016	671	861
2007	272	406	2017	628	881
2008	342	453	2018	573	903
2009	452	519	2019	228	431
Total				**7,787**	**10,458**

The INREV dataset encompasses a total of 18,245 observations from 258 closed-end and 305 open-end funds (see Table 1 and the extended version thereof in Appendix B). The first reported quarter is 2000

Q2 and the last reported quarter is 2019 Q2. The applied panel dataset has several characteristics. Firstly, since not every fund (*i*) reports each quarter (*t*), the dataset is an unbalanced panel (Brooks, 2008). The unbalanced nature of the dataset will not cause a problem because missing observations are automatically accounted for by the software package used, which, in the case of this research, is StataSE (Brooks, 2008). Secondly, the dataset is a short panel, as there are substantially more individuals than periods (Cameron & Trivedi, 2009).

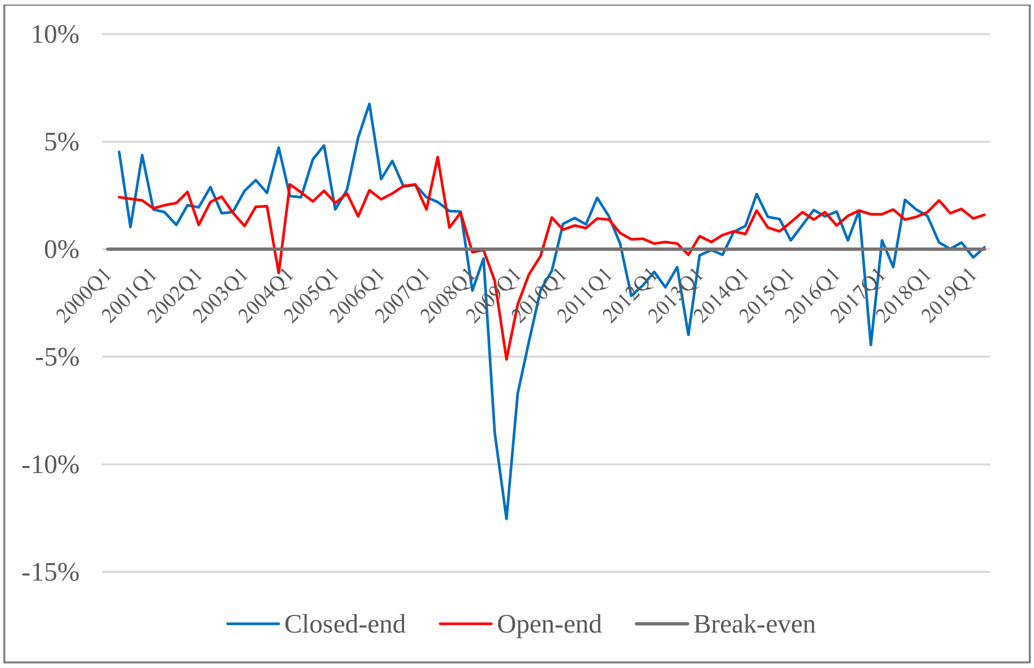


Figure 2: Nominal quarterly total returns closed-end and open-end funds from 2000 Q2 to 2019 Q2, raw dataset

Other data sources are employed as well. Eurostat (2019) provides the quarterly GDP of 28 EU countries, an INREV Index report (2019a) provides the historical aggregated return of peers in the non-listed real estate asset class, and the Organization for Economic Co-operation and Development (OECD) (2019) provides the quarterly interest rates on 10-year German government bonds.

3.2 Panel models, model estimation, and robustness

As panel data requires a fundamentally different modeling approach compared to the approach that used for non-panel data, this section provides some background on panel models. The use of panel data in real estate is developing, and such data is increasingly used in real estate research (Brooks & Tsolacos, 2010). Panel data gives the researcher many advantages over solely cross-sectional or time-series data, as has been described by Baltagi (2015) and Hsiao (2007). If modeled appropriately, panel models control for individual heterogeneity, mitigate the issue of multicollinearity, and control for the omitted variables bias (Brooks, 2008; Fuerst, et al., 2014; Baltagi, 2015; Hsiao, 2007). The equation for the basic panel data regression model is shown in equation (1). Y_{it} is the dependent variable, where i depicts the index or entity at time t. α_i is the unknown intercept for each entity and captures the random individual-specific effects. β is a k *1 vector of independent variables that have to be estimated. X_{it} is a 1*k vector of observations on the independent variable, t = 1, …, T; I = 1, …, N (Brooks, 2008, pp. 487-488). The error term is denoted as u_{it} (Brooks, 2008; Torres-Reyna, 2007).

$$y_{it} = \alpha_i + \beta x_{it} + u_{it} \tag{1}$$

Primarily, panel models aim to model the within variation, the between variation, or both simultaneously, where all panel models define estimators differently due to alternative handling of these variations (Cameron & Trivedi, 2009). There are many types of panel models; the two basic panel models are the fixed effects (FE) model, which models the within variation using the time-series information in the data, and the random effects (RE) model, which captures both the within and between variation (Cameron & Trivedi, 2009; Katchova, 2013). The between estimator models the between variation using the cross-sectional information in the data. The between variation is necessary from a statistical point of view in order to derive the RE from the FE model. In practice, the between estimator is very rarely used because the RE estimator is more efficient (Cameron & Trivedi, 2009). All panel models have advantages and disadvantages relative to each other, but these are not further elaborated on in this paper for the sake of concision. The choice of panel model depends on the purpose of the study and the characteristics of the dataset. Different types of panel models and their applications are described by Baltagi (2015), Brooks (2008), Cameron and Trivedi (2009), Hsiao (2007), McManus (2011), and Wooldridge (2010).

Model estimation

When applied to this research, the panel model of equation (1) results in equation (2). The independent variable is the quarterly total return of a fund (i) in the reported quarter (t). The independent variables are divided into three subcategories: β is the structure of a fund, δ is a vector of structure-related variables, and θ is a vector of other factors that influence fund return. γ represents $t\text{-}1$ time dummies for each reporting quarter in the dataset. Finally, α is a constant, and u depicts the error term. The operationalization of the variables is discussed in the next paragraph.

$$Return_{it} = \alpha_i + \beta_1 FundStructure_i + \delta_{it} + \theta_{it} + \gamma + u_{it} \tag{2}$$

Equations (1) and (2) are both pooled linear panel models. According to Brooks (2008), this is the simplest way to deal with panel data because it allows the equation to be estimated based on the usual ordinary least squares (OLS) approach. However, this approach has some crucial limitations because it implicitly assumes that the average values are constant over time and constant across all cross-sectional units, thus failing to take into account that the data is panel data. To take advantage of the panel structure, an alternative method is necessary. The method used needs to allow for variation over time (*within* variation), across individuals (*between* variation), or both (Brooks, 2008; Katchova, 2013).

Several tests are applied to obtain the appropriate panel model for this research. First, the Breusch and Pagan Lagrangian multiplier test for random effects is used. This test indicates whether the appropriate model is a panel model or a pooled OLS model without panel effect. The null hypothesis is that the variances across all entities are zero and thus there is no significant difference across units (Cameron & Trivedi, 2009; Katchova, 2013; Torres-Reyna, 2007). After running the test, the null hypothesis is rejected, and so it is clear that there is a panel effect in the data and that a panel model is needed to estimate the coefficients for this research.

The second test is the Hausman test, which tests for an FE versus a RE model based on whether individual effects are random. It tests whether the unique errors of the model are correlated with the estimators (the null hypothesis is that they are not). If the null hypothesis is not rejected, the appropriate model is a RE model. If the null hypothesis is rejected, the appropriate model is an FE model (Cameron & Trivedi, 2009; Katchova, 2013; Torres-Reyna, 2007). After running the test, the null hypothesis is rejected, making it clear that the fixed effect (within) model should be used for estimation of the panel model in this research.

Thus, according to the results of both the Breusch and Pagan Lagrangian multiplier test and the Hausman test, it is appropriate to apply an FE model to the dataset. This is problematic, however, because FE models do not estimate time-invariant variables due to multicollinearity with the entity (i) between the induvial funds. A fund is either closed-end or open-end during its entire lifetime. Therefore, the time-invariant variable $FundStructure_{it}$ is not estimated by an FE model (Baltagi, 2015; Brooks, 2008; Cameron & Trivedi, 2009; Torres-Reyna, 2007). The research objective is to identify the effect of precisely this variable. Therefore, an alternative to the FE model is required in order to estimate the effect of $FundStructure_i$ on $Return_{it}$. Three methods are applied to estimate this effect: pooled OLS with time dummies, the between estimator, and RE estimator. All three methods have advantages and disadvantages relative to each other, but the between estimator seemed to be the most appropriate model for the research. While the pooled OLS is generally more efficient than the between estimator (Cameron & Trivedi, 2009), the panel effect that is present in the dataset is not taken into account when using the pooled OLS with time dummies (Brooks, 2008). Including time dummies does partially control for the time effects in the data. Furthermore, the OLS assumptions are taken into account (Appendix D).

The second model, and seemingly the most appropriate alternative panel model in the case of this research, is the between estimator. The between estimator is rarely used because "pooled [OLS] estimators and RE estimators are more efficient" (Cameron & Trivedi, 2009, p. 254). The between estimator only uses the variation between the cross-sectional observations and is, as a result, effectively "the OLS estimator applied to the time-averaged equation" (Wooldridge, 2010, p. 269). The between estimator is inconsistent in FE, but is consistent under the assumption in RE of standard rank condition (Wooldridge, 2010). It ignores time-series information; from this perspective it is more efficient to use the RE model (Cameron & Trivedi, 2009; Wooldridge, 2010). However, the between estimator allows for the use of the panel structure of the dataset. The inclusion of time dummies in the regression equation partially controls for the time effects in the data.

The most conventional solution for estimating time-invariant variables is to apply a RE model (Brooks, 2008). However, the RE model is not the appropriate panel model for this research either, as the Hausman test indicates that the FE model is more appropriate. If the RE model is applied when the FE model is the more appropriate panel model, the estimators will be inconsistent (Katchova, 2013). However, a RE model can serve as a sensitivity check for previous estimators.

Robustness and sensitivity

The results of panel models may be biased if multicollinearity or heteroskedasticity present (van den Heuvel & Morawski, 2013). Highly correlated variables are excluded from the model to avoid multicollinearity; these are discussed in the next section and also in Appendix D (Brooks, 2008). Unfortunately, no tests for heteroskedasticity are available for the panel model (van den Heuvel & Morawski, 2013). To address the potential heteroskedasticity issue, a White's test is performed on the pooled OLS regression. Since the null hypothesis of no heteroskedasticity is rejected, heteroskedasticity-robust standard errors are used (van den Heuvel & Morawski, 2013). The heteroskedasticity that is present does not produce biased estimators (Williams, 2020).

The sensitivity of the results is tested in different ways. First, the dataset is split into a closed-end and open-end fund subset for each of the three modeling methods mentioned in the previous section (pooled OLS, between estimator, and RE). Using this approach, it becomes clear how the open-end and closed-end fund structure influence the estimators of independent variables differently. Second, an additional sensitivity check is performed for reporting dates before, during, and after the subprime crisis. This is relevant because real estate fund returns depend significantly on the macroeconomic environment (Delfim & Hoesli, 2016; Maurer, et al., 2004; Phalippou & Zollo, 2005; Tomperi, 2010). Open-end funds have a higher risk on a redemption run, especially during slow economic times. This may in turn affect fund returns (Bannier, et al., 2007; Glenn & Patrick, 2004; Sebastian & Tyrell, 2006). The modeling technique used is the between estimator because it produces the highest R^2 of all three model types. Thus, based on the between estimator model, the second sensitivity check produces a vector of three times four estimations: the full dataset, the open-end funds, and closed-end funds versus the full period and the periods 2000 to 2006, 2007 to 2009, and 2010 to 2019.

3.3 Operationalization of variables

The critical variables in the dataset are checked to establish whether the data is stationary or whether there is a systematic change in data in variances or mean, with both the augmented Dickey-Fuller test and the Phillips-Perron test (Alcock, et al., 2013; Fuerst, et al., 2014). The test results are presented in

Table 2. The null hypothesis is that unit root exists, and the null hypothesis is rejected for all variables. The data is stationary and does not need to be differentiated, which alleviates concerns about autocorrelation (Fuerst, et al., 2014).

Table 2: Unit root tests results

	Return	Redemptions	CapitalCalls	LnFundSize	Gearing	MarketReturn
Chi-sq	4088.3891	2704.9129	5499.9688	2611.4373	2871.2108	1415.3286
(Dickey-Fuller)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Chi-sq	8783.7914	6612.2312	1.04e+04	3546.5007	2095.2545	3087.2039
(Phillips-Perron)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Some variables in the dataset are highly correlated with each other (see the correlation matrix in Appendix D) and have the potential to cause multicollinearity issues (Brooks, 2008). First, the variables *CashReserve* and *Gearing* are highly positively correlated. This is unsurprising, as both variables are calculated based on GAV. *CashReserve* is an under-researched variable in non-listed real estate literature, whereas *Gearing* is included in much of the existing literature. For this reason, the variable *CashReserve* is dropped in favor of *Gearing* (Brooks, 2008). Second, the variable *GDPEU28* is highly negatively correlated with the quarterly yield on German 10-year bonds, which serves as a proxy for the risk-free rate. In this case, the variable *GDPEU28* is retained. Prior research indicates that unlisted real estate shows more similarities with direct real estate than listed real estate (Anderson, et al., 2016; Delfim & Hoesli, 2016). Following this line of reasoning, *GDPEU28* is considered a more important variable to include in the model than the variable *RiskFreeRate*, as the overall economic development is assumed to be a more substantial driver for real estate demand than the risk-free rate. Additionally, the latter is more critical for funds that exercise vast cash reserves, and this variable has already been excluded from the model. Third, the squared size, gearing, and age are highly positively correlated to their non-squared counterparts. They are included in the research due to their function of indicating a quadratic effect of the variables. Lastly, *FundAgeMax3* and *FundAgeMax2* are highly correlated because *FundAgeMax3* included all observations of *FundAgeMax2*. The correlation between *FundAgeMax3* and *FundAgeMax2* is ignored (Brooks, 2008).

Based on the literature, the results of the correlation matrix, and the statistical tests, panel regression equation (3) is specified. The independent variable is the quarterly total return of a fund (*i*) in the reported quarter (*t*). α_i represents a constant, β_1 represents the fund structure, δ_{it} represents a set of structure-related variables, θ_{it} represents other fund characteristics, γ represents *t-1* quarterly time dummies, and u_{it} represents the error term.

The dependent variable $Return_{it}$ represents a fund's (*i*) total realized (nominal) return in percentage over the reported quarter (*t*). The total return values are given as the sum of the income return and the capital return and are calculated on a time-weighted basis of cash flows occurred by capital calls, redemptions, and distributions (INREV, 2019c). The dependent variable is continuous and normally distributed (see Appendix D). Not all funds have reported their earnings in the same currency; using the reported relative return (rather than the absolute return) allows all funds in the dataset to be included, regardless of reporting currency. Winsorization at the 1% level is applied to returns to retain sample size and decrease the influence of outliers, following the approach of Fuerst et al. (2014).

$$Return_{it} = \alpha_i + \beta_1 FundStructure_i + \delta^3{}_{it} + \theta^4{}_{it} + \gamma + u_{it} \quad (3)$$

The first independent variable is the beta variable $FundStructure_i$, which represents the structure of a fund and is, therefore, the variable of central focus in this research. It is a dummy variable that takes the value 0 if a fund has an open-end structure and the value 1 if a fund has a closed-end structure. The structure of a fund does not change over time (*t*). Fund structure is considered to be a proxy for liquidity. Open-end funds are considered to be a more liquid investment alternative than closed-end funds. $FundStructure_i$ is a time-invariant regressor. It is important to note that fund structure is treated as strictly delimited, despite the potential presence of either a fund-specific legal framework or of domestic regulations that allow relaxing or tightening of share redemption and share-issuing policies (Bannier, et al., 2007; Maurer, et al., 2004; Sebastian & Tyrell, 2006). As a result, from an investor perspective, closed-end funds are considered to be strictly illiquid, and open-end funds are considered strictly liquid.

The first delta variable is $Redemptions_{it}$, which represents the total value of redemptions that a fund (*i*) is obliged to reimburse to its shareholders over the reported quarter (*t*). The variable is measured as a percentage of total return and is a continuous variable. This variable is manually generated based on the absolute redemption value divided by the total return denominator[5]. Only open-end funds are obliged to meet redemptions during their lifetimes. Closed-end funds, in contrast, have discretion over redemptions. Therefore, a large volume of observations in the panel dataset have the value zero.

$CapitalCalls_{it}$, the second delta variable, is the total volume of capital calls that a fund (*i*) has received from its shareholders over the reported quarter (*t*). The variable is measured as a percentage of total

[3] Full list of **delta variables**: Redemptions, CapitalCalls and YearsToTermination. The latter is only included in regressions with closed-end subsets.
[4] Full list of **theta variables**: LnFundSize, LnFundSizeSq, SmallMediumFund, LargeMediumFund, LargeFund, Gearing, GearingSq, Strategy*, MultiCountry*, MultiSector*, FundAge, FundAgeSq, FundAgeMax2, FundAgeMax3, CrisisVintage*, Distributions, MarketReturn**, GDPEU28**.
* The values of Strategy, MultiCountry, MultiSector, and CrisisVintage do not change over time (*t*) for individual funds (*i*). ** the values of MarketReturn and GDPEU28 at time (*t*) do not vary over individual funds (*i*).
[5] The total return denominator is a given variable in the dataset. The denominator is applied by fund in the INREV Index to report, among others, their total return. In accordance with the INREV professional guidelines (2019d), the provided denominator in the dataset has been calculated as: NAV_{t-1} plus time-weighted daily contributions over the measurement period minus time-weighted daily redemptions over the measurement period minus time-weighted daily distributions over the measurement period.

return and is a continuous variable. This variable is manually generated based on the absolute value of capital calls divided by the total return denominator. Open-end funds can issue shares during the life of the fund. Closed-end funds have discretion over the share issue and, typically, their capital calls last from the beginning of their life until they have sold their predetermined share volume. A large volume of observations for $CapitalCalls_{it}$ have the value zero (albeit fewer than $Redemptions_{it}$).

The third delta variable, $YearsToTermination_{it}$, represents the years until termination of a closed-end fund (*i*) in the reported quarter (*t*). The years to termination are considered to influence return for closed-end funds only, due to their infinite life. Therefore, the variable is not included in the full dataset regression. Instead, it is included in the regressions based on the closed-end subset only. Open-end funds are only terminated in the case of a market-driven event (Sebastian & Tyrell, 2006). After termination, they are bound to pay back debt obligations. During the liquidation process, which can take several years, funds may sell off properties to meet their debt obligations, returns may not be optimized, or the fund may be managed less actively (KanAm Grund, 2015). Thus, $YearsToTermination_{it}$ interacts with $FundStructure_i$. It is manually generated using data from the planned termination year minus the reporting year. If closed-end funds are active beyond their primarily planned termination date, the fund age is negative (this is possible if a fund has a provision for life extension). These observations are removed from the sample because fund operating conditions are not considered representative of the typical fund management process during active fund life. Thus, returns and other reported values are potentially unreliable. Another reason for the exclusion of observations of funds with extended operations is that the dataset is anonymous; it is not possible to indicate fund-specific provisions. The variable $YearsToTermination_{it}$ is included in the model. This inclusion is based on Kandel et al.'s (2011) hypothesis that funds approaching their termination date are more likely to generate lower returns.

The theta variables are those that are not structure-related and are expected to influence the total return. The size of a fund is indicated by $LnFundSize_{it}$, measured as the natural logarithm of the GAV of the fund (*i*) over the average of quarter *t* and *t-1* (Delfim & Hoesli, 2016). The squared size is included to indicate whether there is a quadratic effect (Delfim & Hoesli, 2016). Dummies are created for small funds (< 250 million), medium-small funds (250 >, < 500 million), medium-large funds (> 500, < 1,000 million), and large funds (> 1,000 million) in line with the method of Fuerst et al. (2014). Small funds are excluded from the equation to avoid the dummy variable trap (Brooks & Tsolacos, 2010).

$Gearing_{it}$ is another theta variable. It is measured as the level of gearing of the fund (*i*) over the reported quarter (*t*). Because the value for GAV that is given in the dataset contained numerous zero values, $Gearing_{it}$ is manually generated to distinguish between certain missing values of gearing and true zero values of gearing (where funds operated on an all-equity basis). This method results in the indication of 1,000 missing values and the retention of approximately the same number of true zero values. Gearing is calculated as a percentage based on the total outstanding loan divided by the total average GAV at *t* and *t-1*. This is a similar approach to that used for $LnFundSize_{it}$, due to the possibility of performance affecting both of these variables (Delfim & Hoesli, 2016; Fuerst, et al., 2014). The squared gearing is included in the model to indicate whether there is a quadratic effect (Delfim & Hoesli, 2016).

$Strategy_i$, the third delta variable, is used as a dummy variable for the fund's (*i*) defined investment style, taking the value 0 for core funds and the value 1 for value-added funds. The dataset contains no opportunistic funds. $MultiCountry_i$ is a dummy variable that denotes whether a fund's (*i*) investment strategy is focused on a single country (value 0) or multiple countries (value 1). $MultiSector_i$, in contrast, is used as a dummy variable that denotes whether a fund's (*i*) investing strategy is focused on a single asset class (value 0) or multiple asset classes (value 1).

The continuous variable $FundAge_{it}$ indicates the age of a fund (*i*) in years in the reported quarter (*t*). It is manually generated using the reporting year minus the fund's vintage year. To indicate whether a J-curve effect is present, dummies are included for funds with an age of two years or less and funds with an age of three years or less (Fuerst, et al., 2014). The squared age is included in the model to indicate whether there is a quadratic effect (Delfim & Hoesli, 2016). $CrisisVintage_i$ is a dummy variable that denotes whether or not a fund (*i*) is launched during one of the years in the financial crisis (2007 to 2009). It takes the value 0 if not founded during these years and the value 1 if founded during the crisis.

The variable $Distributions_{it}$ is the total income return that a fund (*i*) distributed to its shareholders during the reported quarter (*t*). It is a continuous variable and a percentage of the denominator for total return. Following the INREV guidelines, "Distributions include dividends and interests paid during the period" (2019c, p. 58). The distributed return is a given variable in the dataset and is calculated by INREV by dividing the absolute value of distributions by the total return denominator. It is a relevant variable for predicting the total return because a fund cannot reinvest the distributed capital. No lag is applied for distributions because they may occur daily during each reporting period. Fund managers control the timing of these cash flows (INREV, 2019c).

The aggregated returns of the INREV quarterly index are denoted as $MarketReturn_t$ and represent the market return for non-listed real estate funds in the reporting quarter (*t*). The data is retrieved from an INREV Index report (2019a) and is an individual-invariant regressor. $GDPEU28_t$ represents the GDP in the reporting quarter (*t*) of the 28 EU member states (by the end of 2019) and is included as a proxy for overall economic development in the major European economies. The GDP of countries that were not an EU member at the specific reporting date are still included in the GDP index.

3.4 Descriptive statistics

Table 3 shows the summary statistics of the most essential variables for the research. After preparing the data as described in Appendix C, the dataset contains 13,125 observations (N) of 550 funds (n). The panel summary statistics of all variables are included in Appendix E, along with the non-panel data summary statistics (which are the same as the overall variation but are included for improved readability). Panel summary statistics differ from non-panel data summary statistics in that they split the overall variation into the *between* and *within* variation for each variable. The between variation averages a variable on fund level (n) and calculates the standard deviation over this mean. The within variation is the variation over time for the individual (n). A higher between variation indicates a higher variation across individuals than over time (Katchova, 2013). In Appendix E, the summary statistics by fund structure are presented too, as this is the central variable of the research.

Table 3: Panel summary statistics (full sample). Graph includes only the most relevant variables.

Variable	Variation	Mean	Std.Dev.	Min	Max	Observations		
Return	overall	0.009	0.049	-0.220	0.177	N	=	13,125
	between		0.023	-0.144	0.112	n	=	550
	within		0.045	-0.231	0.308	T-bar	=	23.864
ClosedEndFund	overall	0.443	0.497	0	1	N	=	13,125
	between		0.499	0	1	n	=	550
	within		0	0.443	0.443	T-bar	=	23.864
Redemptions	overall	0.011	0.059	0	0.999	N	=	13,125
	between		0.034	0	0.495	n	=	550
	within		0.056	-0.484	0.954	T-bar	=	23.864
CapitapitalCalls	overall	0.039	0.113	0	0.996	N	=	13,125
	between		0.063	0	0.555	n	=	550
	within		0.106	-0.391	1.008	T-bar	=	23.864
YearsToTermination	overall	5.394	4.160	0	30	N	=	5,303
	between		3.141	0	24.762	n	=	230
	within		2.603	-4.229	14.771	T-bar	=	23.056
LnFundSize	overall	5.872	1.017	0.057	9.292	N	=	12,657
	between		1.002	0.633	8.436	n	=	517
	within		0.446	0.717	7.751	T-bar	=	24.482
Gearing	overall	0.386	0.182	0.000	1	N	=	12,486
	between		0.180	0.001	0.893	n	=	509
	within		0.073	-0.076	0.834	T-bar	=	24.530
FundAge	overall	7.141	6.445	0	52	N	=	13,125
	between		6.071	0	49.133	n	=	550
	within		3.005	-9.002	16.764	T-bar	=	23.864
Distributions	overall	0.010	0.022	0	0.809	N	=	13,125
	between		0.007	0	0.079	n	=	550
	within		0.021	-0.069	0.740	T-bar	=	23.864

The average quarterly return is 0.009% for the full sample, 0.0125 for open-end funds, and 0.006% for closed-end funds. *Return* has slightly more within variation (0.045) than between variation (0.023), which indicates a higher variation over time than across individuals. However, the effect is negligible as the effect is small. The average return of an individual fund is between -0.144% and 0.112% and varies for each fund by approximately 0.539% over time. This pattern is the similar for closed-end funds. The average return of an individual open-end fund is between -0.105% and 0.111%, varying for each fund by 0.422% over time. *Redemptions* (0.056 versus 0.034), *CapitalCalls* (0.106 versus 0.063), and *Distributions* (0.021 versus 0.007) all follow the same pattern, showing slightly more within variation than between variation. This effect is also negligible since the differences are small as well.

LnFundSize shows more between variation (1.002) than within variation (0.446), which indicates a higher variation across individuals than over time. The average size of an individual fund is between 2 million and 4,610 million and varies by approximately 2,321 million for each fund over time. The average size of an individual open-end fund is between 2 million and 4,510 million, varying for each fund by 4,858 million over time. For closed-end funds, the variation over time is 7,644, and the average size of a fund is between 19 million and 4,610 million. The average fund age is 8.399 years for open-end funds (maximum age 52 years). The average age of closed-end funds is 5.561 years (maximum age 20 years). Because open-end funds have a virtually infinite age, they show a much larger between variation (7.698) than within variation (3.260). The difference in variation for closed-end funds is negligible.

Time-invariant variables show no within variation. As expected, the variables *FundStructure*, *Strategy*, *MultiCountry*, *MultiSector*, *CrisisVintage*, and *FundID* show this pattern. Individual-invariant variables are expected to show zero between variation, as all observations at all *t* have the same value. However, the summary statistics do not indicate that the individual invariant regressors *MarketReturn* and *GDPEU28* show a between variation is zero. As a result, the dataset is checked manually, where after it is confirmed that observations of *MarketReturn* and *GDPEU28* represent the same value at all *t*.

4. RESULTS

This chapter discusses the results of the quantitative analysis. The first section analyses the three regression results for the full sample. These results are presented in Table 4. Based on this table, the first hypothesis (that closed-end funds produce a higher return than open-end funds), the second hypothesis (that higher redemption levels result in a lower return) and the third hypothesis (that higher levels of capital commitments lead to lower fund returns) can be tested. In the second section, a robustness analysis is carried out based on the application of different subsets. The estimation results from the subsets are used to add nuance to the findings in the first section, if required, and provide information to test the fourth hypothesis (that a more distant termination date has no effect on return). Finally, sub-questions 2 and 3 are answered based on the results presented in this chapter.

4.1 Main results

The results from the pooled OLS, between estimator, and RE for the full sample are presented in Table 4. All models are found to be significant after carrying out the F-test for the pooled OLS and the between estimator and the Chi-square test for the RE. The between estimator model (2) produces the best fit, accounting for 54.5% of the variation in the quarterly return. The R-squared of both the pooled OLS model (1) and the RE model (3) explain 17.6% and 17.4%, respectively, of the variation in the dependent variable.

Over the full sample, the effect of a closed-end fund structure positively influence the return in all three models. However, the effect is not significant. As a result, null hypothesis 1 (that there is no difference in return between closed-end and open-end funds) is not rejected. This result is not in line with the expectations based on previous studies, including those by Bers and Madura (2000), Case (2015) Franzoni et al. (2012), Fuerst and Matysiak (2013), and Wiley (2014). This suggests that investments with higher liquidity result in a lower return. Open-end funds bear less risk for the investor and are, therefore, a higher risk for fund managers. A similar conclusion is drawn for capital calls, for which the measured effect is negative. Again, this is not in line with previous studies, in which a constant capital volume is found to be beneficial to the total return (Glenn & Patrick, 2004; Harris, et al., 2014). However, since the effect is non-significant, null hypothesis 3 (that capital commitments have no effect on return) is not rejected.

Redemptions have a positive impact on the total return. The effect is significant at a 1% level for the pooled OLS model (1) and RE model (3) but not significant for the between estimator model (2). The interpretation for the pooled OLS model is that, when redemptions increase by 1% (redemptions are measured in %; 1 unit is 1%), the total quarterly return increases by 0.0376%, ceteris paribus (Brooks & Tsolacos, 2010). The interpretation of the RE model is slightly different because the beta coefficient includes both the within fund and the between fund effects (Torres-Reyna, 2007). Thus, the interpretation of the beta coefficient for redemptions is as follows: on average, the quarterly fund return increased by 0.0420% when redemptions changed across time and between funds by 1% (Torres-Reyna, 2007).

Null hypothesis 2 (that higher redemption levels have no effect on return) is rejected. The existing literature suggests that redemptions have a negative impact on the return. Instead, the regression results indicate that higher redemptions lead to higher quarterly returns. This effect is unexpected. A possible reason for this may be that the meeting of redemptions is done at fund managers' discretion (Wiley, 2014). If managers can time the exact moment of cash outflow due to redemptions, they may be able to mitigate the effect of redemption requests. This effect exists under the condition that there is not a run on redemptions for a given fund, which might lead to premature termination.

Table 4: Regression results for the full dataset; Pooled OLS (1), between estimator (2), and RE (3)

	(1) Pooled OLS		(2) Between estimator		(3) RE	
ClosedEndFund	0.0011	(0.0009)	0.0006	(0.0023)	0.0014	(0.0018)
Redemptions	0.0376***	(0.0124)	0.0332	(0.0462)	0.0420***	(0.0071)
CapitalCalls	-0.0017	(0.0047)	-0.0054	(0.0201)	-0.0019	(0.0040)
YearsToTermination						
LnFundSize	0.0066	(0.0055)	0.0004	(0.0098)	0.0109**	(0.0043)
LnFundSizeSq	-0.0004	(0.0005)	-0.0001	(0.0010)	-0.0006	(0.0004)
SmallMediumFund	0.0007	(0.0015)	-0.0011	(0.0045)	0.0025	(0.0016)
LargeMediumFund	0.0024	(0.0019)	0.0029	(0.0064)	0.0030	(0.0023)
LargeFund	0.0001	(0.0031)	0.0014	(0.0120)	-0.0006	(0.0039)
Gearing	0.0842***	(0.0113)	0.1036***	(0.0207)	0.0862***	(0.0105)
GearingSq	-0.1452***	(0.0180)	-0.1821***	(0.0257)	-0.1522***	(0.0130)
Strategy	-0.0018	(0.0012)	0.0020	(0.0026)	-0.0013	(0.0020)
MultiCountry	-0.0073***	(0.0009)	-0.0064***	(0.0020)	-0.0072***	(0.0016)
MultiSector	-0.0017*	(0.0009)	-0.0039**	(0.0019)	-0.0021	(0.0016)
FundAge	-0.0010***	(0.0002)	0.0001	(0.0007)	-0.0016***	(0.0003)
FundAgeSq	0.0000***	(0.0000)	0.0000	(0.0000)	0.0000***	(0.0000)
FundAgeMax2	0.0036**	(0.0017)	0.0124	(0.0098)	0.0033**	(0.0016)
FundAgeMax3	0.0006	(0.0016)	-0.0015	(0.0095)	-0.0008	(0.0016)
CrisisVintage	-0.0015	(0.0011)	-0.0027	(0.0030)	-0.0019	(0.0020)
Distributions	0.1170**	(0.0477)	0.1692	(0.1225)	0.0987***	(0.0178)
MarketReturn	-0.1618	(1.1274)			-0.2537	(1.4091)
GDPEU28	0.0002	(0.0004)	0.0156	(0.0809)	0.0002	(0.0008)
Constant	-0.0375	(0.0623)	-1.5260	(8.2843)	-0.0440	(0.1032)
Time Dummies	YES		YES		YES	
Obs.	12,486		12,486		12,486	
R^2	0.176		0.545		0.174	
Chi^2					2,309	
F-statistic	16.72		5.26			
Df model	94		94		94	
Df regression	12,391		414			
Prob > test stat	0.0000		0.0000		0.0000	

*Quarterly fund return (%) is the dependent variable. Standard errors are in parentheses. ***p < 0.01, ** p < 0.05, * p < 0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when a variable is excluded from the regression model or dropped due to multicollinearity. Note: RE model follows a chi-distribution. The reported R^2 is overall R^2, between $R^2 = 0.273$, and within $R^2 = 0.174$, respectively.*

The effect of fund size is positive and significant at the 5% level in the RE model (3). However, it is not significant in models (1) and (2). In all three models, the effect of squared fund size is negative, suggesting a quadratic relationship. This result is in line with the findings of Delfim and Hoesli (2016). None of the estimators are significant for different fund size categories, which suggests that there is no pattern of outperformance related to specific fund size. The fact that the betas are largely non-significant is somewhat surprising because nearly all prior research indicates significant positive effects of size on fund returns.

A significant (at 1% level) positive effect of gearing on quarterly fund return is found in all three models. The size of the effect is similar for all models. The interpretation of the coefficient in the between estimator is, again, slightly different than the interpretation from models (1) and (3). The average quarterly fund return increases from one fund to the next by 0.1036%, while the level of gearing increases by 1% (Katchova, 2013). Furthermore, the negative significant estimator of the *GearingSq* shows a significant quadratic effect, suggesting that there is a point at which increased gearing levels is beneficial to fund managers. On average and over time, the optimal gearing level[6] is 28% for all funds, which can be specified in 25% for open-end funds and 40% for closed-end funds. The significant effect is in line with previous studies (Alcock, et al., 2013; Baum & Farrelly, 2009; Brounen, et al., 2007; Case, 2015; Chaudhry, et al., 2004; Delfim & Hoesli, 2016; Fuerst, et al., 2014; Patel & Olsen, 1984; Pagliari Jr, 2016).

In line with expectations, funds that specialized in a country or sector outperformed non-specialized funds. In contrast to the results presented by the existing literature, the effect is significant (Farrelly & Stevenson, 2016; Fisher & Hartzell, 2016; Patel & Olsen, 1984; Ro & Ziobrowski, 2011; van den Heuvel & Morawski, 2013). The effect of country specialization is greater than that of sector specialization. In contrast to the results of previous studies, however, fund strategy does not have a significant effect on fund returns. The effect of fund age is found to be significantly negative for both the pooled OLS model (1) and the RE model (3). This finding, in combination with a weak but significant positive quadratic effect and significant positive effect for funds under three years of age, indicates that the hypothesized J-curve effect is not present in the data (Fuerst, et al., 2014; Hahn, et al., 2005; Phalippou & Gottschalg, 2008). In contrast to prior expectations, a vintage year in the subprime crisis does not produce higher returns.

Another remarkable result is the impact of yield distributions to shareholders. A positive effect is found in the pooled OLS model (1) and the RE model (3). This effect is significant at the 1% and 5% level, respectively. The effect is in line with the work of Fuerst and Matysiak (2013), who have found that distributions have a positive impact on quarterly return. A possible explanation may be that a higher dividend payout reflects more proficient management. This may have persuaded lenders to agree to higher gearing levels. Finally, a somewhat surprising result is that the variables representing the macroeconomic environment (i.e., $MarketReturn_t$ and $GDPEU28_t$) are not significant in any of the models. A positive and significant relationship with these factors is found in prior literature. Furthermore, the effect of peer performance is estimated to be negative, which may indicate strong

[6] Computation of the optimal point is based on the approach demonstrated by Delfim and Hoesli (2016). Applied estimators for deriving the right values are: 0.1036 (Gearing) and -0.1821 (GearingSq) for all funds, 0.0395 (Gearing) and -0.0028 (GearingSq) for the open-end subset and 0.2002 (Gearing) and -0.2533 (GearingSq) for the closed-end subset. All values can be found in Table 4 and Appendix F.

competition in the non-listed real estate market. However, this theory cannot be substantiated based on the data.

4.2 Sensitivity 1: structure subsets

For the first sensitivity analysis, the dataset is split into two subsets: all observations for open-end funds and all observations of closed-end funds. For both subsets, the same regression model is run as for the full sample. In Table 5, a brief summary of the results for the open-end subset is shown, while Table 6 presents the results for the closed-end subset (Appendix F shows the full regression tables). The between estimator model (2) produces the best fit, explaining 54% of the variation in the quarterly return for open-end funds and 73.1% of the quarterly return for closed-end funds. All models are significant, except the RE model (3) for the open-end subset.

The between estimator model (2) shows a positive effect of capital calls on open-end funds (significant at the 5% level). On average, the quarterly fund return increased from one fund to the next by 0.0449%, when the capital calls increase by 1%. Therefore, null hypothesis 3 (that capital commitments have no effect on return) is rejected for open-end funds. This effect can potentially be explained if the closed-end funds in the dataset have not yet reached their optimal size (Delfim & Hoesli, 2016). For closed-end funds, both the pooled OLS model (1), significant at the 5% level, and the RE model (3), significant at the 1% level show a positive effect of redemptions on total return. This result is in line with the earlier findings for the full dataset.

The closed-end subset provides proof for hypothesis 4 (a more distant termination date leads to a higher fund return). The effect is positive and significant at the 5% level for both the pooled OLS model (1) and the RE model (3). The size in both models is the same. For the pooled OLS model (1), each additional year until termination results in an average 0.0010% higher quarterly return over time, ceteris paribus (Brooks & Tsolacos, 2010). The RE model (3) shows that each additional year until termination results in an average 0.0010% higher quarterly return over time and across funds (Torres-Reyna, 2007). Additionally, the variable representing fund age produces a significant negative effect at the 5% level, which supports these results. Concludingly, null hypothesis 4 (that a more distant termination date has no effect on return) is rejected.

Another remarkable result obtained using the closed-end subset (see Appendix F for full table) is that the RE model (3) indicates a significant positive effect of fund size on fund return. In contrast, fund size does not have a positive effect in the previous regressions. The squared fund size is negative and significant, in line with the results of Delfim and Hoesli (2016), who indicate that larger funds outperform smaller funds. These findings are significant for the closed-end funds only.

Table 5: Regression results open-end subset

	(1) Pooled OLS		(2) Between estimator		(3) RE	
ClosedEndFund						
Redemptions	0.0214	(0.0141)	0.0559	(0.0827)	0.0305***	(0.0079)
CapitalCalls	-0.0014	(0.0046)	0.0449**	(0.0211)	-0.0054	(0.0041)
YearsToTermination						
Time Dummies	YES		YES		YES	
Obs.	6,927		6,927		6,927	
R^2	0.160		0.540		0.157	
Chi^2					.	
Df regression	6,883		175			
Prob > test stat	0.0000		0.0000		.	

*Quarterly fund return (%) is the dependent variable. Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when a variable is excluded from the regression model or dropped due to multicollinearity. Note: RE model follows a chi-distribution. The reported R^2 is overall R^2, between $R^2 = 0.122$, and within $R^2 = 0.146$, respectively.*

Table 6: Regression results closed-end subset

	(1) Pooled OLS		(2) Between estimator		(3) RE	
ClosedEndFund						
Redemptions	0.0458**	(0.0187)	-0.0685	(0.0739)	0.0442***	(0.0126)
CapitalCalls	-0.0079	(0.0091)	0.0183	(0.0472)	-0.0042	(0.0077)
YearsToTermination	0.0010***	(0.0003)	0.0000	(0.0007)	0.0010**	(0.0004)
Time Dummies	YES		YES		YES	
Obs.	5,065		5,065		5,065	
R^2	0.223		0.731		0.222	
Chi^2					1,285	
Prob > test stat	0.0000		0.0000		0.0000	

*Quarterly fund return (%) is the dependent variable. Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1; Reference category is a small closed-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when the variable is excluded from the regression model or dropped due to multicollinearity. Note: RE model follows a chi-distribution, and the reported R^2 is overall R^2, between $R^2 = 0.394$, and within $R^2 = 0.189$, respectively.*

4.3 Sensitivity 2: reporting date categories and structure subsets

For the second sensitivity analysis, the dataset is split into different reporting date categories: before, during, and after the subprime crisis. Again, the open-end and closed-end subsets are applied in the model. Tables 7, 8, and 9 present the regression results of the structure-related variables for the full dataset, the open-end subset, and the closed-end subset. The models (1) represents the full dataset and is a repetition of the model (2) of Tables 4, 5, and 6. The models (2) represent the data before the subprime crisis, covering the years 2000 to 2006. For Tables 7, 8, and 9, none of the models (2) are significant due to an insufficient number of observations; thus, those estimators are not relevant.

Models (3) represent the observations during the subprime crisis, covering the years 2007 to 2009, while models (4) represent the observations after the subprime crisis, covering the years 2010 to 2019.

Open-end funds underperform closed-end funds during the subprime crisis. This effect is not significant, and, as a result, null hypothesis 1 (that there is no difference in return between closed-end and open-end funds) is not rejected. In fact, none of the estimators in Table 7 for fund structure are significant. In the full dataset, redemptions during the subprime crisis are found to negatively affect the return (significant at the 1% level). One percent more redemptions means, on average, a decrease in quarterly return of 0.1179% from one fund to the next. Null hypothesis 2 (that higher redemption levels have no effect on return) is rejected. For the open-end subset, a negative effect of redemptions during the subprime crisis is found. However, this effect is not significant. Redemptions for the closed-end subset provide a significant negative result for the same period. In conclusion, based on the regression results presented in Tables 4 to 9, redemptions do not seem to negatively affect the return. The exception to this finding is specific to the case of closed-end funds during an economic crisis. A significant negative effect was expected, especially for the open-end funds, since severe economic conditions may result in a redemption run (Bannier, et al., 2007; Glenn & Patrick, 2004; Sebastian & Tyrell, 2006).

Table 7: Between estimator regression results full dataset vs. times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund	0.0006	(0.0023)	0.0003	(0.0127)	-0.0048	(0.0048)	0.0026	(0.0024)
Redemptions	0.0332	(0.0462)	-0.1543	(0.2379)	-0.1179***	(0.0367)	0.0072	(0.0466)
CapitalCalls	-0.0054	(0.0201)	-0.0224	(0.0359)	-0.0250	(0.0313)	0.0129	(0.0218)
YearsToTermination								
Time Dummy	YES		YES		YES		YES	
Obs.	12,486		982		1,761		9,743	
R^2	0.545		0.399		0.466		0.457	
Prob > F	0.0000		0.8414		0.0000		0.0000	

Quarterly fund return(%) is the dependent variable. Standard errors are in parentheses.
**** p < 0.01, ** p < 0.05, * p < 0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when a variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*

Another interesting finding in the full dataset (see Appendix G for full table) is that, during the financial crisis, funds with a value-add strategy underperform core funds (significant at the 5% level). This effect is not unexpected due to the higher risk profile of value-add funds (Pagliari Jr, 2016). Additionally, yield distributions positively contribute to higher returns during the crisis. During the crisis, 1% increase in distributions result in an increase of quarterly return by 0.5406% from one fund to the next (significant at the 5% level). After the financial crisis, distributions also contribute to the return for the open-end subset (significant at the 1% level). This is in line with the findings of Fuerst and Matysiak (2013). However, this effect is also expected to occur during other time frames.

For open-end funds, capital commitments in the period after the financial crisis have a positive impact on the quarterly return (significant at the 1% level). An increase of 1% in capital calls results in a 0.05395% increase in quarterly return from one fund to the next. Null hypothesis 3 (that capital commitments have no effect on return) is rejected. Capital commitments do influence return, but this effect is positive. This finding is in line with results of the first sensitivity analysis.

Table 8: Between estimator regression results open-end subset vs. times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund								
Redemptions	0.0559	(0.0827)	-0.1715	(0.2499)	-0.1452	(0.0878)	0.0523	(0.0610)
CapitalCalls	0.0449**	(0.0211)	0.0240	(0.0582)	-0.0339	(0.0454)	0.0539***	(0.0203)
YearsToTermination								
Time Dummy	YES		YES		YES		YES	
Obs.	6,927		572		865		5,490	
R^2	0.540		0.881		0.619		0.509	
Prob > F	0.0000		0.2911		0.0000		0.0000	

*Quarterly fund return (%) is the dependent variable. Standard errors are in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when a variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*

Table 9: Between estimator regression results closed-end subset vs. times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund								
Redemptions	-0.0685	(0.0739)	-0.2414	-15251	-0.1240**	(0.0508)	-0.0232	(0.0797)
CapitalCalls	0.0183	(0.0472)	0.1765	(0.1525)	0.0151	(0.0644)	0.0399	(0.0563)
YearsToTermination	0.0000	(0.0007)	0.0015	(0.0101)	-0.0000	(0.0010)	0.0006	(0.0007)
Time Dummy	YES		YES		YES		YES	
Obs.	5065		352		821		3892	
R^2	0.7312		0.6372		0.5712		0.6068	
Prob > F	0.0000		0.9697		0.0001		0.0000	

*Quarterly fund return (%) is the dependent variable. Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when a variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*

The open-end subset produces several other notable results (see Appendix H for full table). First, during the financial crisis, the GDP of the 28 EU countries has a significant negative effect on quarterly returns. A one-point increase in GDP has led, on average, to a decrease in quarterly returns of 0.1127% from one fund to the next. This result contrasts with the results obtained by Phalippou and Zollo (2005), who have demonstrated that non-listed real estate is procyclical. The negative effect may be explained by the reaction of the asset class to market shocks; as the overall economy improves after a drop, real estate is still recovering (Hoesli & Oikarinen, 2012; Yunus, et al., 2010). However, this possible explanation cannot be substantiated with the data. Second, while the constant during all regressions is not significant, it is highly significant in the open-end subset during the crisis. Lastly, while the effect of gearing is positive (and the quadratic effect negative) in all other subsets, the effect of gearing is negative (and the quadratic effect positive) after the subprime crisis. A possible explanation may be the surge in real estate investments after the crisis, especially in the last five years (INREV, 2019b). As a result, open-end funds have had more equity to invest in income-generating real estate properties, and the need to finance investments with debt is decreased. Again, this reasoning cannot be substantiated with the data.

5. CONCLUSION

This study investigates the effect of fund structure on the realized total return of non-listed real estate funds. The objective of this research is to determine whether (and how) the returns of closed-end non-listed real estate funds differ from their open-end counterparts. The research objective resulted in the central research question: *How does the open-end or closed-end fund structure influences the return of non-listed real estate funds?* A quantitative analysis is conducted to answer the central research question. The research uses an INREV panel dataset consisting of 563 unique funds, and contains of a total of 18,245 quarterly observations from the second quarter of 2000 to the second quarter of 2019.

The variables that potentially influence fund return are identified based on previous academic literature by answering the first sub-question: *What is the theoretical relationship between fund characteristics and return?* According to the literature, the critical differentiating factor at work for returns related to fund structure is liquidity. Closed-end funds are considered to be less liquid, whereas open-end funds provide more liquidity. The indicated structure-related return drivers are redemptions, capital commitments, marketable reserves, years until termination (closed-end funds only), and the structure itself. The indicated control variables are size, gearing, investment strategy, specialization in specific country or sector, fund age, vintage year, fund sequence, dividend payout, management expenditures, and the general (macro)economic environment.

Three estimation techniques are applied: the pooled OLS model (1), the between estimator model (2), and the RE model (3). The model is used to answer sub-question and sub-question 3. The sensitivity of results is tested in two ways: First, it is tested by dividing the dataset into open-end and closed-end subsets and then running all three estimation models. Second, it is tested by dividing the data into different periods (full period, before the financial crisis, during the financial crisis, and after the financial crisis) and running the between estimator model (2), which consistently produce the highest explanatory power through the research.

Four hypotheses are formulated to answer sub-question 2 (*How is the return of a non-listed real estate fund influenced by its finite or infinite nature?)*. For hypothesis 1, it is expected that closed-end funds produce higher returns than open-end funds. The present study finds no significant effect for the fund structure variable, meaning that the null hypothesis of no difference in returns is not rejected. For hypothesis 2, it is expected that higher levels of redemptions result in lower fund returns. The null hypothesis that higher redemption levels have no effect return is rejected for the full dataset due to a significant positive effect. Additionally, the study finds only during the subprime crisis redemptions have been leading to a significantly lower return. This effect is mainly observed in the closed-end subset. For hypothesis 3, it is expected that capital commitments negatively impact fund return. The null hypothesis that capital commitments have no effect on return is also rejected due to a significant positive effect. This effect is observed for open-end funds only. Lastly, in hypothesis 4, for closed-end funds it is expected that a more distant termination date leads to a higher fund return. The null hypothesis that that a more distant termination date has no effect on return is rejected for the full dataset. A significant positive effect of a more distant termination date is observed.

When answering sub-question three (*How do funds with different structure reacts to the same return driver?)*, some remarkable findings become clear. For both open-end and closed-end funds, age and a multi-country strategy negatively affect the return. Distributions positively influence the return of both structures for the full dataset. However, the second sensitivity check makes clear that only open-end fund returns have a significant positive reaction to yield distributions to shareholders (and this in only the case during times of economic prosperity). Furthermore, while only open-end funds interact significantly with macroeconomic driver GDP, closed-end funds underperformed during the subprime crisis. Both open-end and closed-end funds return react positively to higher gearing levels. However, this effect is more substantial for closed-end funds. The gearing effect on return is closely related to the economic environment: a positive effect is demonstrated during economic prosperity and a negative effect is observed during the subprime crisis. Lastly, for closed-end funds, size is a significant return driver. No significant effect of size is found for open-end funds.

6. DISCUSSION

The validity, limitations, and implications of this research are discussed in this chapter, and suggestions for further research are made. The validity of the research lies mostly in the applied dataset. There are some advantages and disadvantages to the INREV dataset. Funds included in the INREV Index are subject to the INREV Guidelines of Professional Standards (INREV, 2019c) in reporting their financial data. The guidelines are developed by INREV to accommodate the increased demand for standardized return measures and aim to improve the consistency of return reporting. The standardization increases the reliability of the data comparability between funds. Other advantages of the INREV database are that the included information is extensive, the dataset contains a large number of funds, and the values presented are based on market (appraisal) values and not based on book values (Pagliari Jr, et al., 2005). One critique of the INREV database is that funds report voluntarily, which may lead to a sampling problem known as survivorship bias (Pagliari Jr, 2016). Becoming part of the INREV Index may be more attractive for successful funds and less attractive for unsuccessful funds. Furthermore, the frequency of valuation is not standardized, and not all funds employ the same accounting standards (Pagliari Jr, et al., 2005; Phalippou & Gottschalg, 2008).

There are limits to the liquidity assumptions for fund structure. As mentioned in Chapter 2, open-end structures provide more liquidity than closed-end structures since investors may purchase or redeem shares from the fund as outlined in the contractual agreements. The exact legal structure determines the level of liquidity and differs from fund to fund. For example, legislation for open-end funds in Swiss funds differs from that covering open-end funds in Germany (as addressed by Bannier et al. (2007). There are examples of open-end funds that are able to postpone redemptions up to a year (Sebastian & Tyrell, 2006). Wiley (2014, p. 206) points out the practice in the mutual fund industry where high exit fees on open-end funds effectively “converts an open-end fund to a closed-end fund.” A similar pattern is observed with capital calls, as some closed-end funds have reported capital calls at a late stage in their life. As the dataset is anonymous, the contractual agreements of each fund cannot be identified. It can be concluded that determining the liquidity of a fund is not always straightforward. Open-end funds are not always wholly liquid, and closed-end funds are not always wholly illiquid.

As a result of these variations in liquidity, the points of departure in this research with regard to the variables of redemptions and capital commitments have been somewhat loose. Almost all redemption and capital commitment observations for closed-end funds are included in the regressions. Closed-end funds are sometimes obligated to meet redemptions during their lives. As for capital commitments, it is not reasonable to exclude observations because closed-end funds are open for commitments until the preset target value, which may take several years to reach. Additionally, some closed-end funds issue shares during their life. All redemption and capital call policies are outlined in each fund’s individual contractual legal framework. These frameworks, however, are not traceable due to the anonymity of the dataset. Therefore, estimators for these variables may include some bias. This potential limitation is addressed via the different sensitivity tests and by cleaning the dataset to remove obvious measurement errors.

Another point of discussion is the phenomenon of secondary trading, which exists for both open-end and closed-end funds. Secondary trading enhances the liquidity of non-listed funds for investors. In an open-end structure, secondary trading may prevent a fund from defaulting during a redemption run. It may also allow investors to avoid carrying a deadweight loss after default, since in practice only a minority of investors tend to redeem shares (Sebastian & Tyrell, 2006). In contrast, secondary trading in closed-end funds grants investors some liquidity within the illiquid closed-end structure. In practice, secondary trading opportunities remain very scarce (INREV, 2016; Lloyd, et al., 2016) and, in this study, are therefore not considered to influence return. Nevertheless, the phenomenon may influence the results of this research to some extent.

The main research implication is that the results contribute to the current debate in the real estate investment industry concerning whether open-end funds are a suitable format for illiquid assets such as real estate. None of the results show significant different returns between the two formats. Even during the severe economic conditions of the subprime crisis, overall open-end funds do not significantly underperform closed-end funds or vice versa. As a result, it cannot be unequivocally stated whether open-end formats are suitable for real estate or not: there appears to be no difference in performance. Recent examples of high redemption demands (e.g., during the Brexit process) show that the open-end format bears some long-run stability risk that may put the continuity of the fund under treat. A fund’s legal framework and contractual agreements can help to mitigate some of the risks. In summary, the suitability of an open-end format for illiquid assets as real estate can be considered fund-specific, and the answer also depends on individual investor or manager taste.

There are numerous interesting avenues for further research. First, an interesting topic for further research is the effect of fund structure on the return for investors, which can be measured by the dividend yield. Yield to investors can be modeled as the dependent variable, whereas this research has applied fund returns as the dependent variable. Second, it is interesting to more thoroughly investigate the effect of different market return variables or proxies in order to understand the behavior of non-listed real estate in relation to the macroeconomy (e.g., oil prices or several major stock indices). Third, a case study of several unique and non-anonymous open-end funds can be performed (following the example of Baum and Farrelly, 2009), in order to understand both open-end fund manager and investor behavior in the case of a run on redemptions. This approach helps to tackle the issue of the individual contractual agreements. For example, how do open-end real estate fund investors react on a worldwide crisis with large macroeconomic impact, such as the current Corona crisis or the past subprime crisis?

7. REFERENCES

Aarts, S. & Baum, A., 2016. Performance persistence in real estate private equity. *Journal of Property Research,* 33(3), pp. 236-251.

Alcock, J., Baum, A., Colley, N. & Steiner, E., 2013. The Role of Financial Leverage in the Performance of Private Equity Real Estate Funds. *The Journal of Portfolio Management,* 39(5), pp. 99-110.

Anderson, R. I., Krautz, S. & Rottke, N. B., 2016. Is real estate private equity real estate? - Dynamic interactions between real estate private equity funds, non-real estate private equity funds, and direct real estate investments. *Journal of Property Research,* 33(3), pp. 252-268.

Baltagi, B. H., 2015. *The Oxford Handbook of Panel Data.* 1st ed. Oxford: Oxford University Press.

Bannier, C. E., Fecht, F. & Tyrell, M., 2007. Open-end real estate funds in Germany - genesis and crisis. *Deutsche Bank Discussion Paper,* 2(4), pp. 1-26.

Baum, A. & Farrelly, K., 2009. Sources of Alpha and Beta in Property Funds. *Journal of European Real Estate Research,* 2(3), pp. 218-234.

Bers, M. K. & Madura, J., 2000. The Performance Persistence of Closed-End Funds. *The Financial Review,* 35(3), pp. 33-52.

Bond, S. a. & Mitchell, P., 2010. Alpha and Persistence in Real Estate Fund Performance. *The Journal of Real Estate Finance and Economics,* 31(1), pp. 53-79.

Brooks, C., 2008. *Introductory Econometrics for Finance.* 2nd ed. Cambridge: Cambride University Press.

Brooks, C. & Tsolacos, S., 2010. *Real Estate Modelling and Forecasting.* 1st ed. Cambridge: Cambridge University Press.

Brounen, D., Op 't Veld, H. & Raitio, V., 2007. Transparency in the European Non-listed Real Estate Funds Market. *Journal of Real Estate Portfolio Management,* 13(2), pp. 107-117.

Brounen, D., Eichholtz, P. & Ling, D. C., 2007. Trading Intensity and Real Estate Performance. *The Journal of Real Estate Finance and Economics,* 35(4), pp. 449-474.

Cameron, A. C. & Trivedi, P. K., 2009. *Microeconomics Using Stata.* 1st ed. Texas: Stata Press.

Case, B., 2015. What Have 25 Years of Performance Data Taught Us About Private Equity Real Estate?. *The Journal of Real Estate Portfolio Management,* 21(1), pp. 1-20.

Chaudhry, M., Maheshwari, S. & Webb, J., 2004. REITs and Idiosyncratic Risk. *Journal of Real Estate Research,* 26(2), pp. 207-222.

Chen, J., Hong, H., Huang, M. & Kubik, J. D., 2004. Does Fund Size Erode Mutual Fund Performance? The Role of Liquidity and Organization. *The American Economic Review,* 94(5), pp. 1276-1302.

Citywire, 2019a. *Brexit Meltdown: are property trusts better than funds?.* [Online] Available at: https://citywire.co.uk/wealth-manager/news/brexit-meltdown-are-property-trusts-better-than-funds/a1199093/ [Accessed 9 July 2019].

Citywire, 2019b. *Is the end nigh for open-ended property funds?.* [Online] Available at: https://citywire.co.uk/wealth-manager/news/is-the-end-nigh-for-open-ended-property-funds/a1246799/ [Accessed 9 July 2019].

Delfim, J. C. & Hoesli, M., 2016. Risk factors of European non-listed real estate fund returns. *Journal of Property Research,* 33(3), pp. 190-213.

Eurostat, 2019. *GDP and main components (output, expenditure and income).* [Online] Available at: https://appsso.eurostat.ec.europa.eu/nui/ [Accessed 11 December 2019].

Farrelly, K. & Stevenson, S., 2016. Performance drivers of private real estate funds. *Journal of Property Research,* 33(3), pp. 214-235.

Financial Times, 2019. Blackstone leads global surge in property investment. *Financial Times*, 22 May.

Fisher, L. M. & Hartzell, D. J., 2016. Class Differences in Real Estate Private Equity Fund Performance. *The Journal of Real Estate Finance and Economics,* 52(4), pp. 327-346.

Franzoni, F., Nowak, E. & Phalippou, L., 2012. Private Equity Performance and Liquidity Risk. *The Journal of Finance,* 67(6), pp. 2341-2373.

Fuerst, F., Lim, W. & Matysiak, G., 2014. *Private equity real estate: Asymmetric effects of gearing and drivers of performance.* [Online] Available at: http://dx.doi.org/10.2139/ssrn.2519794 [Accessed 29 June 2019].

Fuerst, F. & Matysiak, G., 2013. Analysing the performance of nonlisted real estate funds: a panel data analysis. *Applied Economics,* 45(14), pp. 1777-1788.

Glenn, B. J. & Patrick, T., 2004. The Mechanics Behind Investment Funds: Why Closed-end Funds Provide Superior Returns. *Managerial Finance,* 30(12), pp. 86-102.

Hahn, T. C., Geltner, D. & Gerardo-Lietz, N., 2005. Real Estate Opportunity Funds. *The Journal of Portfolio Management,* 31(5), pp. 143-153.

Harris, R. S., Jenkinson, T. & Kaplan, S. N., 2014. Private Equity Performance: What Do We Know?. *The Journal of Finance,* 69(5), pp. 1851-1882.

Hoesli, M. & Oikarinen, E., 2012. Are REITs real estate? Evidence from international sector level data. *Journal of International Money and Finance,* 31(7), pp. 1823-1850.

Hsiao, C., 2007. Panel data analysis - advantages and challenges. *TEST,* 16(1), pp. 1-22.

INREV, 2016. *Secondary Trading and Liquidity Study,* Amsterdam: INREV Research.

INREV, 2019a. *INREV Quarterly Index.* [Online] Available at: https://www.inrev.org/library/inrev-quarterly-index/ [Accessed 11 December 2019].

INREV, 2019b. *Top global real estate manager scores industry first with AUM in excess of €200 billion.* [Online] Available at: https://www.inrev.org/news/press/top-global-real-estate-manager-scores-industry-first-aum-excess-eu200-billion/ [Accessed 9 July 2019].

INREV, 2019c. *INREV professional guidelines.* [Online]Available at: https://www.inrev.org/guidelines/ [Accessed 3 October 2019].

INREV, 2019d. *Global Definitions Database (GDD).* [Online] Available at: https://www.inrev.org/definitions/EN/all/ [Accessed 7 July 2019].

KanAm Grund, 2015. *Open-Ended Real Estate Funds in Liquidation - The Investors View,* Frankfurt am Main: KanAm Grund Real Estate Asset Management GmbH & Co. KG.

Kandel, E., Leshchinskii, D. & Yuklea, H., 2011. VC Funds: Aging Brings Myopia. *Journal of Financial and Quantitative Analysis,* 46(2), pp. 431-457.

Kaplan, S. N. & Schoar, A., 2005. Private Equity Performance: Returns, Persistence, and Capital Flows. *The journal of Finance,* 60(4), pp. 1791-1823.

Katchova, A., 2013. *The Econometrics Academy: Panel Data Models.* [Online] Available at: https://sites.google.com/site/econometricsacademy/econometrics-models/panel-data-models/ [Accessed 8 December 2019].

Lloyd, D. et al., 2016. *End of Fund Life Project: End of Fund Life Report,* London: INREV, AREF & Investment Property Forum.

Maurer, R., Reiner, F. & Rogalla, R., 2004. Return and risk of German open-end real estate funds. *Journal of Property Research,* 21(3), pp. 209-233.

McManus, P. A., 2011. *Introduction to Regression Models for Panel Data Analysis.* [Online] Available at: https://ssrc.indiana.edu/doc/wimdocs/2011-10-07_mcmanus_panel_slides.pdf [Accessed 21 December 2019].

OECD, 2019. *Long-term interest rates.* [Online] Available at: https://data.oecd.org/interest/long-term-interest-rates.htm [Accessed 11 December 2019].

Pagliari Jr, J. L., 2016. Real Estate Returns by Strategy: Have Value-Added and Opportunistic Funds Pulled Their Weight?. *Real Estate Economics,* 2017(1), pp. 1-46.

Pagliari Jr, J. L., Scherer, K. A. & Monopoli, R. T., 2005. Public Versus Private Real Estate Equities: A More Refined, Long-Term Comparison. *Real Estate Economics,* 33(1), pp. 147-187.

Patel, R. C. & Olsen, R. A., 1984. Financial Determinants of Systematic Risk in Real Estate Investment Trusts. *Journal of Business Research,* 12(4), pp. 481-491.

PERE, 2019. *Bespoke open-ended funds offer control over diversification.* [Online] Available at: https://www.perenews.com/single-asset-open-funds-offer-control-over-investment-diversification/ [Accessed 9 July 2019].

Phalippou, L. & Gottschalg, O., 2008. The Performance of Private Equity Funds. *The Review of Financial Studies,* 22(4), pp. 1747-1776.

Phalippou, L. & Zollo, M., 2005. *What drives private equity fund performance?.* 1st ed. Amsterdam: University of Amsterdam.

Ro, S. & Ziobrowski, A. J., 2011. Does Focus Really Matter? Specialized vs. Diversified REITs. *The Journal of Real Estate Finance and Economics,* 42(1), pp. 68-83.

Schober, P., Boer, C. & Schwarte, L., 2018. Correlation Coefficients: Appropriate Use and Interpretation. *Anasthesia & Analgesia,* 126(5), pp. 1-34.

Sebastian, S. & Tyrell, M., 2006. Open-End Real Estate Funds: Danger or Diamond?. *Working paper series: Finance & Accounting. Fachbereich Wirtschaftswissenschaften. Johann Wolfgang Goethe-Universität Frankfurt am Main,* Issue no. 168, pp. 1-34.

Tomperi, I., 2010. Performance of private equity real estate funds. *Journal of European Real Estate Research,* 3(2), pp. 96-116.

Torres-Reyna, O., 2007. *Panel Data Analysis Fixed and Random Effects using Stata (v. 4.2).* [Online] Available at: https://www.princeton.edu/~otorres/Panel101.pdf [Accessed 21 December 2019].

van den Heuvel, T. & Morawski, J., 2013. Performance drivers of German institutional property funds. *Journal of Property Investment & Finance,* 32(2), pp. 154-167.

Wiley, J. A., 2014. Illiquidity Risk in Non-Listed Funds: Evidence from REIT Fund Exits and Redemption Suspensions. *The Journal of Real Estate Finance and Economics,* 2014(49), pp. 205-236.

Williams, R., 2020. *Heteroskedasticity.* [Online] Available at: https://www3.nd.edu/~rwilliam/stats2/l25.pdf [Accessed 20 February 2020].

Wooldridge, J. M., 2010. *Econometric Analysis of Cross Section and Panel Data.* 1st ed. Cambridge: The MIT Press.

Yunus, N., Hansz, J. A. & Kennedy, P. J., 2010. Dynamic Interactions Between Private and Public Real Estate Markets: Some International Evidence. *The Journal of Real Estate Finance and Economics,* 45(4), pp. 1021-1040.

8. APPENDIXES

Appendix A: expected effect all variables

Variables for fund return	Specification	Hypothesized effect on return
Fund structure[1]	Closed-end	Positive
Fund structure[1]	Open-end	Negative
Redemptions[1]	Higher	Negative
Capital inflows[1]	Higher	Negative
Marketable reserves[12]	Higher	Negative
Years until termination[1]	More years	Positive
Fund size	Larger	Positive
Gearing	Higher	Positive
Defined strategy	Core funds	Positive
Geographic specialization	Specialized funds	Positive
Sector specialization	Specialized funds	Positive
Age	Older funds	Negative
Vintage year	Recession	Positive
Yield distributions	Higher	Positive
Macroeconomic development	Prosperity	Positive
Management expenditures[2]	Higher	Negative
Fund sequence[2]	More predecessors	Negative

[1]Factors denoted with one are considered to be structure-related variables
[2]Factors denoted with two are exempt from this research due to data constraints or high correlation with other variables

Appendix B: Number of observations in database, before preparation

Year of reporting	No. Funds included in the database			Observation by fund structure		
	Closed-end	Open-end	Total	Closed-end	Open-end	Total
2000	4	22	26	12	65	77
2001	8	32	40	31	126	157
2002	13	38	51	52	153	205
2003	16	44	60	64	174	238
2004	21	53	74	83	211	294
2005	32	61	93	128	245	373
2006	51	75	126	204	301	505
2007	68	102	170	272	406	678
2008	86	113	199	342	453	795
2009	113	130	243	452	519	971
2010	150	174	324	600	695	1.295
2011	166	182	348	663	727	1.390
2012	168	193	361	672	771	1.443
2013	179	206	385	717	825	1.542
2014	175	213	388	699	852	1.551
2015	175	215	390	696	859	1.555
2016	169	215	384	671	861	1.532
2017	158	220	378	628	881	1.509
2018	144	226	370	573	903	1.476
2019	127	229	356	228	431	659
Total	**258**	**305**	**563**	**7.787**	**10.458**	**18.245**

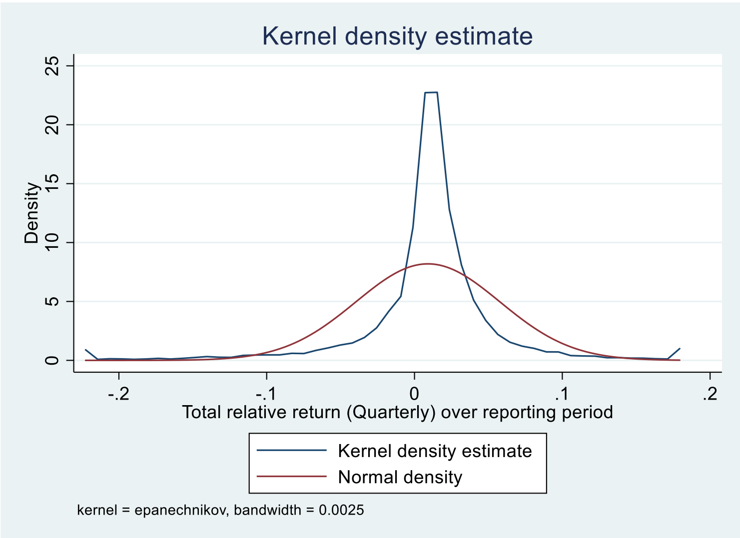
Appendix C: Data preparation process

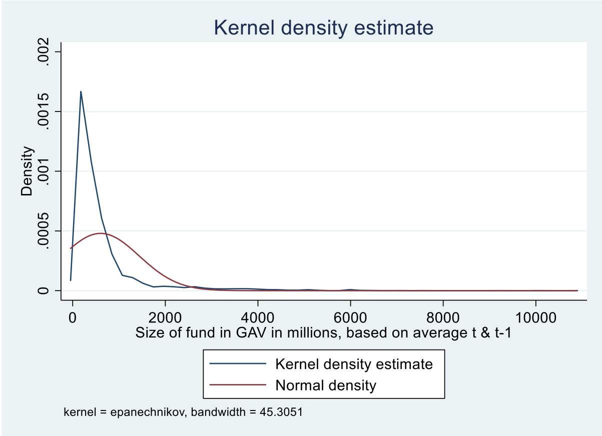
.do file, separately submitted

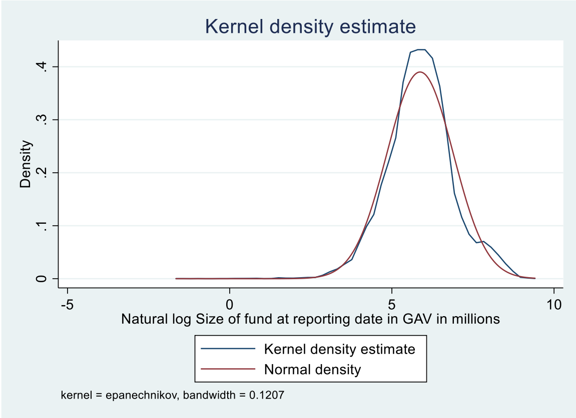
Appendix D: Linear Regression assumptions

Table 1: Assumptions concerning disturbance terms and their interpretation (Brooks & Tsolacos, 2010)

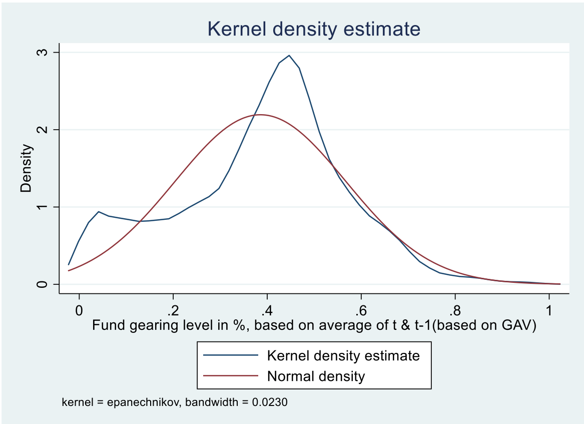
Assumption	Notation	Explanation
1	$E(u_t) = 0$	Average value of errors is zero
2	$var(u_t) = \sigma^2 < \infty$	The variance of the errors is constant and finite over all values of x_t #2 is the assumption of assumption of **homoscedasticity**. If violated there is **heteroscedasticity**. White's Test on residuals to detect. Solution is transformation (eg in log)
3	$cov(u_i, u_j) = 0$	The errors are statistically independent (uncorrelated) of one another. If so it is called **autocorrelation**. Durbin Watson Test on residuals (first autocorrelation)
4	$cov(u_t, x_t) = 0$	There is no relationship between the error and corresponding x variable
5	$u_t \sim N(0, \sigma^2)$	u_t is normally distributed
Multicollinearity		explanatory variables are not correlated with one another.

Distribution of dependent and indepent variables is observed via Stata function *.kdensity* (blue lines). A normality line is added to the function (red lines).	
	
Independent variables	
Fund size	Ln Fund size


Kernel density estimate
Density
0
.0005
.001
.0015
.002
0
2000
4000
6000
8000
10000
Size of fund in GAV in millions, based on average t & t-1
Kernel density estimate
Normal density
kernel = epanechnikov, bandwidth = 45.3051


Kernel density estimate
Density
0
.1
.2
.3
.4
-5
0
5
10
Natural log Size of fund at reporting date in GAV in millions
Kernel density estimate
Normal density
kernel = epanechnikov, bandwidth = 0.1207

Gearing


Kernel density estimate
Density
0
1
2
3
0
.2
.4
.6
.8
1
Fund gearing level in %, based on average of t & t-1(based on GAV)
Kernel density estimate
Normal density
kernel = epanechnikov, bandwidth = 0.0230

By using the STATA function *correlate* the data has been checked for multicollinearity. Interpretation of the correlations: negligible correlation if $0 \leq r \leq 0.1$, weak correlation if $0.1 \leq r \leq 0.39$, moderate correlation if $0.40 \leq r \leq 0.69$, strong correlation if $0.7 \leq r \leq 0.89$ and very strong correlation if $0.9 \leq r \leq 1.0$ (Schober, et al., 2018).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
(1) Return	1.00																							
(2) ClosedEndFund	-0.06	1.00																						
(3) Redemptions	0.05	0.03	1.00																					
(4) CapitalCalls	0.03	-0.02	0.01	1.00																				
(5) CashReserve	-0.16	0.41	-0.01	0.01	1.00																			
(6) LnFundSize	0.04	-0.10	-0.05	-0.14	-0.08	1.00																		
(7) LnFundSizeSq	0.04	-0.10	-0.05	-0.13	-0.09	**0.99**	1.00																	
(8) SmallMedFund	0.01	0.00	0.00	-0.03	0.01	-0.01	-0.06	1.00																
(9) LargeMedFund	0.00	0.01	-0.01	-0.07	0.06	0.33	0.30	-0.35	1.00															
(10) LargeFund	0.03	-0.09	-0.03	-0.05	-0.13	0.65	**0.72**	-0.25	-0.21	1.00														
(11) Gearing	-0.12	0.39	-0.04	0.03	**0.88**	-0.16	-0.18	0.02	0.02	-0.19	1.00													
(12) GearingSq	-0.17	0.40	-0.04	0.01	**0.84**	-0.14	-0.15	-0.00	0.03	-0.17	**0.95**	1.00												
(13) Strategy	-0.08	0.42	0.03	0.02	0.33	-0.11	-0.12	-0.04	0.03	-0.12	0.35	0.38	1.00											
(14) MultiCountry	-0.07	0.06	0.03	0.06	0.12	0.03	0.03	0.00	0.08	-0.03	0.14	0.11	0.03	1.00										
(15) MultiSector	-0.03	-0.11	0.00	0.05	-0.03	-0.03	-0.03	0.02	0.06	-0.07	-0.05	-0.04	0.05	0.21	1.00									
(16) FundAge	0.01	-0.22	0.04	-0.21	-0.33	0.35	0.36	-0.06	0.11	0.27	-0.38	-0.30	-0.16	-0.11	0.10	1.00								
(17) FundAgeSq	0.02	-0.19	0.01	-0.10	-0.29	0.26	0.27	-0.09	0.08	0.23	-0.33	-0.25	-0.13	-0.11	0.14	**0.90**	1.00							
(18) FundAgeMax2	0.03	0.05	-0.04	0.34	0.10	-0.28	-0.26	-0.07	-0.12	-0.11	0.11	0.08	0.03	0.03	0.02	-0.43	-0.18	1.00						
(19) FundAgeMax3	0.02	0.07	-0.05	0.31	0.12	-0.28	-0.27	-0.06	-0.11	-0.13	0.13	0.11	0.05	0.03	0.02	-0.51	-0.24	**0.76**	1.00					
(20) CrisisVintage	-0.06	0.10	-0.00	0.00	0.15	-0.10	-0.09	-0.05	-0.03	-0.04	0.17	0.17	0.05	-0.00	-0.07	-0.14	-0.12	0.00	0.02	1.00				
(21) Distributions	0.08	0.00	0.07	-0.02	0.00	-0.00	-0.01	0.03	-0.00	-0.02	-0.01	-0.03	-0.02	-0.03	-0.02	0.01	0.00	-0.03	-0.02	-0.02	1.00			
(22) MarketReturn	0.34	-0.07	0.04	0.01	-0.14	-0.00	0.00	0.01	-0.04	0.02	-0.10	-0.12	-0.05	0.00	-0.00	0.09	0.05	-0.07	-0.09	-0.06	0.02	1.00		
(23) GDPEU28	0.10	-0.11	0.04	-0.04	-0.19	0.04	0.05	0.01	0.01	0.03	-0.11	-0.15	-0.11	0.06	0.04	0.16	0.08	-0.10	-0.13	-0.02	0.03	0.22	1.00	
(24) RiskFreeRate	-0.08	0.09	-0.05	0.10	0.18	-0.01	-0.01	-0.02	0.01	-0.00	0.10	0.13	0.10	-0.05	-0.02	-0.20	-0.09	0.18	0.23	-0.04	-0.02	-0.33	**-0.80**	1.00

Appendix E: Summary statistics

Explanation of variables

Table 10: Explanation of variables

Variable	Variable name	Type of variable	Between or within variation pattern
Index var.	FundID	time-invariant	Within variation = 0
Time var.	Year and quarter	individual-invariant	Higher between variation; Non-zero between variation*
Dep. var.	Total return	time and individual varying	Higher within variation
Indep. var. β_1	FundStructure	time-invariant	Within variation = 0
Indep. var. δ_1	Redemptions	time and individual varying	Higher within variation
Indep. var. δ_2	CapitalCalls	time and individual varying	Higher within variation
Indep. var. δ_3	Years to termination	time and individual varying	Higher between variation
Control var. θ_1	LnFundSize	time and individual varying	Higher between variation
Control var. θ_2	LnFundSizeSq	time and individual varying	Higher between variation
Control var. θ_3	SmallMediumFund	time and individual varying	Almost equal variation
Control var. θ_4	LargeMediumFund	time and individual varying	Almost equal variation
Control var. θ_5	LargeFund	time and individual varying	Almost equal variation
Control var. θ_6	Gearing	time and individual varying	Higher between variation
Control var. θ_7	GearingSq	time and individual varying	Higher between variation
Control var. θ_8	Strategy	time-invariant	Within variation = 0
Control var. θ_9	MultiCountry	time-invariant	Within variation = 0
Control var. θ_{10}	MultiSector	time-invariant	Within variation = 0
Control var. θ_{11}	FundAge	time and individual varying	Higher between variation
Control var. θ_{12}	FundAgeSq	time and individual varying	Higher between variation
Control var. θ_{13}	FundAgeMax2	time and individual varying	Almost equal variation
Control var. θ_{14}	FundAgeMax3	time and individual varying	Almost equal variation
Control var. θ_{15}	CrisisVintage	time-invariant	Within variation = 0
Control var. θ_{16}	Distributions	time and individual varying	Higher within variation
Control var. θ_{17}	MarketReturn	individual-invariant	Higher within variation; Non-zero between variation*
Control var. θ_{18}	GDP EU28	individual-invariant	Higher within variation; Non-zero between variation*

**individual invariant variables are expected to have zero between variation, since at time T all observations are equal. The data is manually checked after this observation. Nonetheless, a Non-zero between variation is observed.*

Panel summary statistics, full dataset, Stata function xtsum

Table 11: Panel summary statistics, full dataset

Variable	Variation	Mean	Std.Dev.	Min	Max	Observations		
FundID	overall	277.572	163.813	1	563	N	=	13,125
	between		163.416	1	563	n	=	550
	within		0	277.572	277.572	T-bar	=	23.864
YrQ2	overall	211.007	16.383	161	237	N	=	13,125
	between		13.451	161	237	n	=	550
	within		11.987	146.007	250.562	T-bar	=	23.864
Return	overall	0.009	0.049	-0.220	0.177	N	=	13,125
	between		0.023	-0.144	0.112	n	=	550
	within		0.045	-0.231	0.308	T-bar	=	23.864
ClosedEndFund	overall	0.443	0.497	0	1	N	=	13,125
	between		0.499	0	1	n	=	550

	within		0	0.443	0.443	T-bar	=	23.864
Redemptions	overall	0.011	0.059	0	0.999	N	=	13,125
	between		0.034	0	0.495	n	=	550
	within		0.056	-0.484	0.954	T-bar	=	23.864
CapitapitalCalls	overall	0.039	0.113	0	0.996	N	=	13,125
	between		0.063	0	0.555	n	=	550
	within		0.106	-0.391	1.008	T-bar	=	23.864
YearsToTermination	overall	5.394	4.160	0	30	N	=	5,303
	between		3.141	0	24.762	n	=	230
	within		2.603	-4.229	14.771	T-bar	=	23.056
LnFundSize	overall	5.872	1.017	0.057	9.292	N	=	12,657
	between		1.002	0.633	8.436	n	=	517
	within		0.446	0.717	7.751	T-bar	=	24.482
LnFundSizeSq	overall	35.510	12.030	0.003	86.343	N	=	12,657
	between		10.982	0.401	71.172	n	=	517
	within		4.951	-3.704	62.144	T-bar	=	24.482
SmallMediumFund	overall	0.285	0.452	0	1	N	=	13,125
	between		0.310	0	1	n	=	550
	within		0.343	-0.691	1.272	T-bar	=	23.864
LargeMediumFund	overall	0.218	0.413	0	1	N	=	13,125
	between		0.286	0	1	n	=	550
	within		0.292	-0.759	1.198	T-bar	=	23.864
LargeFund	overall	0.123	0.329	0	1	N	=	13,125
	between		0.247	0	1	n	=	550
	within		0.154	-0.863	1.103	T-bar	=	23.864
Gearing	overall	0.386	0.182	0.000	1	N	=	12,486
	between		0.180	0.001	0.893	n	=	509
	within		0.073	-0.076	0.834	T-bar	=	24.530
GearingSq	overall	0.182	0.141	0.000	1	N	=	12,486
	between		0.136	0.000	0.798	n	=	509
	within		0.061	-0.268	0.726	T-bar	=	24.530
Strategy	overall	0.262	0.440	0	1	N	=	13,125
	between		0.452	0	1	n	=	550
	within		0	0.262	0.262	T-bar	=	23.864
MultiCountry	overall	0.497	0.500	0	1	N	=	13,125
	between		0.499	0	1	n	=	550
	within		0	0.497	0.497	T-bar	=	23.864
MultiSector	overall	0.470	0.499	0	1	N	=	13,125
	between		0.500	0	1	n	=	550
	within		0	0.470	0.470	T-bar	=	23.864
FundAge	overall	7.141	6.445	0	52	N	=	13,125
	between		6.071	0	49.133	n	=	550
	within		3.005	-9.002	16.764	T-bar	=	23.864
FundAgeSq	overall	92.531	231.788	0	2704	N	=	13,125
	between		223.371	0	2433.667	n	=	550
	within		70.545	-1252.136	873.372	T-bar	=	23.864
FundAgeMax2	overall	0.200	0.400	0	1	N	=	13,125
	between		0.330	0	1	n	=	550
	within		0.345	-0.717	1.178	T-bar	=	23.864
FundAgeMax3	overall	0.294	0.455	0	1	N	=	13,125

	between		0.360	0	1	n	=	550
	within		0.381	-0.635	1.272	T-bar	=	23.864
CrisisVintage	overall	0.175	0.380	0	1	N	=	13,125
	between		0.365	0	1	n	=	550
	within		0	0.175	0.175	T-bar	=	23.864
Distributions	overall	0.010	0.022	0	0.809	N	=	13,125
	between		0.007	0	0.079	n	=	550
	within		0.021	-0.069	0.740	T-bar	=	23.864
MarketReturn	overall	0.011	0.018	-0.081	0.050	N	=	13,125
	between		0.008	-0.041	0.050	n	=	550
	within		0.018	-0.085	0.060	T-bar	=	23.864
GDPEU28	overall	103.733	5.456	87	114.600	N	=	13,125
	between		4.860	87	114.600	n	=	550
	within		4.060	80.918	118.423	T-bar	=	23.864

Panel summary statistics open-end funds, Stata function xtsum

Table 12: Panel summary statistics open-end funds,

Variable	Variation	Mean	Std.Dev.	Min	Max	Observations		
FundID	overall	265.872	168.046	1	563	N	=	7,305
	between		169.072	1	563	n	=	298
	within		0	265.872	265.872	T-bar	=	24.513
YrQ2	overall	212.172	17.162	161	237	N	=	7,305
	between		13.799	161	237	n	=	298
	within		12.999	147.172	251.727	T-bar	=	24.513
Return	overall	0.012	0.036	-0.220	0.177	N	=	7,305
	between		0.017	-0.105	0.111	n	=	298
	within		0.034	-0.228	0.194	T-bar	=	24.513
ClosedEndFund	overall	0	0	0	0	N	=	7,305
	between		0	0	0	n	=	298
	within		0	0	0	T-bar	=	24.513
Redemptions	overall	0.009	0.055	0	0.999	N	=	7,305
	between		0.036	0	0.495	n	=	298
	within		0.053	-0.485	0.953	T-bar	=	24.513
CapitapitalCalls	overall	0.041	0.110	0	0.987	N	=	7,305
	between		0.065	0	0.555	n	=	298
	within		0.103	-0.389	0.970	T-bar	=	24.513
YearsToTermination	overall	.	.	.	.	N	=	0
	between		.	.	.	n	=	0
	within		.	.	.	T	=	.
LnFundSize	overall	5.956	1.038	0.348	9.292	N	=	7,055
	between		1.080	0.633	8.414	n	=	274
	within		0.474	2.891	7.749	T-bar	=	25.748
LnFundSizeSq	overall	36.549	12.561	0.121	86.343	N	=	7,055
	between		11.747	0.401	70.842	n	=	274
	within		5.430	7.573	62.074	T-bar	=	25.748
SmallMediumFund	overall	0.284	0.451	0	1	N	=	7,305
	between		0.312	0	1	n	=	298
	within		0.345	-0.690	1.244	T-bar	=	24.513

LargeMediumFund	overall	0.212	0.409	0	1	N	=	7,305
	between		0.271	0	1	n	=	298
	within		0.293	-0.760	1.192	T-bar	=	24.513
LargeFund	overall	0.148	0.355	0	1	N	=	7,305
	between		0.278	0	1	n	=	298
	within		0.166	-0.838	1.128	T-bar	=	24.513
Gearing	overall	0.322	0.166	0.001	0.860	N	=	6,927
	between		0.162	0.001	0.759	n	=	267
	within		0.071	-0.068	0.732	T-bar	=	25.944
GearingSq	overall	0.132	0.105	0.000	0.740	N	=	6,927
	between		0.094	0.000	0.583	n	=	267
	within		0.049	-0.188	0.498	T-bar	=	25.944
Strategy	overall	0.094	0.292	0	1	N	=	7,305
	between		0.256	0	1	n	=	298
	within		0	0.094	0.094	T-bar	=	24.513
MultiCountry	overall	0.471	0.499	0	1	N	=	7,305
	between		0.493	0	1	n	=	298
	within		0	0.471	0.471	T-bar	=	24.513
MultiSector	overall	0.522	0.500	0	1	N	=	7,305
	between		0.501	0	1	n	=	298
	within		0	0.522	0.522	T-bar	=	24.513
FundAge	overall	8.399	7.800	0	52	N	=	7,305
	between		7.698	0	49.133	n	=	298
	within		3.260	-7.744	18.023	T-bar	=	24.513
FundAgeSq	overall	131.373	301.480	0	2704	N	=	7,305
	between		296.653	0	2433.667	n	=	298
	within		88.029	-1213.294	912.214	T-bar	=	24.513
FundAgeMax2	overall	0.182	0.386	0	1	N	=	7,305
	between		0.345	0	1	n	=	298
	within		0.326	-0.735	1.160	T-bar	=	24.513
FundAgeMax3	overall	0.265	0.441	0	1	N	=	7,305
	between		0.377	0	1	n	=	298
	within		0.361	-0.664	1.244	T-bar	=	24.513
CrisisVintage	overall	0.140	0.347	0	1	N	=	7,305
	between		0.334	0	1	n	=	298
	within		0	0.140	0.140	T-bar	=	24.513
Distributions	overall	0.010	0.016	0	0.245	N	=	7,305
	between		0.005	0	0.023	n	=	298
	within		0.015	-0.013	0.238	T-bar	=	24.513
MarketReturn	overall	0.012	0.018	-0.081	0.050	N	=	7,305
	between		0.008	-0.041	0.037	n	=	298
	within		0.017	-0.084	0.061	T-bar	=	24.513
GDPEU28	overall	104.220	5.798	87	114.600	N	=	7,305
	between		4.975	87	114.600	n	=	298
	within		4.481	81.406	118.910	T-bar	=	24.513

Panel summary statistics closed-end funds, Stata function xtsum

Table 13: Panel summary statistics closed-end funds

Variable	Variation	Mean	Std.Dev.	Min	Max	Observations		
FundID	overall	292.257	157.125	3	561	N	=	5,820
	between		156.373	3	561	n	=	252
	within		0	292.257	292.257	T-bar	=	23.095
YrQ2	overall	209.544	15.225	161	237	N	=	5,820
	between		12.857	168	237	n	=	252
	within		10.582	171.544	247.544	T-bar	=	23.095
Return	overall	0.006	0.061	-0.220	0.177	N	=	5,820
	between		0.029	-0.144	0.112	n	=	252
	within		0.057	-0.234	0.305	T-bar	=	23.095
ClosedEndFund	overall	1	0	1	1	N	=	5,820
	between		0	1	1	n	=	252
	within		0	1	1	T-bar	=	23.095
Redemptions	overall	0.013	0.064	0	0.981	N	=	5,820
	between		0.032	0	0.410	n	=	252
	within		0.060	-0.397	0.952	T-bar	=	23.095
CapitalCalls	overall	0.036	0.116	0	0.996	N	=	5,820
	between		0.062	0	0.504	n	=	252
	within		0.109	-0.236	1.005	T-bar	=	23.095
YearsToTermination	overall	5.394	4.160	0	30	N	=	5,303
	between		3.141	0	24.762	n	=	230
	within		2.603	-4.229	14.771	T-bar	=	23.056
LnFundSize	overall	5.765	0.981	0.057	8.582	N	=	5,602
	between		0.904	2.197	8.436	n	=	243
	within		0.407	0.611	7.645	T-bar	=	23.053
LnFundSizeSq	overall	34.201	11.191	0.003	73.644	N	=	5,602
	between		10.007	6.032	71.172	n	=	243
	within		4.272	-5.013	60.835	T-bar	=	23.053
SmallMediumFund	overall	0.287	0.453	0	1	N	=	5,820
	between		0.307	0	1	n	=	252
	within		0.341	-0.689	1.274	T-bar	=	23.095
LargeMediumFund	overall	0.224	0.417	0	1	N	=	5,820
	between		0.301	0	1	n	=	252
	within		0.291	-0.753	1.202	T-bar	=	23.095
LargeFund	overall	0.092	0.289	0	1	N	=	5,820
	between		0.201	0	0.986	n	=	252
	within		0.138	-0.894	1.042	T-bar	=	23.095
Gearing	overall	0.464	0.169	0.000	1	N	=	5,559
	between		0.166	0.004	0.893	n	=	242
	within		0.076	0.002	0.913	T-bar	=	22.971
GearingSq	overall	0.244	0.154	0.000	1	N	=	5,559
	between		0.148	0.000	0.798	n	=	242
	within		0.073	-0.205	0.788	T-bar	=	22.971
Strategy	overall	0.472	0.499	0	1	N	=	5,820
	between		0.499	0	1	n	=	252
	within		0	0.472	0.472	T-bar	=	23.095
MultiCountry	overall	0.530	0.499	0	1	N	=	5,820

	between		0.500	0	1	n	=	252
	within		0	0.530	0.530	T-bar	=	23.095
MultiSector	overall	0.405	0.491	0	1	N	=	5,820
	between		0.496	0	1	n	=	252
	within		0	0.405	0.405	T-bar	=	23.095
FundAge	overall	5.561	3.585	0	20	N	=	5,820
	between		2.752	0	16.750	n	=	252
	within		2.652	-3.816	15.184	T-bar	=	23.095
FundAgeSq	overall	43.778	53.058	0	400	N	=	5,820
	between		36.612	0	285.500	n	=	252
	within		38.694	-122.062	285.843	T-bar	=	23.095
FundAgeMax2	overall	0.223	0.416	0	1	N	=	5,820
	between		0.311	0	1	n	=	252
	within		0.367	-0.694	1.192	T-bar	=	23.095
FundAgeMax3	overall	0.330	0.470	0	1	N	=	5,820
	between		0.340	0	1	n	=	252
	within		0.404	-0.559	1.281	T-bar	=	23.095
CrisisVintage	overall	0.220	0.414	0	1	N	=	5,820
	between		0.397	0	1	n	=	252
	within		0	0.220	0.220	T-bar	=	23.095
Distributions	overall	0.010	0.028	0	0.809	N	=	5,820
	between		0.009	0	0.079	n	=	252
	within		0.027	-0.069	0.740	T-bar	=	23.095
MarketReturn	overall	0.010	0.019	-0.081	0.050	N	=	5,820
	between		0.007	-0.014	0.050	n	=	252
	within		0.018	-0.085	0.059	T-bar	=	23.095
GDPEU28	overall	103.121	4.927	87	114.600	N	=	5,820
	between		4.607	89.600	114.600	n	=	252
	within		3.460	89.820	117.419	T-bar	=	23.095

Non-panel summary statistics, full sample, Stata function sum

Table 14: Non-panel summary statistics, full sample

Variable	Obs	Mean	Std.Dev.	Min	Max
FundID	13,125	277.572	163.813	1	563
YrQ2	13,125	211.007	16.383	161	237
Return	13,125	.009	.049	-.22	.177
ClosedEndFund	13,125	.443	.497	0	1
Redemptions	13,125	.011	.059	0	.999
CapitalCalls	13,125	.039	.113	0	.996
YearsToTermination	5,303	5.394	4.16	0	30
LnFundSize	12,657	5.872	1.017	.057	9.292
LnFundSizeSq	12,657	35.51	12.03	.003	86.343
SmallMediumFund	13,125	.285	.452	0	1
LargeMediumFund	13,125	.218	.413	0	1
LargeFund	13,125	.123	.329	0	1
Gearing	12,486	.386	.182	0	1
GearingSq	12,486	.182	.141	0	1
Strategy	13,125	.262	.44	0	1
MultiCountry	13,125	.497	.5	0	1
MultiSector	13,125	.47	.499	0	1
FundAge	13,125	7.141	6.445	0	52
FundAgeSq	13,125	92.531	231.788	0	2704
FundAgeMax2	13,125	.2	.4	0	1
FundAgeMax3	13,125	.294	.455	0	1
CrisisVintage	13,125	.175	.38	0	1
Distributions	13,125	.01	.022	0	.809
MarketReturn	13,125	.011	.018	-.081	.05
GDPEU28	13,125	103.733	5.456	87	114.6

Non-panel summary statistics Open-End funds, Stata function sum

Table 15: Non-panel summary statistics Open-End funds

Variable	N	mean	sd	min	max
FundID	7,305	265.872	168.046	1	563
YrQ2	7,305	212.172	17.162	161	237
Return	7,305	.012	.036	-.22	.177
ClosedEndFund	7,305	0	0	0	0
Redemptions	7,305	.009	.055	0	.999
CapitalCalls	7,305	.041	.11	0	.987
YearsToTermination	0	.	.	.	.
LnFundSize	7,055	5.956	1.038	.348	9.292
LnFundSizeSq	7,055	36.549	12.561	.121	86.343
SmallMediumFund	7,305	.284	.451	0	1
LargeMediumFund	7,305	.212	.409	0	1
LargeFund	7,305	.148	.355	0	1
Gearing	6,927	.322	.166	.001	.86
GearingSq	6,927	.132	.105	0	.74
Strategy	7,305	.094	.292	0	1
MultiCountry	7,305	.471	.499	0	1
MultiSector	7,305	.522	.5	0	1
FundAge	7,305	8.399	7.8	0	52
FundAgeSq	7,305	131.373	301.48	0	2704
FundAgeMax2	7,305	.182	.386	0	1
FundAgeMax3	7,305	.265	.441	0	1
CrisisVintage	7,305	.14	.347	0	1
Distributions	7,305	.01	.016	0	.245
MarketReturn	7,305	.012	.018	-.081	.05
GDPEU28	7,305	104.22	5.798	87	114.6

Non-panel summary statistics Closed-End funds, Stata function sum

Table 16: Non-panel summary statistics Closed-End funds

Variable	N	mean	sd	min	max
FundID	5,820	292.257	157.125	3	561
YrQ2	5,820	209.544	15.225	161	237
Return	5,820	.006	.061	-.22	.177
ClosedEndFund	5,820	1	0	1	1
Redemptions	5,820	.013	.064	0	.981
CapitalCalls	5,820	.036	.116	0	.996
YearsToTermination	5,303	5.394	4.16	0	30
LnFundSize	5,602	5.765	.981	.057	8.582
LnFundSizeSq	5,602	34.201	11.191	.003	73.644
SmallMediumFund	5,820	.287	.453	0	1
LargeMediumFund	5,820	.224	.417	0	1
LargeFund	5,820	.092	.289	0	1
Gearing	5,559	.464	.169	0	1
GearingSq	5,559	.244	.154	0	1
Strategy	5,820	.472	.499	0	1
MultiCountry	5,820	.53	.499	0	1
MultiSector	5,820	.405	.491	0	1
FundAge	5,820	5.561	3.585	0	20
FundAgeSq	5,820	43.778	53.058	0	400
FundAgeMax2	5,820	.223	.416	0	1
FundAgeMax3	5,820	.33	.47	0	1
CrisisVintage	5,820	.22	.414	0	1
Distributions	5,820	.01	.028	0	.809
MarketReturn	5,820	.01	.019	-.081	.05
GDPEU28	5,820	103.121	4.927	87	114.6

Appendix F: Full tables regression results first sensitivity check

Regression results open-end subset

	(1) Pooled OLS		(2) Between estimator		(3) RE	
ClosedEndFund						
Redemptions	0.0214	(0.0141)	0.0559	(0.0827)	0.0305***	(0.0079)
CapitalCalls	-0.0014	(0.0046)	0.0449**	(0.0211)	-0.0054	(0.0041)
YearsToTermination						
LnFundSize	-0.0031	(0.0037)	0.0021	(0.0111)	-0.0032	(0.0042)
LnFundSizeSq	0.0004	(0.0003)	-0.0003	(0.0011)	0.0005	(0.0004)
SmallMediumFund	-0.0011	(0.0014)	-0.0028	(0.0049)	0.0005	(0.0015)
LargeMediumFund	0.0005	(0.0019)	0.0046	(0.0068)	0.0007	(0.0022)
LargeFund	-0.0019	(0.0033)	0.0083	(0.0123)	-0.0027	(0.0037)
Gearing	0.0203	(0.0125)	-0.0296	(0.0300)	0.0330***	(0.0119)
GearingSq	-0.0369*	(0.0223)	0.0395	(0.0458)	-0.0653***	(0.0181)
Strategy	-0.0040**	(0.0020)	-0.0028	(0.0045)	-0.0037	(0.0029)
MultiCountry	-0.0082***	(0.0009)	-0.0043**	(0.0021)	-0.0075***	(0.0017)
MultiSector	0.0014	(0.0009)	-0.0000	(0.0022)	0.0017	(0.0016)
FundAge	-0.0006***	(0.0002)	0.0000	(0.0007)	-0.0009***	(0.0003)
FundAgeSq	0.0000***	(0.0000)	-0.0000	(0.0000)	0.0000***	(0.0000)
FundAgeMax2	0.0029	(0.0019)	-0.0073	(0.0159)	0.0033*	(0.0017)
FundAgeMax3	-0.0024	(0.0018)	0.0006	(0.0138)	-0.0031*	(0.0017)
CrisisVintage	0.0020*	(0.0012)	-0.0015	(0.0034)	0.0024	(0.0023)
Distributions	0.2458***	(0.0344)	0.5828**	(0.2310)	0.2128***	(0.0257)
MarketReturn	-0.8438	(0.8979)			-0.8345	(1.2428)
GDPEU28	-0.0003	(0.0003)	-0.0372	(0.0689)	-0.0005	(0.0007)
Constant	0.0717	(0.0477)	3.4792	(6.4291)	0.0915	(0.0934)
Time Dummies	YES		YES		YES	
Obs.	6,927		6,927		6,927	
R^2	0.160		0.540		0.157	
Chi^2					.	
F-statistic	9,03		2,26			
Df model	93		91		93	
Df regression	6,883		175			
Prob > test stat	0.0000		0.0000		.	

*Quarterly fund return(%) is the dependent variable. Standard errors are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when variable is excluded from the regression model or dropped due to multicollinearity. Note: RE model follows a chi-distribution and reported R^2 is overall R^2, between R^2 = 0.122 and within R^2 = 0.146 respectively.*

Regression results closed-end subset

	(1) Pooled OLS		(2) Between estimator		(3) RE	
ClosedEndFund						
Redemptions	0.0458**	(0.0187)	-0.0685	(0.0739)	0.0442***	(0.0126)
CapitalCalls	-0.0079	(0.0091)	0.0183	(0.0472)	-0.0042	(0.0077)
YearsToTermination	0.0010***	(0.0003)	0.0000	(0.0007)	0.0010**	(0.0004)
LnFundSize	0.0215	(0.0152)	-0.0446	(0.0407)	0.0309***	(0.0097)
LnFundSizeSq	-0.0022	(0.0015)	0.0043	(0.0044)	-0.0029***	(0.0010)
SmallMediumFund	0.0066**	(0.0030)	-0.0003	(0.0106)	0.0080**	(0.0032)
LargeMediumFund	0.0109**	(0.0045)	-0.0037	(0.0201)	0.0111**	(0.0049)
LargeFund	0.0151*	(0.0085)	-0.0150	(0.0343)	0.0137	(0.0084)
Gearing	0.1451***	(0.0234)	0.2002***	(0.0418)	0.1456***	(0.0215)
GearingSq	-0.2144***	(0.0299)	-0.2833***	(0.0442)	-0.2167***	(0.0228)
Strategy	0.0015	(0.0016)	0.0046	(0.0035)	0.0015	(0.0026)
MultiCountry	-0.0057***	(0.0016)	-0.0066*	(0.0038)	-0.0065***	(0.0025)
MultiSector	-0.0049***	(0.0017)	-0.0058	(0.0036)	-0.0057**	(0.0025)
FundAge	-0.0032**	(0.0013)	0.0046	(0.0060)	-0.0036**	(0.0014)
FundAgeSq	0.0001*	(0.0001)	-0.0002	(0.0003)	0.0001	(0.0001)
FundAgeMax2	0.0015	(0.0032)	0.0387*	(0.0218)	0.0009	(0.0033)
FundAgeMax3	-0.0015	(0.0032)	-0.0128	(0.0247)	-0.0024	(0.0033)
CrisisVintage	-0.0040**	(0.0020)	-0.0022	(0.0057)	-0.0047	(0.0030)
Distributions	0.0817	(0.0643)	0.0839	(0.1695)	0.0756***	(0.0275)
MarketReturn	2.9490	(3.4564)			2.6494	(3.5280)
GDPEU28	0.0018*	(0.0011)	-0.1301	(0.3703)	0.0021	(0.0018)
Constant	-0.3161*	(0.1749)	12.0630	(33.9601)	-0.3636	(0.2382)
Time Dummies	YES		YES		YES	
Obs.	5,065		5,065		5,065	
R^2	0.223		0.731		0.222	
Chi^2					1,285	
F-statistic	11.88		4.67			
Df model	94		81		94	
Df regression	4,970		139			
Prob > test stat	0.0000		0.0000		0.0000	

*Quarterly fund return(%) is the dependent variable. Standard errors are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1; Reference category is a small closed-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when variable is excluded from the regression model or dropped due to multicollinearity. Note: RE model follows a chi-distribution and reported R^2 is overall R^2, between R^2 = 0.394 and within R^2 = 0.189 respectively.*

Appendix G: Full tables regression result second sensitivity check

Between estimator regression results full dataset vs times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund	0.0006	(0.0023)	0.0003	(0.0127)	-0.0048	(0.0048)	0.0026	(0.0024)
Redemptions	0.0332	(0.0462)	-0.1543	(0.2379)	-0.1179***	(0.0367)	0.0072	(0.0466)
CapitalCalls	-0.0054	(0.0201)	-0.0224	(0.0359)	-0.0250	(0.0313)	0.0129	(0.0218)
YearsToTermination								
LnFundSize	0.0004	(0.0098)	0.0731	(0.0652)	0.0090	(0.0176)	-0.0009	(0.0097)
LnFundSizeSq	-0.0001	(0.0010)	-0.0079	(0.0071)	-0.0009	(0.0019)	0.0001	(0.0010)
SmallMediumFund	-0.0011	(0.0045)	0.0225	(0.0258)	-0.0075	(0.0086)	0.0009	(0.0045)
LargeMediumFund	0.0029	(0.0064)	0.0604	(0.0398)	-0.0002	(0.0123)	0.0047	(0.0062)
LargeFund	0.0014	(0.0120)	0.0718	(0.0801)	-0.0042	(0.0241)	0.0005	(0.0114)
Gearing	0.1036***	(0.0207)	0.2166*	(0.1177)	0.0687*	(0.0389)	0.0877***	(0.0202)
GearingSq	-0.1821***	(0.0257)	-0.3528**	(0.1437)	-0.1323***	(0.0479)	-0.1610***	(0.0254)
Strategy	0.0020	(0.0026)	-0.0049	(0.0129)	-0.0104**	(0.0048)	0.0004	(0.0026)
MultiCountry	-0.0064***	(0.0020)	-0.0112	(0.0111)	-0.0113**	(0.0045)	-0.0067***	(0.0021)
MultiSector	-0.0039**	(0.0019)	-0.0030	(0.0108)	0.0037	(0.0044)	-0.0037*	(0.0020)
FundAge	0.0001	(0.0007)	0.0016	(0.0066)	-0.0012	(0.0019)	-0.0007	(0.0007)
FundAgeSq	0.0000	(0.0000)	-0.0001	(0.0002)	-0.0000	(0.0000)	0.0000	(0.0000)
FundAgeMax2	0.0124	(0.0098)	0.1052	(0.0648)	0.0021	(0.0187)	0.0129	(0.0101)
FundAgeMax3	-0.0015	(0.0095)	-0.0855	(0.0709)	-0.0173	(0.0129)	-0.0059	(0.0091)
CrisisVintage	-0.0027	(0.0030)			-0.0069	(0.0127)	-0.0005	(0.0028)
Distributions	0.1692	(0.1225)	0.6033	(0.8792)	0.5406**	(0.2379)	0.0697	(0.1246)
MarketReturn								
GDPEU28	0.0156	(0.0809)	0.0289	(0.2078)	-0.0208	(0.0207)	0.0200*	(0.0117)
Constant	-1.5260	(8.2844)	-3.0293	(19.1383)	2.0053	(2.0364)	-1.9956*	(1.1619)
Time Dummy	YES		YES		YES		YES	
Obs.	12,486		982		1,761		9,743	
R^2	0.545		0.399		0.466		0.457	
Df model	94		43		30		56	
Df regression	414		48		171		444	
F-statistic	5.26		0.74		4.97		6.66	
Prob > F	0.0000		0.8414		0.0000		0.0000	

*Quarterly fund return(%) is the dependent variable. Standard errors are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*

Between estimator regression results open-end subset vs times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund								
Redemptions	0.0559	(0.0827)	-0.1715	(0.2499)	-0.1452	(0.0878)	0.0523	(0.0610)
CapitalCalls	0.0449**	(0.0211)	0.0240	(0.0582)	-0.0339	(0.0454)	0.0539***	(0.0203)
YearsToTermination								
LnFundSize	0.0021	(0.0111)	0.1129	(0.1911)	-0.0223	(0.0204)	0.0118	(0.0087)
LnFundSizeSq	-0.0003	(0.0011)	-0.0141	(0.0208)	0.0025	(0.0023)	-0.0010	(0.0008)
SmallMediumFund	-0.0028	(0.0049)	0.0237	(0.0364)	-0.0125	(0.0104)	-0.0064	(0.0042)
LargeMediumFund	0.0046	(0.0068)	0.0939	(0.0802)	-0.0183	(0.0158)	0.0008	(0.0056)
LargeFund	0.0083	(0.0123)	0.1336	(0.1948)	-0.0454	(0.0356)	0.0062	(0.0102)
Gearing	-0.0296	(0.0300)	0.1792	(0.2005)	0.1359**	(0.0543)	-0.0429*	(0.0251)
GearingSq	0.0395	(0.0458)	-0.3518	(0.2957)	-0.2494***	(0.0822)	0.0739*	(0.0387)
Strategy	-0.0028	(0.0045)	0.0193	(0.0185)	-0.0116	(0.0071)	-0.0004	(0.0038)
MultiCountry	-0.0043**	(0.0021)	-0.0074	(0.0153)	-0.0081	(0.0061)	-0.0030	(0.0020)
MultiSector	-0.0000	(0.0022)	-0.0046	(0.0170)	0.0033	(0.0056)	0.0003	(0.0020)
FundAge	0.0000	(0.0007)	-0.0041	(0.0077)	-0.0016	(0.0021)	-0.0003	(0.0006)
FundAgeSq	-0.0000	(0.0000)	0.0001	(0.0002)	0.0000	(0.0000)	0.0000	(0.0000)
FundAgeMax2	-0.0073	(0.0159)	0.1218	(0.0971)	0.0272	(0.0268)	-0.0214	(0.0139)
FundAgeMax3	0.0006	(0.0138)	-0.1809	(0.1126)	-0.0358*	(0.0198)	0.0098	(0.0113)
CrisisVintage	-0.0015	(0.0034)			-0.0101	(0.0175)	-0.0015	(0.0029)
Distributions	0.5828**	(0.2310)	-0.4846	(0.9795)	0.1776	(0.3792)	0.6630***	(0.2021)
MarketReturn								
GDPEU28	-0.0372	(0.0689)	0.1337	(0.1116)	-0.1127***	(0.0319)	0.0115	(0.0202)
Constant	3.4792	(6.4291)	-12.3186	(9.9833)	11.3234***	(3.1959)	-1.1880	(2.0012)
Time Dummy	YES		YES		YES		YES	
Obs.	6,927		572		865		5,490	
R^2	0.540		0.881		0.619		0.509	
Df model	91		40		29		55	
Df regression	175		8		65		205	
F-statistic	2.26		1.48		3.65		3.88	
Prob > F	0.0000		0.2911		0.0000		0.0000	

*Quarterly fund return(%) is the dependent variable. Standard errors are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*

Between estimator regression results closed-end subset vs times

	(1) All times		(2) Before crisis		(3) During crisis		(4) After crisis	
ClosedEndFund								
Redemptions	-0.0685	(0.0739)	-0.2414	-15251	-0.1240**	(0.0508)	-0.0232	(0.0797)
CapitalCalls	0.0183	(0.0472)	0.1765	(0.1525)	0.0151	(0.0644)	0.0399	(0.0563)
YearsToTermination	0.0000	(0.0007)	0.0015	(0.0101)	-0.0000	(0.0010)	0.0006	(0.0007)
LnFundSize	-0.0446	(0.0407)	0.1193	(0.4976)	0.0240	(0.0548)	-0.0420	(0.0378)
LnFundSizeSq	0.0043	(0.0044)	-0.0152	(0.0577)	-0.0040	(0.0053)	0.0039	(0.0041)
SmallMediumFund	-0.0003	(0.0106)	0.0710	(0.1012)	0.0146	(0.0174)	0.0046	(0.0101)
LargeMediumFund	-0.0037	(0.0201)	0.0904	(0.2321)	0.0337	(0.0254)	0.0018	(0.0180)
LargeFund	-0.0150	(0.0343)	0.2516	(0.4899)	0.0651	(0.0440)	-0.0105	(0.0325)
Gearing	0.2002***	(0.0418)	0.3757	(0.7304)	0.0172	(0.0922)	0.2013***	(0.0427)
GearingSq	-0.2833***	(0.0442)	-0.4778	(0.8072)	-0.0867	(0.0954)	-0.2863***	(0.0455)
Strategy	0.0046	(0.0035)	-0.0206	(0.0547)	-0.0035	(0.0080)	0.0014	(0.0038)
MultiCountry	-0.0066*	(0.0038)	0.0108	(0.0471)	-0.0169**	(0.0072)	-0.0068*	(0.0039)
MultiSector	-0.0058	(0.0036)	0.0208	(0.0391)	0.0021	(0.0071)	-0.0055	(0.0038)
FundAge	0.0046	(0.0060)	0.0027	(0.1240)	-0.0059	(0.0194)	-0.0069	(0.0054)
FundAgeSq	-0.0002	(0.0003)	0.0102	(0.0352)	-0.0001	(0.0014)	0.0003	(0.0003)
FundAgeMax2	0.0387*	(0.0218)	-0.2180	(0.7856)	-0.0181	(0.0334)	0.0337	(0.0235)
FundAgeMax3	-0.0128	(0.0247)	0.6463	-18081	-0.0350	(0.0249)	-0.0489**	(0.0236)
CrisisVintage	-0.0022	(0.0057)			-0.0013	(0.0221)	-0.0006	(0.0051)
Distributions	0.0839	(0.1695)	31234	-72465	0.5219	(0.3568)	-0.1157	(0.1797)
MarketReturn								
GDPEU28	-0.1301	(0.3703)	0.1779	(0.6685)	-0.0183	(0.0552)	0.0053	(0.0142)
Constant	12.0630	(33.9601)	-16.8855	(61.8600)	1.7654	(5.4112)	-0.4443	(1.4099)
Time Dummy	YES		YES		YES		YES	
Obs.	5065		352		821		3892	
R^2	0.7312		0.6372		0.5712		0.6068	
Df model	81		32		29		55	
Df regression	139		7		68		163	
F-statistic	4.67		0.384		3.12		4.57	
Prob > F	0.0000		0.9697		0.0001		0.0000	

*Quarterly fund return(%) is the dependent variable. Standard errors are in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$; Reference category is a small open-end core fund that is specialized in a single country and a single sector and is not launched during the financial crisis. Empty cells occur when variable is excluded from the regression model or dropped due to multicollinearity. Note: reported R^2 is between R^2.*