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MASTER'S THESIS

Return drivers of Finnish real estate funds

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ABSTRACT

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Purpose of this master's thesis is to examine main drivers of Finnish real estate funds total returns from 2013 to 2019. Thesis geographical area is limited to funds that invest only in Finland, since there are few studies conducted in this area. Also, this study investigates if there is a possible index as one of the key elements in explaining the fund returns, since Finnish real estate funds does not present comparable index. Potential real estate fund return drivers, as well as relevant methods, are derived from the relevant academic literature. From the previous studies, four fund-specific and four macroeconomic factors are used in empirical panel analysis of 8 Finnish real estate funds on quarterly data.

Empirical analysis reveal, that in this thesis, fund characteristics growth, and high leverage have significant positive effect on total returns. Size of the fund has no statistically significant effect on fund returns in this study. Fund fees seem to have negative effect on real estate fund total returns, though results were not statistically significant. Gross domestic product change has a positive significant effect on fund returns. Mortgage spread, with a lag of 1 quarter, has statistically significant negative effect on total returns. Change in inflation and in Finnish housing prices, have mixed results on real estate fund returns and the results were not statistically significant. Created index from Helsinki stock exchange real estate companies has positive effect on Finnish real estate funds total returns, but results were not statistically significant. Helsinki stock exchange total return index was not statistically relevant in explaining Finnish real estate fund returns.

Results give investors important insight of common Finnish real estate fund return drivers, which can be used in optimizing investment selection, investment timing and investment portfolio. Results are also useful to fund companies considering best risk to return strategies.

TIIVISTELMÄ

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Tämän Pro gradu -tutkielman tavoitteena on tutkia Suomalaisten kiinteistörahastojen kokonaistuottojen ajureita vuodesta 2013 vuoteen 2019. Tutkielma on rajoitettu koskemaan Suomessa toimivia rahastoja, koska alueesta on tehty vain vähän tutkimuksia. Tutkimus tutkii myös mahdollista indeksiä rahastojen tuottojen ennustajana, sillä Suomalaiset kiinteistörahastot eivät esitä vertailuindeksiä. Mahdolliset tuottoajurit, kuten myös relevantit metodit, ovat johdettu akateemisesta kirjallisuudesta. Aiemmista tutkimuksista, neljää rahastokohtaista tekijää sekä neljää makrotaloudellista tekijää käytetään empiirisessä paneelianalyysissä, jossa tutkitaan 8 rahastoa neljännesvuosittaisella datalla.

Empiirinen analyysi paljastaa, että tässä tutkielmassa, rahastokohtaisista muuttujista kasvulla, sekä korkealla velkaisuusasteella on merkittävä positiivinen vaikutus kokonaistuottoihin. Rahaston koolla ei ole tilastollisesti merkitsevää vaikutusta kokonaistuottoihin. Rahaston kuluilla näyttäisi olevan negatiivinen vaikutus kiinteistörahastojen kokonaistuottoihin, tulokset eivät kuitenkaan olleet tilastollisesti merkitseviä. Tutkimus osoittaa, että bruttokansantuotteen muutoksella on tilastollisesti merkitsevä positiivinen vaikutus rahastojen tuottoihin. Asuntolainan ja valtionlainan korkoerolla, viivästettynä yhdellä kvartaalilla, on merkitsevä negatiivinen vaikutus kokonaistuottoihin. Inflaation muutoksella sekä Suomalaisten asuntojen hintojen muutoksella on epäyhtenäiset vaikutukset kiinteistörahastojen kokonaistuottoihin ja tulokset eivät olleet tilastollisesti merkitseviä. Helsingin pörssin kiinteistöyhtiöistä luodulla indeksillä on positiivinen vaikutus Suomalaisten kiinteistörahastojen kokonaistuottoihin, tulokset eivät kuitenkaan olleet tilastollisesti merkitseviä. Helsingin pörssin kokonaistuottoindeksillä ei ollut tilastollisesti merkitsevää selitysvoimaa Suomalaisten kiinteistörahastojen kokonaistuottoihin.

Tulokset antavat tärkeää tietoa sijoittajille Suomalaisten kiinteistörahastojen tuottoajureista, joita voidaan käyttää sijoitusten valinnan, ajoituksen sekä portfolion optimoinnissa. Myös rahastoyhtiöt voivat hyödyntää tuloksia tehostamaan rahastojensa tuotto-riski-suhdetta.

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In Helsinki, 13.7.2020

Kössi Kuusimurto

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LIST OF ABBREVIATIONS

AIF	Alternative investment fund
AIFMD	Alternative investment fund managers directive
CPI	Consumer price index
ECB	European central bank
EMU	Economic and monetary union
EU	European Union
FE	Fixed effects model
GDP	Gross domestic product
NAV	Net asset value
OLS	Ordinary least squares
OMXH	Helsinki stock exchange total return index
RE	Random effects model

REAL	Created real estate company stock total return index
REIT	Real estate investment trust

1. INTRODUCTION

In a vast investment universe, real estates are well known as investments, as are mutual funds. Since real estate investments are highly capital intensive, it is difficult for small investors to invest in them, still less to create diversified real estate portfolio. For these purposes real estate funds are developed for the investors. This study provides additional understanding to real estate funds in Finnish region.

Since many are involved in real estate investments through their own real estates, such as homes and summer houses, there might be an assumption that real estate investments are easy to comprehend. Similar assumption seems to be in academic literature, since real estate investments are rather scarcely studied subject, with respect to the fact, that real estate is by any measure most significant store of wealth. Even though it is difficult to measure, world's real estate value, to give perspective, was estimated at the end of 2017 around 280 trillion dollars. (Savills, 2020)

Because real estates are most significant investments in many of our lives and in the world, there can be never enough research and studies regarding to it. With addition to the previous argument, there seems to be insufficient amount of studies made compared for example stock markets, which provides suitable research domain for this thesis. As the writer of the thesis, with experience of owning my own real estates, working in building and renovating real estates and experience of working in asset management company, the subject of this thesis seems to be the natural choice for me.

1.1 Subject and limitations

Purpose of this thesis is to study Finnish real estate funds returns and their drivers from 2013 to 2019. Also, thesis geographical area is limited to funds that invest only in Finland, since there are few studies conducted in this area. The timeframe is selected with intention to get as much of the information as possible and to keep number of the funds still reasonable for the analysis. 8 funds selected represent majority of real estate funds in Finland, thus represents the real estate fund sector appropriately. With Finnish real estate funds investing in Finland being reasonably new investment vehicles for the general public, the number of funds and data availability substantially diminishes as the time frame is stretched past the 7 years, which rationalizes the time frame selection.

Studying real estate fund returns, it can be considered, that each fund has its own characteristic attributes that might affect fund returns. Also, the operational environment, the economy, influences success of the companies, also funds. These aspects are studied from academic literature and derived into quantitative analysis. All the variables gathered are from fund companies reports, portfolio managers or from secondary sources.

This thesis focus is on investors perspective, as to see what analysis can be made with the data available to investors. The funds are adequately presented and explained by fund companies and third parties, for example in respect of return, risk, investments and allocations and costs. But there is a lack of comparing analysis made, since real estate funds in Finland exhibit no comparable index and there is no interest of the funds themselves to conduct and present competitor analysis for the investors. Also, the sector has been a niche market until recent years, so researches are rare. This study aims to provide unbiased insight to investors and to fund companies about Finnish real estate fund performance drivers.

1.1.1 Conceptual framework

The conceptual framework in figure 1. aims to provide epiphany to the reader regarding to the showcased subject and the relation of the selected limitations of this thesis. The overlapping substance of the squares represents the possible causalities of the studied real estate fund returns and presented concepts. Real estate funds belong to asset management sector, where there are specific features and rules for the funds, fund characteristics are unique for the real estate funds, Finnish economy and Finnish real estate markets provides the operational environment for the funds and have an influence on investment vehicles. Since this study is not exhaustive, there are elements that effect on concepts presented and are not measured, which are represented in the figure with empty squares.

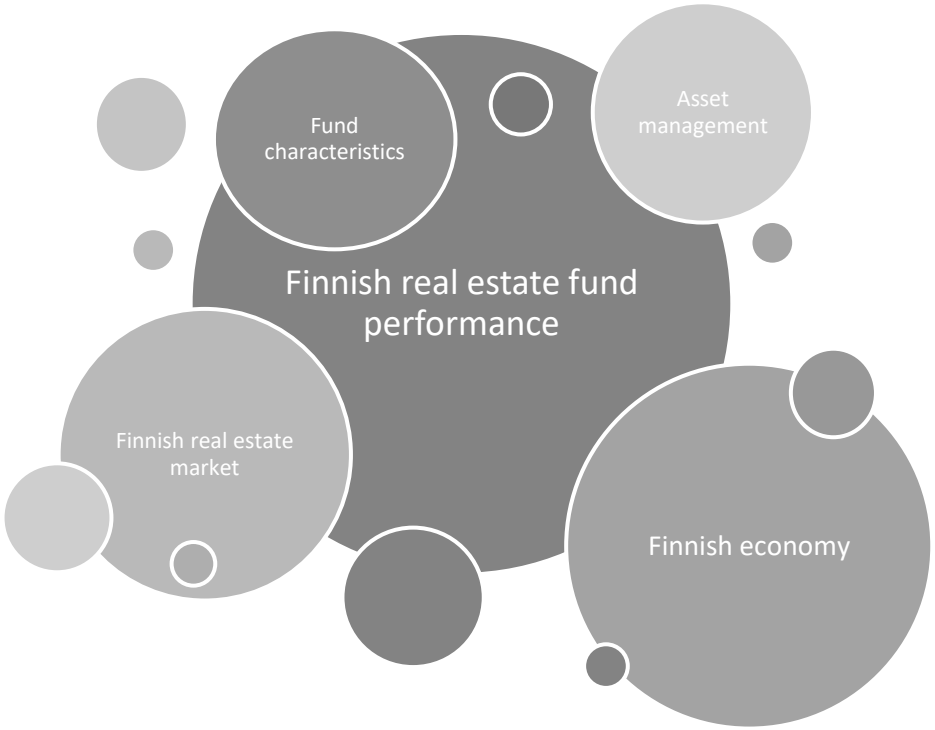

Figure 1. Conceptual framework

1.2 Aim of the study and research questions

Aim of this thesis is to recognize, from the literature, the key elements that affect real estate fund returns and then use these variables in explaining the Finnish real

estate funds returns. The following research questions guide the thesis literature review as well as empirical part of this study. The main research question is supported with sub-questions to provide additional understanding to the explored question. Research questions are as followed:

- *What are key elements found in explaining Finnish real estate fund returns in chosen period?*
    - *How well discovered key variables explain Finnish real estate fund returns in chosen period?*
    - *Can some of the chosen variables be used as an index for Finnish real estate funds?*

The main research question answer is discovered from the literature, further verified with empirical analysis. The first sub-question answers empirically how much the chosen elements explain the Finnish real estate fund returns. The second sub-question aims to answer if there is a possible index as one of the key elements in explaining the fund returns, since Finnish real estate funds does not present index. The second sub-question also answers how well the potential index explains the fund returns and compares potential index with other variables.

1.3 Structure of the research

This thesis consists of six main chapters, the progression of the thesis can be seen in figure 2. In the first two chapters, introduction and background, the thesis subject is presented with research questions, respect to limitations in geographical area, time period and specific investment vehicle. The third chapter uncovers possible investment vehicle specific as well as regional return drivers and exhibits methods used in previous researches. These performance drivers and methods serve as a

base for the methodology in chapter four and data gathering in chapter 5. In chapter six, empirical analysis is carried out with the gathered data and chosen methods, also discussing results. Chapter seven concludes the thesis.

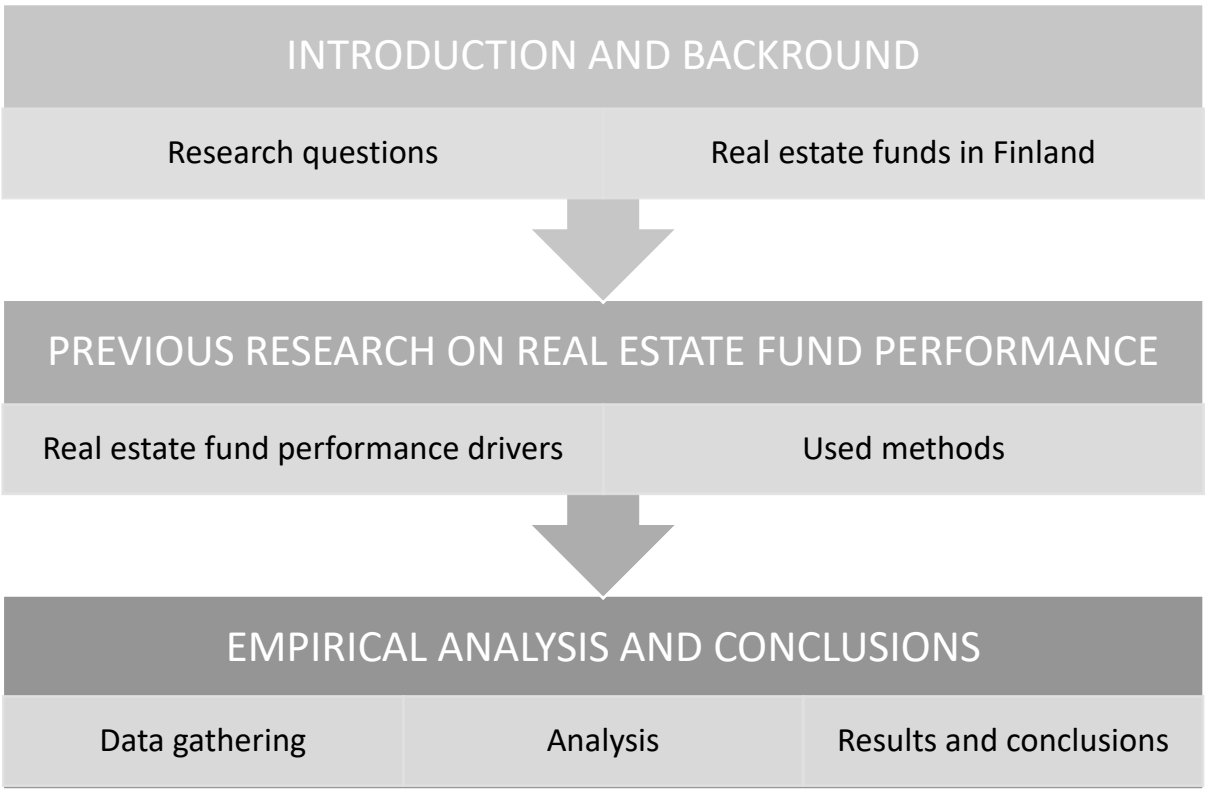

Figure 2. The structure of the thesis.

2. BACKGROUND

This thesis focuses on Finnish real estate markets and existing real estate funds in the market. This section specifies the concepts of real estate and mutual fund and binds them together in a concept of real estate mutual fund. Also, due to the local nature of real estate markets and the geographical selection of the thesis, it is relevant to have an outlook of the development and the status of the Finnish economy as well.

2.1 Finnish economy

Finland joined to European Union in 1995 and soon after that adopted shared currency Euro 1999 (Eurostat, 2019; European Commission, 2019a). Economic governance under economic and monetary union (EMU) is divided in the EU institutions and member states, The European Central Bank (ECB) sets monetary policy as objective to maintain price stability (European Commission, 2019b). In recent years, despite the depression in the early of 1990s', financial crisis in 2009 and European crisis 2012, Finland has seen growth in terms of gross domestic product (GDP) as seen in the figure 3.

Figure 3. Development of Finnish GDP (Tilastokeskus, 2019a).

Recent GDP growth is connected with detected inflation and actions made by the ECB to stimulate the economy. From the figure 4., we can see that Finnish inflation as in consumer price index (CPI), has been significantly lower in recent years. Significant is that inflation has been lower than European Central Banks aimed price stability objective of European inflation being close to 2%. (ECB, 2020a)

With inflation being relatively low, European Central Banks main tool for reviving economy are interest rates, affecting financing conditions in the economy. All three key interest rates, Main refinancing operations, deposit facility and marginal lending facility, have been gradually decreasing for a decade, and currently at their lowest levels (ECB, 2020b). With Interest rates near zero, incentive for investing is higher as the cost of capital is lower. Also, companies and individuals are encouraged to use of debt leveraging their assets. As the deposit rates are low, investors seek new investment opportunities with low or moderate risk, this in return, at least partially, has created more demand for real estate investing, real estate funds in Finland.

Figure 4. Finnish Inflation (Tilastokeskus, 2020).

2.2 Real estate investment market in Finland

There are several types of property sectors that can be invested in. The list presented is not exhaustive, but currently the main sectors in Finland are office, retail, industrial, residential, hotel, care, and other properties. The current distribution can be seen in figure 5, where it is visible that residential sector is the biggest, following office and retail. Notable is that a decade ago, office sector was the biggest sector and in recent years considering transaction volumes it has been the biggest sector. (KTI, 31, 46, 2019b)

Figure 5. The structure of Finnish property investment market by sector (KTI, 2019a).

2.2.1 Office and retail sector

From the office space, new development is currently concentrating in the Finnish metropolitan area and currently 44 percent of the office space is in the Helsinki metropolitan area. The rental practices can vary, but it is common to apply fixed lease terms in larger units. Rental levels and vacancy rates depend mainly of the office location and quality of the offices. Helsinki city center is most valued office area in Finland. For a decade, the office premises have had solid income returns and decreasing capital growth, until recent years. This is due to the concentration to Helsinki metropolitan area. Now total return is divided more with the two, with slight decrease in income returns. Retail sector is behaving similarly to office sector, although having more variety and not being as sensitive concerning geographical area. Capital growth has been negative for a decade, total return consisting mainly on income return. Rental agreements being usually quite long, around three years, giving stability to the market. In commercial sector, total returns have been around 5 percent, showing some variability. (KTI, 2019b, 46-56)

2.2.2 Residential sector

The housing market consist mainly of, around 76%, households of one or two persons. This is the main reason for the smaller housing sizes. 32% of the homes are rented, rest are owned by the occupier. Obviously, the development is currently focusing on small apartments and at 2018 the number of dwellings constructed for rental use was 12000, 9000 in Helsinki area. This is double the amount a decade ago. Rental agreements are usually made indefinite period, there can be minimum vacancy time such as 12 months agreed. In Helsinki metropolitan area, rents have been increasing for a decade. In average, whole Finland housing prices of old dwellings have been rising also for a decade. Total return of the sector has been around 8 percent, return divided to income return and capital growth, income return slightly higher than capital growth. (KTI, 2019b, 56-63)

2.2.3 Industrial, care and hotel sector

Industrial and logistics properties are not so sensitive to the area they are built. These properties are quite heterogenous, the largest properties are usually owned by the occupier. Important for these properties is that they are located with good traffic connections. Rental agreements are usually long, but due to the heterogeneity there is variation in the practices. Total return is for a decade consisted purely of income return, capital growth being negative. Average return has been around 7 percent. (KTI, 2019b, 63-65)

Properties focusing on healthcare and social sector have been increasing as the population is ageing. Facilities are mainly assisted living premises, nursing homes, daycare, and medical facilities. Rental agreements are usually long, 10 to 15 years, investments are highly net income driven. Sector being quite new for the investments, transaction volume more doubled in 2018 to 620 million euros. (KTI, 2019b, 65-66)

There are 628 hotels in Finland 2019. Hotel business is characterized low occupancy rate, around 55% in average 2018 in Finland. The leases are usually long for 15-25 years. Uusimaa and Lapland are the focus areas in Finland due to the tourism. Hotels total return were around 8 percent 2018 and 2017, consisting mainly of income return. (KTI, 2019b, 67)

2.2.4 Players in Finnish real estate investment market

Finnish real estate investment market has been growing in recent years, even more than overall economy. This can be seen in figure 6, with the investor groups. The invested amount was 2018 around 70 billion. As can be seen from the figure 6, the biggest investors in the real estate market are foreign investors, which have also increased their investments most in recent years to 22 billion. The institutional investors have traditionally been biggest investors in real estate market, but now with real estate funds doubling their investment in the horizon period, as well as non-listed property companies and listed property companies, the dynamics of the market players have shifted. This thesis focuses on real estate funds, that have risen

to became significant influencer in the Finnish real estate investment market with investments of 11.7 billion euros 2018.

Figure 6. The structure of the Finnish property investment market by investor group (KTI, 2019a).

2.3 Open-ended Real estate funds in Finland

The mutual fund history reaches to 1924, when the Massachusetts Investors Trust was founded in US. At the time, investment trust companies were more popular, but after the 1929 crash, they were considered riskier and more prone to abuse. In fact, they were considered as a part of the crisis and 1936 US Revenue Act and 1940 The US Investment Company Act lead the success of mutual funds in the US. (Morecroft, 2017, 223-225)

General concept of investment funds is that investors deposit money to the fund, which then invest the assets on behalf of the investors. The fund has four types of essential activities. First, fund promotion, establishment, organization, and administration of participant relationship. Second, investment of the collected resources. Third, Custody of financial instruments and fund liquidity and finally distribution of the fund units. Also, the fund must be organized according to EU and national law. (Basile & Ferrari, 2016, 33-37) In return for their deposited sum, investors receive equivalent market value of registered shares, shares have their own nominal value as well. Funds are exempt of taxes to avoid double taxation to investors. (Thomas, 1995)

Considering real estate funds, there are many names in the literature of real estate funds: non-listed real estate funds, private equity real estate funds and real estate private equity funds are commonly used among others (Gupta et al., 2018). In fact, Anderson et al. (2016) suggests the use of real estate private equity fund instead of private equity real estate fund, as the funds have closer relationship with real estate than non-real estate private equity in their research. Real estate funds are in Europe part of alternative investment funds (AIFs) defined by alternative investment fund managers directive (AIFMD). (Basile & Ferrari, 2016, 406) Also some might have heard of real estate investment trusts (REIT), which are pool of properties or mortgages traded in the stock market (Goddard & Marcum, 2012, 254). In the Finnish real estate fund market, almost all funds are non-listed real estate funds, thus thesis focuses on these funds explicitly. Also, real estate funds are typically divided into open-end or close-end structure. (Basile & Ferrari, 2016, 408) This thesis focuses on open-ended funds specifically.

Open-end real estate funds in Finland are mostly all so-called special investment real estate funds. Special investment funds regulation differs from normal open-ended fund. Mainly different aspects are diversification of risks, pricing of fund units, requirements for fund valuation and reporting, provisions, and redemption rules. (KTI, 2019b, 28) Also in Finland, open-ended special investment real estate funds

have only semi-open-end structure (Appendix 1.) This means that there are specific time periods when subscriptions and redemptions can be executed, this reduces liquidity risks. (Basile & Ferrari, 2016, 408) Examined Finnish real estate funds are open for subscriptions and for redemptions quarterly. This also means that value of the fund is calculated only quarterly. (Appendix 1.)

Thomas (1995) describes the main performance components of real estate funds: capital growth and net income return, which includes rent minus running expenses. There has been discussion in the media about the proportions of these two components. Although net income return is clear to understand and to validate, the capital growth part is more complex to evaluate. In Finland, Real estate investors use conservative valuations, sales comparison method is most used, but also income approach is used (Hall, 2014). Mattarocci and Siligardos (2015) studied Italian real estate fund's performance in financial crisis as income return versus capital appraisal, and they found that these contributions are not exactly related to overall performance of the funds. The thesis does not observe differences in performance components, total return includes both.

Generally real estate portfolios can be divided into three management strategies: core, value added and opportunistic. Core portfolios invest resources in real estate assets that can be easily placed on the space market, in other words completed real estates, and lease them. Value added portfolios seek to obtain high returns also in increasing the value of the assets by renovation or re-allocation in new market segments. Opportunistic management aims to develop properties from the ground up or to renovate completely. Obviously, risk and expected return grows as the portfolio is concentrated more on developing rather than leasing real estate. (Basile & Ferrari, 2016, 420-421) In Finland, real estate funds generally lease and develop real estates, so perhaps value-added portfolio describes Finnish real estate funds the best. Although, real estate private equity funds are usually categorized in core, value-added or opportunistic by their risk class, Fisher & Hartzell (2016) discovered that class does not predict differences in performance. Due to the fact, that there

are only few real estate funds active in Finland, this thesis does not consider different management strategies, but considers them similar.

Real estate funds can also be divided based on the property sectors they invest in, introduced in previous chapter. Typically fund tend to focus in one sector, but it is common to have mixed funds also. In Finland there are funds that invest in residential properties, multiple sector properties, office properties and care properties (Appendix 1.) There are also plot funds available, but this thesis focuses on developed properties only. These funds have different characteristics and tend to have different risk class. Nevertheless, these funds are exposed to similar changes in Finnish economy and similarly fund characteristics may affect the fund returns. Also, since the amount of real estate funds in Finland is limited, this research does not categorize funds by property sectors.

3. PREVIOUS RESEARCH ON FUND PERFORMANCE

Finland is scarcely studied region in terms of real estate funds. Nevertheless, there is numerous researches done across the world in which we will focus now. The main purpose of the literature review is to find suitable variables for the analysis as well as to find meaningful benchmark for the Finnish real estate funds. Currently, Finnish real estate funds do not illustrate any benchmark or index. Also, one of the key attributes in literature review is to study used methods in reviewed studies. This will guide method selection in the empirical part of the thesis. Considering what compiling previous research gives for the investors, it is rather difficult to gain information about the success factors of the real estate funds without exploring the academic literature. Databases SCOPUS (Elsevier), EBSCO - Business Source Complete and Emerald Journals were used to discover relevant studies.

3.1 Fund characteristics

Fund characteristics are fund specific factors and, at least partially, factors that managers can affect. With active asset management there might be benefits that affect fund performance. Tomperi (2010) found that in the U.S. emerging managers are likelier to obtain better returns. O'Neal & Page (2000) showed similar results in their research, fund age had negative effect on fund returns. Also, Kaushik & Pennathur (2012) research showed overperformance of the US real estate funds (REIT's) compared to index 1990-2008, except 2007-2008, revealing that fund managers can produce extra value to the shareholders. Lee (1997) on the other hand found that managers had selective ability but no timing ability. Also, Shen et al. (2012) discovered no managers timing abilities in their study in U.S.

Possible downside could be that managers make wrong decisions or do not act in the best interest of the fund performance. Agent problem occurs as a conflict of interests between the shareholders and the directors/managers, both parties are usually utility maximizers emphasizing their own benefits in decision-making. Also, even though corporation's purpose is to maximize the wealth of the shareholder, the law considers corporations as its own legal entity. Law regards managers as the agents of the company rather than shareholders, their purpose is to maximize wealth of the company. (Zubair Abbassi, 2009) Especially in the fund management, it might be difficult to balance between maximizing fund corporation, fund, and fund shareholders wealth.

Obviously, managers cannot influence all the fund characteristics, especially in open-ended funds. Nevertheless, these factors could be a part of return predictability. The following subchapters present most found fund specific characters and discusses their effects to fund performance.

3.1.1 Management fees

It is not unusual to hear from investors in investing to similar funds, that it is best to choose the fund with the lowest fees, they are all similar. Management fees consist of compensation of the management costs, value calculation, accounting, and reporting (Nordea, 2019). Compensation of the management can and should also be considered as value creative aspect. Management fees have been studied in relation to real estate fund performance. Philpot & Peterson (2006) discovered in their study, that funds with higher alpha, have higher management fees; however higher turnover ratio has no relation to management fees in their paper.

Morri & Lee studied performance of Italian real estate mutual funds using Sharpe ratio based on fund characteristics such as size, management efficiency, active property management, property locations, fund age, management fees, fund setup typology. They found only active property management, property locations and level of property-type diversification to have positive influence on fund performance. (Morri & Lee, 2009) Alcock et al. (2013) found systematic underperformance measured by Jensen's alpha in their study, which could possibly relate to market frictions, such as management fees and transaction costs. Also, Chou & Hardin (2014) found expenses to lower returns, in their study funds generally exceeded benchmarks before expenses. Supplementing previous research, O'Neal & Page (2000) stated in their study, that expense ratio had negative and significant relation to return.

Fee structure is also a possible agent problem. Possible agent problem has been studied Pattitoni et al. 2015 in the Italian market, in real estate mutual funds compensation structures, whether fees are paid on Net asset value or Gross asset value. In the study, funds that charge GAV-based fees, have incentive to have higher leverage, which might not always be optimal to the portfolio/investors. (Pattitoni et al., 2015)

3.1.2 Capital flows

Downs et al. (2016) discovered that higher returns caused higher fund flows, explaining that investors are chasing better performers. Also, Kaushik & Pennathur (2012) as well as Shen et al. (2012) researches verifies momentum in fund flows and return chasing behavior. Vasques et al. (2009) on the other hand proved performance persistency in Portuguese Real estate funds, as well as Tomperi in the U.S. (2010). This states that it is justifiable to chase past high returns if they are on the stable fundaments.

Baranyai (2019) on the other hand, uncovers relationship between capital flows and real estate holdings ratio. Inflows 12-18 months ago have significant negative impact on real estate ratio, stating that funds allocate resources rather more liquid assets than to real estates. Approximately 43% of the assets invested around a year ago are allocated to real estate investments. (Baranyai, 2019) There might be several reasons for this, nevertheless it is plausible, that capital inflows and outflows might have negative effects in real estate fund returns. In fact, Chou & Hardin (2014) found negative effect of fund size, increased fund flows and fund returns. Avramov et al. (2013) studied hedge fund return predictability using default spread, dividend yield, VIX index and aggregate fund flows. These factors had significant effects on various funds, for example excessive inflows had negative affect on fund returns. These factors can also be considered in predicting real estate funds returns in Finland.

3.1.3 Size

Farrelly & Stevenson (2016) found studying U.S. private real estate fund's performance drivers, that fund size had limited influence, as well as sector specialization. Fund size statistically negatively impacted only outperforming funds, expressing importance of selecting best investments, rather than taking advantage of economies of scale. Also, total vintage year capital flows had a negative impact on fund performance in their study. Vintage years were from 1990-2008, suggesting

macroeconomic effects on fund performance. Fund investment activity was found pro-cyclical and to have impact on fund performance. (Farrelly & Stevenson, 2016) With negative relationship between performance and capital market conditions, Farrelly & Stevenson (2016) found in fund distributions, that managers tend to realize investments in strong market conditions and balance allocations through market cycles. ANREV (2013) studied European and Asian funds drivers and found that one of the primary predicting variables was size of the fund.

Chui et al. (2003) Studied REIT return predictability using variables such as book-to-market, size, past returns, and liquidity. They also used Fama French three-factor model predicting returns including factors such as market factor, size factor and book-to-market factor. Their study states that especially turnover-momentum were significant factor explaining REIT returns. (Chui et al., 2003)

McLemore (2019) investigated property mutual funds mergers and found evidence that after the merger, a positive shock to fund size, fund returns were lower. In their study, Mattarocci & Siligardos (2015) found fund performance main explanatory variable to be assets under management and to have negative effect on fund returns. On the other hand, fund size had no significant impact to returns in O'Neal & Page (2000) research.

Also, Tomperi (2010) found in the U.S. that there is significance in private equity real estate fund size and performance. In his studies, historically best performed funds grew faster, and the growth rate of the funds slowed as the fund grew. Although, the best performed funds had relatively slower growth rate. Also, macroeconomic influence was found, stating that returns are higher, if the markets perform well. (Tomperi, 2010).

3.1.4 Leverage

Heuvel & Morawski (2014) studied German non-listed real estate special funds' performance drivers in different market phases and found leverage to have positive impact on returns. Also, in different market cycles, sector and geographical allocations, fund volume, liquidity and management costs had significant effect on fund returns. On the other hand, ANREV (2013) found gearing to be significant factor in fund returns, exhibiting negative effect to real estate fund returns. Alcock et al. (2013) on the other hand, found no evidence of leverage effect on their study on real estate private equity funds. As can be seen, the results are mixed in different studies, leaving much to discover in empirical analysis of this thesis in Finnish real estate fund market.

Baum & Farrelly (2009) suggest in their case study of property fund that primary sources of alpha and beta could be fund structure (leverage), portfolio structure, stock selection and investment timing. While their other variables were inconclusive, leverage impact found to have significant impact to beta. The examination of US real estate investment trusts (REIT's) capital structure decisions discovered that funds followed pecking order theory of financing, stating that funds prefer internal sources of resources rather than debt financing. The study also emphasized the high leverage ratios due to the nature of real estate sector. (Morri & Beretta, 2008) Also De Francesco (2007) found similar result in studying Australian REIT's, highlighting conservative and relatively low gearing considering real estate sector.

3.2 Macroeconomic factors

Although real estate markets are considered a local, they are affected of national and international economy (Leväinen, 2013, 152). Wang et al. (2017) studied 24 categories of Australian fund returns with 13 macroeconomic variables, domestic and international, their discovery was that explanatory power is strong especially in property funds. This gives evidence that it is relevant to examine and include at least some of these variables in the research.

3.2.1 Inflation

In their paper, Akinsomi et al. (2016), studied real estate market returns predictability in the US market. They note that sentiment and uncertainty indicators might be significant predictors in real estate fund market, especially in turbulent times. They used 13 possible explanatory variables with a lag of 4, in predicting REIT returns, and that found 3-month treasury bill, inflation, term spread, REIT return volatility, equity market uncertainty index had predictive power to the REIT returns. (Akinsomi et al, 2016). Tomperi (2010) examined private equity real estate fund returns in the U.S and found positive relation to inflation and fund returns.

The study conducted 2013 investigated relationship between Hongkong inflation and property returns. The research indicates that there is one-way causality, inflation leading property returns. At least in Hong Kong, higher inflation rates attract investors to invest in property markets. (Lee, 2013) Also Dalina & Annaert (2014) found similar results from Thailand real estate market, stating that inflation have significant relationship to real estate funds and real estate market returns in Thailand. Hoesli (1994) also studied inflation-real estate return -relationship in Swiss market and discovered that real estates can be used for better hedge against inflation than common stocks.

3.2.2 Gross domestic product (GDP)

GDP is used in many studies in explaining real estate market and real estate fund performance. McGough et al. (2000) forecasted returns of office rental properties in Helsinki using GDP, interest rate, Helsinki stock return index as predictive variables. They found that national GDP growth was key variable in modelling property returns. Also, Tomperi’s (2010) research indicate, that funds that are established during lower GDP growth, perform better.

In effects of macroeconomic variables, it must be stated that effects might be visible with a lag. Fuerst & Matysiak (2013) discovered studying over 1000 of non-listed real estate funds, that GDP growth had significant positive explanatory power to real estate fund returns. They found that especially lagging GDP growth by one year resulted best results, their data was yearly. The study conducted 2017, analyzed USA NCREIF office price appreciation rate using macroeconomic indicators and a probit model. Researchers found that Gross domestic product of lagged quarters k=3, 5, 6 and 8 were significant in the models, among others. (Laposa & Mueller, 2017)

3.2.3 Mortgage spread/Term spread

Term spread is used in previous studies to explain fund returns. For example, Akinsomi et al. (2016) used term spread and found that it had explanatory power to REIT returns. In fact, Hännikäinen (2016) used mortgage spread, difference between mortgage rate and government bond rate, as a predictor for economic activity in the market, and found that there is predictive power to the real GDP and industrial production, even typically better than term spread.

Mortgage spread may be a potential important factor considering real estate fund markets returns and investors activity in real estate fund markets. Real estate funds in Finland use leverage in optimizing their portfolios and individual investor activity might also be influenced by mortgage spread. Also, Walentin (2014) studied mortgage spread shocks and found them to have significant, negative correlation, that effect on consumption, residential investments, and GDP in US. Walentin also studied Swedish markets and found that the consumption and GDP reacted faster to the mortgage spread shocks possible due to the lower durations of the mortgages and high fraction of adjustable mortgages in Sweden (Walentin 2014).

3.2.4 Housing prices

Manganelli (2015, 24-30) distinguishes positive relationship between consumer income and house prices. Manganelli also states that price/rent above its historical average could be a sign of an overestimation of house prices. Rents could be considered as a proxy for dividend in purchasing of property in real estate business. If dividends increase, underlying assets value increases and vice versa. Of course, external forces are affecting prices and price/rent ratio, and thus cannot reflect purely of over-or under evaluation in real estate markets. Nevertheless, fluctuation of real estate prices and rents could be factors in predicting real estate fund returns. In fact, Manganelli et al. (2014) studied the relationship between housing prices and rents in Italy and found that prices affect rents but not vice versa. Housing prices change causes similar change in rents. His study also reveals that Investors considers capital gains decisive compared to rent yield. This implies that housing prices fluctuations could be more defining factor in real estate fund returns.

3.3 Methods from previous studies

Presented studies give insight to the empirical analysis of what variables should be included in the analysis. Also, the methods used in these papers should be reviewed more closely. Clearly, it can be stated that the data available and used in the studies guide and restrict the method selection.

Tomperi (2010) used ordinary least squares (OLS) regression method in studying performance of private equity real estate funds, also stating that one of the key challenges was the lack of data. Also, Philpot & Peterson (2006) used OLS method in their study, as well as Morri & Lee (2009) and in addition Baum & Farrelly (2009). Chou & Hardin (2014) applied pooled OLS method with clustered standard error estimates, they also used fixed effect regressions in their study. this indicates that also fixed effects method can be considered in the analysis. This is further verified with the ANREV (2013) study using fixed effects model, Baranyai (2019) employing fixed-effects panel regressions in her study, also Farrelly & Stevenson (2016) used

fixed effects panel analysis. To amplify the fixed effects method popularity, it must be stated that also Heuvel & Morawski (2014) used the method in their report.

Mattarocci & Siligardos (2015) utilized panel analysis with random effects model in their research. Kurzrock et al. (2009) on the other hand used analysis of variance, ANOVA, method studying differences between groups. Chui et al. (2003) applied cross-sectional regression in their study. Factor models were used by Kaushik & Pennathur (2012). Laposa & Mueller (2017) instead used probit model with time lagged dependent variables, which is linear probability model (Baltagi, 2011, 334).

Hoesli (1994) used ARIMA model in his study, which is autoregressive integrated moving average model and suits for time series analysis (Baltagi, 2011, 375). Downs et al. (2016) instead employed Vector Autoregression (VAR) model in their study, which is more dynamic model for times series and assumes that all the variables are endogenous (Baltagi, 2011, 378). Akinsomi et al. (2016) also used more complex models in their study forecasting REIT returns, using time-varying parameter (TVP) model, two variants of dynamic model averaging (DMA), dynamic model selection (DMS), Bayesian model averaging (BMA) and an autoregressive model based on recursive ordinary least squares (OLS). Considering advanced methods for the empirical analysis, error correction model (ECM) is to be considered, which McGough et al. (2000) applied in their study.

To be stated, more advanced methods require more data than the simplest methods, which is usually not the case in studying non-listed real estate funds. With reviewing numerous studies, it can be discovered that majority of the studies conducted employ more simple models, perhaps in lack of extensive amount of data.

3.4 Summary of previous studies

In the table 1, the summary of previous studies is presented to gain a general view of the researches viewed. The list is not exhaustive, nevertheless there is accumulation visible in the variables and methods used. This gives good guidance for the empirical part of this thesis and serves as a foundation for the thesis.

Table 1. Summary of previous research

Author(s)	*Year*	*Data*	*Method(s)*	*Variables used*	*Findings*
ANREV	2013	1374 European funds, 2001-2011	Panel data regression	weighted market return, gearing, yield, fund style, gross asset value	variables significant, adjusted R-squared 0,62, wmr biggest influencer
Chui et al.	2003	117 US REIT 1984-2000	cross-sectional regression	market capitalization, book-to-market value, turnover ratio, analyst coverage, market factor, size factor, book-to-market factor	importance of turnover and momentum as determinants
Akinsomi et al.	2016	US REIT index 1991-2014	time-varying parameter model, dynamic model averaging, dynamic model selection, bayesian model averaging, ordinary least squares	13 variables used	predictors vary over time, inflation, term spread, volatility, equity market uncertainty index were good predictors
Hännikäinen	2016	US GDP, industrial production, interest rate 1992-2012	OLS, AR,	mortgage spread, term spread, GZ(credit) spread	mortgage spread better predictor of GDP than GZ(credit) spread or term spread.
Avramov et al.	2013	8,376 hedge funds 1994-2008	OLS, MA	leverage, default spread, dividend yield, the VIX, aggregate fund flows	excessive inflows decrease returns, VIX negative effect on returns
Farrelly & Stevenson	2016	396 close-ended US real estate funds 1990-2012	Panel data regression	IRR, fund size, regional and sector exposure, capital market conditions, business cycle upon fund investment activity, vintage year, credit yield, GDP growth, US commercial real estate market conditions (index)	Fund characteristics not significant factors, vintage year capital flows negative impact, observed cash flows pro-cyclical to performance.
Tomperi	2010	896 funds, 1980-2009	OLS	IRR, fund size, vintage year, NCREIF index, NPI index as proxy, US GDP growth rate, US inflation (CPI index),	Performance positive correlation to fund size, top-performing funds growth rate lower.
McGough, T., Tsolacos, S., Olkkonen, O.	2000	Office rental properties 1970-1998, office market in the Central Business District of Helsinki	time series analysis	GDP Finland, interest rate, Helsinki stock return index,	growth of GDP important factor in forecasting

Morri & Lee	2009	17 Italian close-ended real estate mutual funds, 2005-2008	OLS	Sharpe ratio, natural log of net asset value, management efficiency (fund expenses/assets), active property management (properties expenses/properties), property locations, property typologies, age (years since inception), management fees/assets, fund setup typology,	active property management, property typology diversification and way to setup funds (blind pool better than seed) positive impact on performance
Baum & Farrelly	2009	case study of close-ended fund 2001-2006	OLS, fund return attribution	alpha, beta, fund structure, portfolio structure, stock selection, investment timing	fund structure significant impact to beta.
Mattarocci & Siligardos	2015	25 Italian open-end real estate funds 2003-2012	Panel data regression	income return, capital growth, overall return, Herfindahl-Hirschman indexes, AUM, Leverage, index return,	assets under management main explanatory variable. Global index performance also significant factor in explaining.
Kurzrock et al.	2009	137 open-end real estate funds, 2005-2007	ANOVA	fund returns, custom IPD benchmark, year, fund type (retail, institutional), investment type (retail, institutional), asset allocation, fund initiation date	asset allocation (domestic better returns) significant factor, institutional investors better returns than retail
Baranyai	2019	17 open-end real estate funds, 2013-2017	Panel data regression, fixed effects	real estate holding ratio, vacancy rate, saturation rate, capital flows (vintage year), fund age	capital flows 12-18-month lag significant factor to real estate holding ratio
Heuvel & Morawski	2014	22 real estate funds, 2006-2010	unbalanced panel data analysis, fixed period effects and no cross-section effects, panel regression	fund returns, fund volume, leverage, liquidity, management costs, geographical allocation, sector allocation	leverage significant factor, geographical and sector allocation in sub-periods significant factors.
Alcock et al.	2013	169 real estate funds, 2001-2011	fixed-effects panel regression models	total return-risk-free rate, IPD index, investment style, debt/total assets, timing of leverage,	real estate market index biggest influence, fund underperformance (possibly due to transaction costs, fees, other market frictions)
Chou & Hardin	2014	238 real estate funds, 1994-2006	pooled OLS with two-dimensional clustered standard error estimates/Fixed effect regressions	past returns, fees, lag flow, fund sizex100, fund agex100, turnoverx100, indexes, performance rank	return negative associated to fund flows and fund size
Wang et al.	2017	152 fund families, 1998-2013	Principal component analysis (PCA), OLS	return, domestic (GDP, CPI as inflation, stock market prices, foreign exchange rates, current account balance, short- term interest rate, money supply M3), international (world stock market return, world inflation, commodity prices, world industrial production, oil prices, us interest rate 3-month treasury-bill rate)	return negatively affected by factors created, both domestic and international significant factors explaining returns.
Laposa & Mueller	2017	Office price appreciation rate	probit model	Office price appreciation rate, GDP, employment of professional and business services, financial	employment increase decreases negative returns, also financial activities.

				activities, cap rate spreads, commercial mortgage flow of funds	
O'neal & Page	2000	28 real estate funds, 1996-1998	OLS	return, 3-month treasury-bill rate, REIT index, MSCI world stock index, S&P 500 index, expense ratio, turnover, age, size	No abnormal returns visible. Expense ratio, turnover and fund age significant effects on returns.
Fuerst & Matysiak	2013	1024 real estate funds INREV database, 2001-2007	Fixed effects panel regression	return, weighted market return, gearing, gross asset value, fund size, investment style, yield, GDP, bonds, stock market	fund size, investment style, gearing, distribution yield, GDP, stock market returns, bond rates significant predictors for fund performance.

As can be seen from table 1 summary of previous studies, sample sizes and time periods are many, also geographical areas are different. Methods used can be seen to vary also, although panel analysis models are most used. Variables selected differ from fund characteristics to macroeconomic variables. The pool of presented variables is so vast, that the number of variables used must be limited. This is done by selecting commonly used variables and data availability. Also, results of varied studies serve as a foundation of expected results in empirical part of this thesis.

3.5 Used Benchmarks

Finnish open-end real estate funds do not offer comparable index in their own websites. Therefore, it is relevant to see from previous studies what indexes are used. Rodriguez & Romero (2014) studied US based global real estate mutual fund's performance compared with indices. They found that on their sample period 2001-2010, only 2001-2005 funds outperform indexes used, which were NAREIT and FTSE EPRA/NAREIT indexes. In their study, the adjusted R-squared is around 90 percent, showing good predictability. (Rodriguez & Romero, 2014)

Alcock et al. (2013) on the other hand, compared real estate private equity funds returns compared with direct real estate market return from IPD attaching leverage effect and timing effect. They found also that fund performance follows closely to the underlying real estate market. Anderson et al. (2016) used real estate private equity fund, real estate and private equity fund indices in their study and found that

real estate private equity funds follow more accurately real estate markets rather than private equity markets. Chou & Hardin (2014) used CRSP Ziman Reit index and FTSE NAREIT US real estate indexes in explaining causalities of fund size, flows and performance and found them to have significant explanatory effects on fund returns.

In Europe, INREV is the European Association for Investors in Non-Listed Real Estate Vehicles. They have several indices that measure the performance of non-listed real estate funds. Especially INREV Quarterly Index could be suitable for the analysis, as it measures net asset value performance of European non-listed real estate funds on a quarterly basis. Performance is measured net of fees and costs. This quarter's Index release includes 332 funds and represents total gross asset value (GAV) of EUR 252.7 billion at the end of third quarter of 2019. (INREV, 2019)

Since Finnish real estate funds do not have currently comparable index, it might be relevant to use multiple-index method or alternative index instead. Hartzell et al. (2010) studied multiple-index predictability on US REIT compared with REIT index, and they found that adding indexes of non-REIT real estate firms (homebuilders and real estate operating companies, where real estate operating companies are split into hotels and all other firms) statistically improved predictability of returns. When considering alternative benchmark index for real estate funds, McGough et al. (2000) studied office property returns in Helsinki and discovered, that Helsinki stock exchange total return index had explanatory power to office returns.

4. METHODOLOGY

In this section, selected research methods are described, explained, and justified in relation to the collected data and to previous literature.

4.1 Stationarity of variables

First it must be noted, that cross-sectional data is data on number of economic units at a certain point of time, time series data is collected over time on one particular economic unit (Hill et al., 2011, 336). When data is comprised of cross-sectional and time series data, it is called panel data (Finkel, 1995, 2). When analyzing time series or panel data using static models, testing for stationarity is extremely important. One of least squares assumptions is that different observations on y and e are uncorrelated. If variable is correlated with its past values, it is said to be autocorrelated or serial correlated. (Hill et al. 2011, 339). Time series variable is said to be covariance stationary, if its mean and variance are constant and independent of time, and the related covariances depend only upon distance between two time periods instead of time periods per se (Baltagi, 2011, 374).

To test for stationarity, various tests can be made. The data at hand determines what tests can be used, especially when considering unbalanced panel data which is the case in this thesis. Stata program used in analyzing the thesis data provides panel data unit root tests, but only few can be applied to unbalanced data. Only Fisher-type tests with combining p-values and Im-Pesaran-Shin test can be used with unbalanced data in used analysis program Stata. The null hypotheses of both tests are that all panels contain a unit root. (Stata, 2020a, 6, 14, 16). Im-Pesaran-Shin test is a set of Augmented Dickey Fuller tests. Fisher-type tests can use Augmented Dickey Fuller tests or Philips-Perron tests. (Das, 2019, 521, 525) In previous research Fuerst & Matysiak (2013) also used Fisher and Im-Pesaran-Shin tests studying variable stationarity which confirms the use of presented tests.

If time series is non-stationary, it can be induced with data transformations. If the variable is difference stationary, we can convert variable to stationary by taking first difference according to Hill et al. (2011, 492) as followed:

$$\Delta y_t = y_t - y_{t-1} = v_t \qquad (1)$$

Variable can also be trend stationary, in this case stationarity can be achieved by de-trending (Hill et al., 2011, 492).

4.2 Considered panel data analysis methods

Multiple linear regression model, where there is more than one explanatory variable, is used to understand how much the dependent variable changes with the change in one independent variable keeping the other variables remain the same. (Das, 2019, 43) The notion holding all other factors fixed, ceteris paribus, is essence of establishing a causal relationship (Wooldridge, 2002, 3) For explanatory indicator variables, where variable takes values of 0 and 1, have interpretation that indicator variable splits the observations into two populations, without the effect if 0 and with the effect if 1, beta not being a slope in the model (Hill et al., 2011, 75). In case linear-log model, the change in y, represented in its units of measure, is approximately β/100 times the percentage change in x (Hill et al., 2011, 144).

The collected data sets a direction what quantitative methods can and should be used. Data that contains cross-sectional and time series data can be considered panel data. Distinctiveness of panel data is that it contains measures of the same variables from numerous units observed repeatedly through time. (Finkel, 1995, 2) This thesis is following methodology of the studies done by Fuerst & Matysiak (2013), Heuvel & Morawski (2014) and Tomperi (2010), where panel data analysis was used. Especially Heuvel & Morawski (2014) employed unbalanced panel data analysis which allows utilizing both cross sectional and time series properties of the sample. Balanced data consists of N individuals over same T time periods, in unbalanced panel data number of observations is not the same for all individuals. (Matyas & Sevestre, 2008, 44)

In this panel data analysis, three possible models are reviewed: the pooled model, the fixed effects model and the random effects model. In pooled model different individual's data are pooled together, coefficients supposed as constant for all individuals in all time periods and with no individual heterogeneity. (Hill et al., 2011, 539-540) The Pooled model can be expressed in case of two variables according to Hill et al. (2011, 540) as followed:

$$y_{it} = \beta_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} \qquad (2)$$

where y_{it} is dependent variable, i is *i*th individual and t *t*th time period, β are coefficients of intercept and different explanatory variables x_{2it} and x_{3it}, e_{it} are error terms.

Heteroskedasticity can be tested with models such as Breusch-Pagan test for heteroskedasticity and F-test. (Hill et al., 2011, 299-306) If heteroskedasticity is not present, it is possible to proceed with pooled model. In case of pooled model, the assumptions are usually unrealistic. For example, the assumption that errors are not correlated within the same individual across time can be relaxed, as well as homoscedasticity assumption, with using panel-robust standard errors, individuals as clusters. (Hill et. al., 2011, 542).

The fixed effects model (FE) allows individuals to have different coefficients, where all individual heterogeneity is assumed to be captured by the intercept, the model can be expressed in case of two variables according to Hill et al. (2011, 543) as followed:

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} \qquad (3)$$

where y_{it} is dependent variable, i is *i*th individual and t *t*th time period, β are coefficients of intercept and different explanatory variables x_{2it} and x_{3it}, e_{it} are error terms. Validity of the fixed effects, the joint significance test, F-test, of dummies can be performed. The null hypotheses support the pooled regression. If the null test is rejected there is significant loss in goodness of fit by applying pooled OLS, fixed effects model should be used instead. (Das, 2019, 503)

The random effects model (RE) allows treatment of individual intercept parameters differences as random, which can be expressed according to Hill et al. (2011, 551) as followed:

$$\beta_{1i} = \bar{\beta}_1 + u_i \tag{4}$$

where $\bar{\beta}_1$ is population average constant term and the random individual differences are u_i. The random effect model can be interpreted in case of two variables as followed (Hill et al., 2011, 552):

$$y_{it} = \bar{\beta}_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + v_{it} \tag{5}$$

,where $v_{it} = e_{it} + u_i$ represents usual regression random error and random individual effect, y_{it} is dependent variable, i is *i*th individual and t *t*th time period, β are coefficients of intercept and different explanatory variables x_{2it} and x_{3it}.

It is notable, that random effects model allows use of time-invariant variables unlike fixed effects model. Whether to choose fixed effects model or random effects model, Hausman test can test for potential correlation between error component u_i and regressors in random effects model. The Hausman test compares estimates from

both fixed effects model and random effects model, assuming estimates yield identical results. If the Hausman test null hypotheses is rejected, the random effects model is inconsistent and fixed effects model should be used. (Hill et al., 2011, 552-559) Also, Breusch-Pagan Lagrange Multiplier test should be used to test for random effects. If LM test null hypotheses is not rejected, there are no evidence of random effects in the model. (Baltagi, 2011, 320) In fact, if the standard random effects assumptions hold but the model does not contain unobserved effect, according to LM test, pooled OLS model is efficient and its statistics are valid (Wooldridge, 2002, 264).

5. DATA

In this section, data collection is explained, following data description section. Collected data transformations are also presented and justified. Microsoft Excel and Stata program, which is statistical software for data science (Stata, 2020b), were used in analyzing the data.

5.1 Data collection

Due to the focus of the thesis, it is essential to sort out the open-ended property funds in Finland. First, the list of investment funds in Finland is collected from Bank of Finland website, which manages European Central Bank's balance sheet data collection. From there, Special investment funds (Non-UCITS) is selected and fund type real estate is filtered in the 30.06.2019 list. (Bank of Finland, 2019) The list of 25 funds is further filtered with funds that are not feeder funds, fund of funds, plot funds, invest only in Finland, and have minimum investment amount, maximum 20000 euros, so that small investors can invest to the fund. The selected criteria are examined through every individual fund KIIDs and from their websites. The result is 14 comparable funds.

With these selections, search is made in Thomson Reuters Datastream Navigator, selecting category Unit trusts and market Finland, using search word AIF and real estate. Unfortunately, Datastream data does not include all the selected funds or the data is insufficient. For further analysis more information is required. Suomen sijoitustutkimus is Finland's leading provider of investment portfolio performance measurement and consolidation reporting services (Suomen sijoitustutkimus, 2019a). The company has been collected fund reports for several years and in their archives much of the fund information can be collected from their website (Suomen sijoitustutkimus, 2019b). Suomen sijoitustutkimus does not cover fund prices, leverage ratios, dividends in the archives and some of the funds selected are not included in the archives.

Morningstar also covers most of the funds studied, but also some of the funds are not covered in their website. Due to the lack of information in datastream, sijoitustutkimus, Morningstar and from the company websites, three funds previously selected are not covered in this study. Also, three funds have too short historical data for the analysis and were dropped. Remaining 8 funds can be found in Morningstar website and have necessary documents for gathering data. The selected funds, their related property sectors and starting quarters are presented in table 2.

Table 2. Selected Finnish real estate funds (Appendix 1.)

Name of the Fund	*Property Sector*	*Established*
eQ Care Properties	Care	5/2012
eQ Commercial Properties	Commercial	12/2014
Evli Rental Yield	Commercial	4/2018
FIM Real Estate	Residential	3/2014
OP Rental Yield	Mixed	4/2013
OP Service Real estate	Care	11/2017
Titanium Real Estate	Residential	6/2016
Ålandsbanken Real Estate	Residential	12/2012

From the table 2. can be seen, that there are different property sectors that fund invest in. Residential funds invest in housing properties, there are three funds that specialize in residential properties. Commercial properties invest mainly in retail, office, production, service, or storage facilities. In the data collected there are two funds that specialize in commercial properties. Care properties invest for example in teaching, daycare, healthcare, or assisted living accommodation. In the funds studied, there are two funds that specialize in care properties. Also, one of the funds have a mixed portfolio with residential and commercial properties. (Appendix 1.)

Due to the mixed frequencies of the data or the lack of all quarters data, some alteration was required. One of the simplest ways to do the conversions from yearly data to quarterly data is conventional methods, such as imputation. In marginal mean imputation, each missing value is substituted with the mean for those cases with data present on that variable. Danger of imputation is that method is known to produce biased estimates of variances and covariances. (Allison, 2011, 6) Nearest neighbor and linear interpolation methods are univariate imputation techniques which are used to fill the missing data in this thesis. Linear interpolation fits linear line through the missing data and can be expressed with the formula (Loukopoulos et al., 2017):

$$y = y_1 + k(x + x_1), where\ k = (y_2 - y_1)/(x_2 - x_1) \qquad (6)$$

In earlier studies conducted by Batista & Monard (2003) and Loukopoulos et al. (2017) compared ad hoc imputation method and interpolation methods with more complex methods, and found that interpolation methods performed better than ad hoc methods and even though methods are not as good as more complex methods, they are still widely used and easy to apply.

Even though dangers of biased estimates, this thesis missing data consists only of parts of independent variables in some funds in variables such as fees, net assets, leverage, and number of owners. Leverage ratio can be seen to behave conservatively and to move slowly in real estate activities as the loan is paid or acquired, this encourages the use of linear interpolation. The number of owners and net assets also moves slowly, conservatively, and almost linearly, as can be also seen from the other fund's development. Fees are considered to have similar values through time series in the same fund, which encourages the use of nearest neighbor interpolation method.

With fund specific variables gathered, macroeconomic variables and possible index candidates were required from secondary sources. GDP, CPI and Housing prices are collected from Tilastokeskus website, calculated mortgage spread is collected from the Bank of Finland website. Helsinki stock exchange total return index (OMXH) and created real estate company index (REAL) data were recovered from datastream database. In fund specific data, data is collected from fund inception to 2019 quarter 3. Macroeconomic variables data length conforms funds length on each fund.

5.2 Data description

From the data sources used, there are five fund specific variables collected: total return, size as in net assets and number of owners, fees, and leverage. Also, effects of four macroeconomic variables are studied: GDP change, inflation as consumer price index (CPI), mortgage spread as indicator for interest rate effects and old housing prices index in Finland, in order to see how development of housing prices effect fund prices. Also, two possible market returns were studied, Helsinki stock exchange total return index (OMXH) and created real estate company total return index (REAL). Table 3 Summarizes the descriptive statistics of the variables used in this study.

Variable total return consists of calculated returns by fund companies reports and Morningstar website (appendix 1) as well as confirmation from fund managers in some funds. Total return is calculated from per outstanding shares change in net asset values (NAV) as well as paid dividends. Variable total net assets, NAV, consists of fund's assets minus debts. Addition to liquid assets, completed real estates are appraised at current market values by official appraiser, development projects, where the fund is only owner, are appraised at current market value of the real estate times the completion rate. NAV is also affected by changes as shares are bought and sold. Values are calculated quarterly at the end of each quarter. (Appendix 1.)

Number of owners is recovered from fund reports (appendix 1.) and Suomen sijoitustutkimus reports (Suomen sijoitustutkimus, 2019b). Change in number of owners represents change from previous value and indicates the growth of the fund. The fund unit classes studied are intended for small investor, it can be assumed that one investor invests fairly small amounts and change in number of owners acts as an instrument variable for growth of the fund as the assets grow. Fee variable is also recovered from fund reports (appendix 1.) and Suomen sijoitustutkimus reports (Suomen sijoitustutkimus, 2019b). Fee variable represents percentage of operating expenses of the funds. Leverage variable represents debt to total assets and is recovered from fund reports (appendix 1.) and additional information from fund managers.

GDP change represents gross domestic product percentage change in volume of per working day adjusted series from previous year, reference year 2010, retrieved from Statistics Finland (Tilastokeskus, 2019b). The variable represents current economic activity and was also used in previous studies as a possible performance driver. Inflation as in consumer price index (CPI) is also acquired from Statistics Finland website, reference year 2010, and represents the rise in prices in Finland (Tilastokeskus, 2020). Housing prices of Finland might also influence real estate fund performance. Housing prices are retrieved quarterly from Statistics Finland

database, price indices of old dwellings in housing companies, base year 2010, whole Finland (Tilastokeskus, 2019c).

Interest rates in Finland might also affect market conditions, prices of new loans, investors activity, thus also real estate fund performance. Following Walentin (2014), mortgage spread shocks can influence real economy, mortgage spread is calculated as a difference between housing loans interest rate, new contracts, and 5-year government bond rate. Housing loan interest rate is retrieved from Bank of Finland website (2020a) as well as 5-year government bond rate (2020b).

Since real estate funds in Finland do not have comparable index available for quarterly data, Helsinki stock exchange total return index (OMXH) is considered, which includes dividends and is recovered from Datastream database. OMXH selection is inspired by the study of McGough et al. (2000). Also, self-made equally weighted real estate total return index (REAL) is created by choosing 8 stocks from OMXH from Datastream database, with sector selections real estate and construction (Appendix 2). The search criteria results 8 suitable companies, from where logarithmic first difference is calculated with equal weights once the stock enters to the index (Appendix 2).This is believed to be possibly better in explaining real estate fund returns in Finland, encouraged by the example of Hartzell et al. (2010) studying alternative benchmarks for evaluating mutual fund performance. REAL is already transformed to natural logarithmic difference formation to obtain stationarity.

Table 3. Summary statistics of variables

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Total return	145	1.802745	1.072923	-.79730	6.23
Fee	145	2.320828	.3203416	1.9	2.85
Total net assets	145	323.8732	316.9216	3.2	1369

Leverage	145	.2626944	.1418948	0	.481069
Number of owners	145	5539.586	7294.159	135	37251
GDP change	145	1.49931	1.326624	-2.4	3.6
CPI	145	110.2376	1.372379	107.84	112.64
Mortgage spread	145	1.306243	.2283543	.910859	1.726637
Housing prices of Finland	145	105.8662	1.380933	103.6	108.3
OMXH	145	20425.81	3510.06	11846.18	25252.62
ΔREAL	145	-.005175	.0740173	-.16226	.1677279

5.3 Data transformations

Examining data collected, it is obvious that some transformation is required to improve data quality and to obtain stationarity. First, few outliers were dropped in fund specific variables approximately three standard deviations from the mean to keep much of the extreme values and to preserve as much normality as possible.

After dealing with outliers, total net assets were transformed to natural logarithmic to reduce skewness. Second, fee variable was converted into categorical variable at threshold of 2.25. The selection was found to be most suitable, because selection is the median of the variable and this avoids too small sample size in each category. Also, using categorical variable reduces the errors in using imputation method on missing data as the transitions between categories become rarer. Such as transformation of fee, leverage was discovered best to be transformed into categorical variable at threshold 0.25. Behind the transformation a similar conclusion, such as in case of fee variable, is made to reduce errors in imputation method as well as to improve significance of the variable.

In effort to study whether growth of the funds effect to total returns, number of owners variable is transformed to natural logarithmic first difference. The use of

logarithmic values allows interpretation of results to be similar as relative change yet reducing skewness and obtaining stationarity. The transformation formula is as followed:

$$\Delta number\ of\ owners = \ln(number\ of\ owners_t) - \ln(number\ of\ owners_{t-1}) \quad (7)$$

Considering Finnish housing prices, consumer prices, OMXH and REAL, it might be considered, that in fact, changes in the prices have effect on real estate fund returns. Therefore, CPI, Finnish housing prices and OMXH are also transformed to natural logarithmic first differences. Last, macroeconomic variables GDP change and mortgage spread are transformed to absolute first differences to attain stationarity. The final variables summary statistics are presented in table 4.

Table 4 Summary statistics of final variables

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Total return	139	1.703	.8927	-.7973	4.82
High fee	139	.460	.500	0	1
Ln Total net assets	139	5.222	1.2623	1.1632	7.2218
High leverage	139	.5971	.4922	0	1
ΔNumber of owners	136	.1408	.1871	-.1036	1.2141
ΔGDP change	136	.1037	.6904	-1.2	1.9
ΔCPI	136	.0018	.0022	-.0049	.0058
ΔMortgage spread	136	.0030	.1720	-.6939	.2429
ΔHousing prices of Finland	136	.0013	.0083	-.0096	.0206
ΔOMXH	136	.0209	.0660	-.1145	.1198

ΔREAL	139	-.00506	.07485	-.1623	.1677

Table 5 summarizes data collection, imputations and transformations done. As can be seen from table 5, shares of missing values seem reasonable. Also, the data is divided between the funds quite evenly, thus one fund is not distorting the data. categorical transformations made can be considered to minimize imputation errors since there are few transitions between the categories created.

Table 5. Summary of data collection, imputations and transformations.

VARIABLE, FUND	DATA SOURCE	ORIGINAL FREQUENCY	DATA POINTS	SHARE OF MISSING VALUES	IMPUTATION METHOD	FURTHER TRANSFORMATIONS DONE
TOTAL RETURN						
EQ CARE PROPERTIES	Appendix 1	Quarterly	26	-	-	No
EQ COMMERCIAL PROPERTIES	Appendix 1	Quarterly	19	-	-	No
EVLI RENTAL YIELD	Appendix 1	Quarterly	6	-	-	No
FIM REAL ESTATE	Fund manager, Appendix 1	Quarterly	21	-	-	No
OP RENTAL YIELD	Appendix 1	Quarterly	26	-	-	No
OP SERVICE REAL ESTATE	Appendix 1, fund manager	Quarterly	7	-	-	No
TITANIUM REAL ESTATE	Appendix 1	Quarterly	13	-	-	No
ÅLANDSBANKEN REAL ESTATE	Appendix 1	Quarterly	27	-	-	No
OVERALL		Quarterly	145	0 %		
FEE						
EQ CARE PROPERTIES	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	Categorical variable transformation, 100% in one category
EQ COMMERCIAL PROPERTIES	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	19	-	-	Categorical variable transformation, 100% in one category
EVLI RENTAL YIELD	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	6	-	-	Categorical variable transformation, 100% in one category
FIM REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	21	-	-	Categorical variable transformation, 100% in one category

OP RENTAL YIELD	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	Categorical variable transformation, 100% in one category
OP SERVICE REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	7	-	-	Categorical variable transformation, 57% in one category
TITANIUM REAL ESTATE	Appendix 1	Quarterly	13	46 %	Same years closest neighbors average	Categorical variable transformation, 100% in one category
ÅLANDSBANKEN REAL ESTATE	Appendix 1	Quarterly	27	11 %	Same years closest neighbors average	Categorical variable transformation, 100% in one category
OVERALL		Quarterly	145	6 %		
TOTAL NET ASSETS						
EQ CARE PROPERTIES	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	Natural logarithm
EQ COMMERCIAL PROPERTIES	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	19	-	-	Natural logarithm
EVLI RENTAL YIELD	Appendix 1, Suomen sijoitustutkimus (2019b)	Yearly	6	-	-	Natural logarithm
FIM REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	21	-	-	Natural logarithm
OP RENTAL YIELD	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	Natural logarithm
OP SERVICE REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	7	-	-	Natural logarithm
TITANIUM REAL ESTATE	Apppendix 1	Quarterly	13	46 %	Linear interpolation	Natural logarithm
ÅLANDSBANKEN REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	27	4 %	Linear interpolation	Natural logarithm
OVERALL		Quarterly	145	5 %		
LEVERAGE						
EQ CARE PROPERTIES	Fund manager, Appendix 1	Quarterly	26	-	-	Categorical variable transformation, 55% in one category
EQ COMMERCIAL PROPERTIES	Appendix 1, Fund manager	Quarterly	19	-	-	Categorical variable transformation, 84% in one category
EVLI RENTAL YIELD	Fund manager, Appendix 1	Quarterly	6	-	-	Categorical variable transformation, 100% in one category
FIM REAL ESTATE	Fund manager, Appendix 1	Quarterly	21	-	-	Categorical variable transformation, 66% in one category
OP RENTAL YIELD	Appendix 1,	Half-yearly	26	65 %	Linear interpolation	Categorical variable transformation, 85% in one category

OP SERVICE REAL ESTATE	Fund manager, Appendix 1	Quarterly	7	-	-	Categorical variable transformation, 100% in one category
TITANIUM REAL ESTATE	Appendix 1	Quarterly	13	46 %	Linear interpolation	Categorical variable transformation, 85% in one category
ÅLANDSBANKEN REAL ESTATE	Appendix 1	Quarterly	27	11 %	Linear interpolation	Categorical variable transformation, 93% in one category
OVERALL		Quarterly	145	18 %		
NUMBER OF OWNERS						
EQ CARE PROPERTIES	Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	First logarithmic difference
EQ COMMERCIAL PROPERTIES	Suomen sijoitustutkimus (2019b)	Quarterly	19	-	-	First logarithmic difference
EVLI RENTAL YIELD	Suomen sijoitustutkimus (2019b)	Quarterly	6	-	-	First logarithmic difference
FIM REAL ESTATE	Fund manager, Appendix 1	Quarterly	21	-	-	First logarithmic difference
OP RENTAL YIELD	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	26	-	-	First logarithmic difference
OP SERVICE REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	7	-	-	First logarithmic difference
TITANIUM REAL ESTATE	Appendix 1	Quarterly	13	46 %	Linear interpolation	First logarithmic difference
ÅLANDSBANKEN REAL ESTATE	Appendix 1, Suomen sijoitustutkimus (2019b)	Quarterly	27	-	-	First logarithmic difference
OVERALL		Quarterly	145	4 %		
GDP CHANGE	Tilastokeskus (2019b)	Quarterly	145	-	-	First absolute difference
CPI	Tilastokeskus (2020)	Quarterly	145	-	-	First logarithmic difference
MORTGAGE SPREAD	Bank of Finland (2020a), Bank of Finland (2020b)	Quarterly	145	-	-	First absolute difference
HOUSING PRICES OF FINLAND	Tilastokeskus (2019c)	Quarterly	145	-	-	First logarithmic difference
OMXH	Datastream database	Quarterly	145	-	-	First logarithmic difference
REAL	Datastream database	Quarterly	145	-	-	First logarithmic difference

6. EMPIRICAL ANALYSIS AND RESULTS

Aim of this thesis was to discover potential variables and methods in explaining Finnish real estate fund returns. The previous chapters presented key studies conducted, variables used and their respective methods in analyzing these variables. This chapter is dedicated to analyzing chosen variables in explaining selected fund returns in practice. It is expected that the chosen variables act similarly as in the previous studies. First correlation matrix is presented and analyzed. Next, unit roots are tested, and panel analysis are presented and explained.

6.1 Correlation matrix

With all the necessary variables transformed, Pearson correlations were first studied, this can be seen in table 6. The correlation matrix can give direction of linear relationship between dependent variable and independent variables (Baltagi, 2011, 34). Also, if regressors are highly correlated, there might be a problem called multicollinearity, which results in a breakdown of the least squares estimation (Hill et al., 2011, 137) First discovery can be seen from the table 6, there seem to be no multicollinearity problems since there is no high correlations visible. Second, there is negative correlation with total returns and change in housing prices. Also, correlation between CPI change and real estate fund total returns is negative. This is curious since price inflation should increase total returns as real estates are appreciated.

Table 6. Correlation matrix

Variable	*Total return*	*ΔREAL*	*ΔOMXH*	*Ln total net assets*	*High fee*	*Highleverage*	*Δnumber of owners*	*ΔGDP change*	*ΔMortgagespread*	*ΔFinnish housing prices*	*ΔCPI*
Total return	1										
ΔREAL	0.1747	1									

ΔOMXH	0.1048	0.6800	1								
Ln total net assets	-0.1262	-0.1067	-0.0722	1							
High fee	-0.0677	0.1170	0.0538	-0.1380	1						
High leverage	0.2907	0.0050	-0.0543	-0.0654	0.1114	1					
ΔNumber of owners	0.1389	0.1886	0.1332	-0.4195	0.0350	-0.3208	1				
ΔGDP change	0.1699	0.2057	0.0841	-0.0570	0.1005	-0.0219	0.0618	1			
ΔMortgages pread	-0.0925	-0.1466	-0.0917	0.0682	-0.0175	-0.0982	-0.1266	0.2007	1		
ΔFinnish housing prices	-0.0090	-0.0453	0.1536	0.0465	-0.0487	-0.0260	0.0448	0.0896	0.0546	1	
ΔCPI	-0.1609	-0.2465	-0.0515	0.1717	-0.1165	-0.1140	-0.0207	-0.1401	0.1564	0.4140	1

Regarding to the other explanatory variables, potential index comparison, correlation matrix shows that REAL correlates to total return 0.175, whereas OMXH correlates only 0.105. This indicates that REAL might be better index for real estate fund returns. Total net assets have negative correlation to total returns, like high fee. High leverage and growth variables have positive correlation, with values of 0.29 and 0.139. GDP change has positive correlation with total return with value of around 0.17 and change in housing prices have negative correlation with total returns, value of -0.009. Mortgage spread also has negative correlation value of -0.0925. CPI change instead have correlation of -0.16 with total return variable.

6.2 Unit root tests of variables

In table 7 possible unit root were tested. The table 7 values present p-values of Fisher-type unit root tests based on augmented Dickey-Fuller tests, null hypotheses stating that all panels contain unit roots. If p-value is low and null hypotheses can be rejected, at least one panel is stationary. Unit root tests were made with constant and lag 0 and 1. Also, time trend was included with different lags. From table 7, there can be seen, that in original series, some variables indeed have unit roots and must be transformed. As presented in the data section, data transformations were made to induce stationarity. The table 7 transformed series present variables that

were transformed, and as we can see, variables seem to be generally stationery and analysis can be continued.

Table 7. Unit root tests of variables

Original series				
Lag	0	1	0	1
Variable	-	-	time trend included	
Total return	0.00	0.00	0.00	0.00
Total net assets	0.00	0.82	0.94	0.53
Number of owners	0.00	0.44	0.00	0.00
Fee	1	1	1	1
Leverage	0.00	0.00	0.00	0.00
ΔREAL	0.00	0.04	0.00	0.00
OMXH	0.00	0.94	0.00	0.87
Hprice whole Finland	0.52	1	0.00	0.01
Mortgagespread	0.31	0.64	0.99	0.99
GDP change	0.74	0.67	0.66	0,92
CPI	1	1	0.58	0.76
Transformed series				
Lag	0	1	0	1
Variable	-	-	time trend included	
Ln total net assets	0.00	0.00	0.00	0.00
ΔNumber of owners	0.00	0.00	0.00	0.00
Highfee	-	-	-	-
Highleverage	-	-	-	-
ΔOMXH	0.00	0.00	0.00	0.00
ΔHprice whole Finland	0.00	0.00	0.00	0.00
ΔMortgagespread	0.00	0.00	0.00	0.06
ΔGDP change	0.00	0.03	0.00	0.53
ΔCPI	0.00	0.02	0.00	0.14

Note: Fisher-type unit-root tests based on Augmented Dickey Fuller tests. P-values of Inverse chi-squared.

6.3 Panel analysis

Panel analysis were made with Stata statistical program. To test model diagnostics, Stata requires the model first to be tested with fixed effects model and then random effects model. As a postestimation, Hausman test can be run, with Breusch and Pagan Lagrangian multiplier test for random effects, as well as Wooldridge test for

autocorrelation in panel data as postestimation for serial correlation and Friedman's test of cross-sectional independence. Also, relevant model significances are presented in the table with relevant explanatory power measurement R-squared. The following chapters and tables exhibit the results of various panel analysis made, results are also discussed and explained.

6.3.1 Panel analysis results

In this section, various combinations, 4 models in the table 8, are tested to find the best fit in explaining Finnish real estate funds returns. The first models include all fund specific variables which are added with additional macroeconomic variables to improve the model. If variables are found not significant or not improving explanatory power R-squared, they are dropped from further evaluation. In table 8, the fixed effects model R-squared within is reported, while in random effects model the overall R-squared is reported. Also, if coefficients and their signs are irrational, they might not be suited for optimal model. From models M1 – M4 of table 8, it can be stated, that there are 136 observations withing 8 funds, which can be considered reasonable for the analysis. In choosing the best model for analysis, the models were tested for random effects with Breusch-Pagan test. Also, Hausman tests were conducted and proper model was selected based on these tests. Also, serial correlation and cross-sectional dependence were tested and not found in the models. From table 8 can be seen that, the models are significant at 5 percent risk level.

The first model M1 RE in table 8 R-squared is 0.1492, stating that the model explains around 14,9 percent of the variation in quarterly total returns of Finnish real estate funds. This can be considered moderate; the model has some explanatory power to the fund returns. First it must be stated that intercept coefficient is around 1.23 and it is statistically significant. From the variables used, it seems that size variable as in total net assets is not significant at 5% risk level. Also, the coefficient -0.13 is rather small considering its interpretation, stating that there are no significant

diseconomies of scale in fund returns. The growth variable in the first model of table 8, which is transformed from number of owners, coefficient has a positive value of 1,29 and it is statistically significant at 1% risk level. The result can be interpreted that increase of growth by 1 percent, increases total return by approximately 1,29 percent. In the thesis sample, as the fund is ageing, the growth declines. From this thesis sample it seems, that growth in the funds have exponentially decaying properties. The results of growth variable can be considered logical. This is because as the real estate fund is substantially growing, the assets consist for a large proportion of development projects as the resources are allocated to investments. As the assets are channeled to develop real estates, the total return consists largely of capital growth instead of net income return. Also, Capital growth increases substantially when real estates are developed and appraised at current market values times the completion rate in development phases.

High fee variable in table 8 in the first model M1 RE, coefficient can be seen be negative at a value of -0.083. The variable is found not significant at 5 percent risk level in this model. Although not significant, coefficient sign and estimate seem logical considering variable fee properties. The threshold for this indicator variable was set to 2.25 percent. The fee represents operating expenses of the fund; thus, it would be logical to see that funds with higher fees could have smaller returns. The decreasing effect could come directly from the charge that the asset company takes from the value of the fund, but also possibly from other attributes, such as behavior of the investors due to higher fees. In model 1, high fee funds showed around 8,3% lower total returns. Nevertheless, the fee variable was not significant in this model at 5% risk level.

In table 8 M1 RE variable high leverage is found significant at 5 percent risk level, coefficient estimate of 0.473. The results mean that if the fund has leverage ratio above 25%, the fund return is around 47.3% higher than the funds that have lower leverage ratio. Of course, there is a risk considering using more debt. With the risk in mind, it seems that there are significant benefits using above 25% leverage in

real estate funds in Finland. The last variable in M1 RE, created index ΔREAL, is found to be not significant at 5% risk level. Also, the coefficient has a positive value of 0.907, stating that increase in REAL index by one percent, increases real estate fund return around 0.9 percent.

In the second model M2 FE in table 8, we can see that fixed effect model is appropriate according to Hausman test as well as F test for no fixed effects. Also, fund specific variables have similar coefficient signs, magnitudes, and significances as in the first model. Added ΔOMXH variable coefficient of 0.62 in the model two states that one percent increase in OMXH total return increases Finnish real estate funds total returns by around 0,6 percent. However, the variable was not statistically significant at 5 percent risk level. Overall, M2 FE explanatory power R^2 is around 15.4%, similar to first model.

In the M3 RE in table 8, diagnostics confirm the use of RE model and fund specific variables act similarly as in previous models. Added variable changes in Finnish housing prices coefficient is approximately 4.15 and it is not statistically significant at 5 percent risk level. The coefficient estimate sign and size can be considered logical. Added variable ΔCPI coefficient is around -45.6 stating that one percent increase in consumer prices, inflation, decreases fund returns by 45.6 percent, though coefficient is not statistically significant. Coefficient size seems to be quite large, also coefficient standard error is quite large, stating not good precision. Overall M3 RE explanatory power R^2 is around 15.8%.

In the M4 FE in table 8, fund specific variables act similar to previous models and model diagnostics confirm the use of FE model. Added variable change in mortgage spread coefficient is around -0.039 and it can be interpreted that 1% decrease in mortgage spread results in 4% increase in Finnish real estate funds total returns, ceteris paribus. The sign and magnitude of mortgage spread can be seen to be reasonable and logical, though coefficient it is not significant at 5% risk level. Variable ΔGDP change in M4 FE coefficient is around 0.12 and it is not found

significant at 5 percent risk level. It can be interpreted that 0.1 percent change in GDP change from previous year results 1,2 percent parallel change in funds total returns. Result seems proportional and logical. Overall model 4 offers explanatory power R-squared of 16.2% and is significant at 5%.

Table 8. Panel Analysis

Variable\Model	*M1 RE*	*M2 FE*	*M3 RE*	*M4 FE*
Intercept	1.230053** (.5653618)	1.648119*** (.6264285)	1.117849** (.5496419)	1.595062** (.647879)
ln total net assets	-.1368263 (.1064781)	-.0695451 (.1025408)	.0111192 (.0926219)	-.0576091 (.1035534)
Δnumber of owners	1.29555*** (.4499666)	1.303306*** (.4674313)	1.416446*** (.4518341)	1.339697*** (.4681319)
highfee	-.0832051 (.2350359)	-.0507727 (.2768461)	-.0833143 (.2233241)	-.0932997 (.2796727)
highleverage	.4731703*** (.1653581)	.3881106** (.172571)	.4762336*** (.1661227)	.3960704** (.1736626)
ΔHpricewholefinland			4.150006 (8.315063)	
Δmortgagespread				-.039593 (.3774753)
ΔGDP change				.1185953 (.0939318)
ΔCPI			-45.62033 (32.44087)	
ΔREAL	.9076869 (.8722262)			
ΔOMXH		.6218403 (.9495964)		
Number of observations	136	136	136	136
R^2	0.1492	0.1535	0.1579	0.1617
model significance p-value	0.00***	0.00***	0.00***	0.00***
Hausman test p-value	0.20	0.03**	0.0649*	0.00***

Breusch and Pagan Lagrangian multiplier test for random effects p-value	0.00***	0.00***	0.00***	1
F test for no fixed effects p-value	0.00***	0.00***	0.00***	0.00***
Wooldridge test for autocorrelation in panel data p-value	0.89	0.82	0.51	0.20
Friedman's test of cross-sectional independence p-value	0.99	0.97	0.99	0.80

*Note: *P<0.1 (significant at 10%); **P<0.05 (significant at 5%); ***P<0.01 (significant at 1%). Standard errors are shown in brackets.*

6.3.2 Panel analysis results with lagged values

In this chapter, the models are added with the lagged values of some variables to test whether the effects are visible with a lag. In Table 8, several models were tested, and variables found to be significant and add value to the model are included. In table 9, two models are tested with lagged values. The lags are limited to 1 quarter due to the short dataset. Both models are tested with Hausman test and Breusch and Pagan Lagrangian multiplier test for random effects, which confirm the use of random effects model (RE). Also, serial correlation and cross-sectional dependence are tested and not found in the models.

In the first model M1 RE in table 9, model is significant at 5% risk level. Also, explanatory power R^2 is around 19.9 percent, which is an improvement from the previous models. The constant coefficient is around 1.11 and it is significant at 5 percent risk level. Variable Δnumberofowners stating growth of the funds, coefficient is approximately 1.03 and not significant. Interpretation of coefficient is that one percent increase in growth increases fund total returns by 1%, ceteris paribus. High leverage was also included in the model since it was significant in previous models

in table 8. In table 9 M1 RE we can see that high leverage coefficient is significant and value is at 0.616, stating that funds with high leverage have around 62% higher total returns. Also, size variable was included in the models as a control variable though it was not statistically significant in previous models.

Change in mortgage spread was tested with a lag of 1, since according to Walentin (2014), potential drivers for mortgage spread innovations are changes in prepayment risk premium, changes in mortgage industry competition, changes in bank's balance sheets or liquidity, changes in financial regulation, changes in financial securitization and changes in risk aversion of the financial system, among others. These effects could be seen to have an effect to fund total returns with a lag and must be tested in the model. In table 9 M1 RE, change mortgage spread lagged with 1 quarters coefficient has a value of -1.04. The variable is also statistically significant at 5 percent risk level. The coefficient indicates that 0.1% change in mortgage spread one quarter earlier, drives 10% contrary change in total return of real estate funds, ceteris paribus. When mortgage spread is low, general financial system risk aversion can be considered at low levels. This stimulates the economy and real estate funds total returns. Also, as the financial system is tightening the risk premium, the rise of mortgage spread weakens the real estate funds returns. To be noted, the time frame selected is the time when there have been efforts to revive economy, visible in low mortgage spread especially in late 2013 and early 2018. The results also indicate that timing of the fund establishment in relation to economic conditions might be influential to fund returns. For example, Tomperi (2010) found in his study, that funds that are established during lower GDP growth, perform better.

In table 9 M1 RE ΔOMXH coefficient is around 0.113 and it is not significant at 5%. The variable was tested also with lagged values of variable but found not improving the model. Results can be interpreted that one percent change in ΔOMXH equals 0.11 percent change in real estate fund returns. The variable was chosen to the

model since it performed better than ΔREAL in the models in table 8. ΔREAL was also tested with lagged values but found not to be significant.

In the second model M2 RE in table 9, ΔOMXH is replaced with ΔGDP change and added with variable ΔHpricewholefinland with a lag of 1, since these variables showed potential in previous models in table 8. Coefficient of ΔHpricewholefinland lag1 is around -2.38 and it is not statistically significant. Coefficient of ΔGDP change is around 0.218 and it is significant at 5% risk level. Coefficient can be interpreted that 0.1 percent change in GDP change from previous year results 2,2 percent parallel change in funds total returns. Other variables which are included in both models have similar signs and interpretations. The overall explanatory power of table 9 M2 RE is 24.3%, which is higher than in the first model.

Table 9. Panel analysis with lagged variables

Variable\Model	*M1 RE*	*M2 RE*
Intercept	1.109176** (.555612)	1.056642* (.5403442)
ln total net assets	-.020483 (.0904881)	-.0091817 (.0882025)
Δnumber of owners	1.025152 (.6607991)	.9523432 (.6526352)
highfee		
highleverage	.6159314*** (.1553366)	.6084022*** (.1521848)
ΔHpricewholefinland lag1		-2.380352 (7.075504)
Δmortgagespread lag1	-1.03745*** (.364259)	-1.266607*** (.3596152)
ΔGDP change		.2177261** (.0886276)
ΔCPI		
ΔREAL		
ΔOMXH	.112899 (.9076076)	
Number of observations	129	129
R^2	0.1986	0.2433
model significance p-value	0.00***	0.00***
Hausman test p-value	0.0642*	0.16

Breusch and Pagan Lagrangian multiplier test for random effects p-value	0.00***	0.00***
F test for no fixed effects p-value	0.00***	0.00***
Wooldridge test for autocorrelation in panel data p-value	0.53	0.41
Friedman's test of cross-sectional independence p-value	0.98	0.54

Note: *P<0.1 (significant at 10%); **P<0.05 (significant at 5%); ***P<0.01 (significant at 1%). Standard errors are shown in brackets.

Overall, only lagged values of changes in mortgage spread were able to be statistically significant and bring explanatory power to the models. Lagged values of other variables were also tested, but there was no improvement to explanatory power thus not further studied. Effects of mortgage spread changes to economy are indirect and thus it is logical that effects are visible to Finnish real estate fund returns with a lag. From the results, it is visible, that table 9 model's explanatory power, considering models R-squared, is higher than models in table 8, hereby showing better accuracy in explaining Finnish real estate fund returns on a quarterly data. On the hand, using lagged values shortens the dataset, especially from the beginning. The effects can be seen in table 9, where variable Δnumberofowners results are not statistically significant. This is because the highest growth is visible in the beginning of the fund inception, which is partially cut in creation of differenced variables and further in creation of lagged variables.

6.4 Reliability and validity of the results

In research, quality of the study is usually evaluated with concepts reliability and validity. Reliability concerns about the consistency of the results; can the results be replicated. If research reliability is good, the results are similar in replicated analysis. Validity instead addresses the accuracy of the analysis; does the research measure

what it is supposed to measure. Validity can be divided into internal and external validity. (Metsämuuronen, 2009, 74) Assessing internal validity in quantitative analysis, causality is key, (Martin & Bridgmon, 2012, 59) External validity on the other hand concerns the generalization of the results to the established theories and previous studies (Metsämuuronen, 2009, 74)

First, literature review is critical to achieve consensus of the variables and methods used. In the chapter 3, comprehensive assessment is made regarding to the previous studies until cumulation of the variables and methods is visible. To be mentioned, for real estate funds there are quite small amount of studies made which limits objectivity. However, all the variables used in this study are used in several studies as is the case in reviewed and used methods. The methods selected are in fact the most used methods in studied literature.

It can be argued that data gathering is crucial face of the analysis. Real estate funds in Finland are few and the data available is scarce. Obviously, these facts limit the reliability of the thesis. The writers aim is to use all the data available to achieve generalizable results of the population. In this study, 8 out of 14 real estate funds in Finland for small investors are examined, which can be considered a decent effort for selected time. Also, for the mixed-data frequency conversions in variable used, there might be, or they might cause errors, as well as gathering data phase. Some of the data required transformation to improve their attributes. Even though methods used are widely used, it must be stated that there is always a risk of error in using data transformations.

In empirical part, the panel analysis, there were numerous tests made to check correctness of the model and goodness of fit. Model selection stems from literature and final selections are made with data at hand in mind. The results can be seen to be kindred to the results in previous literature, after all, the results from previous studies are ambiguous for each variable. The selected time periods and regional selections differ in each study, which causes unique properties for each research.

However, in this study the results seem consistent to some extent with previous research. This gives solace to the writer.

7. CONCLUSIONS

Aim of this research was to study Finnish real estate funds and give investors, and fund managers, insight about the fund performance drivers. The first chapters, introduction and background introduced small overview of Finnish economy and real estate funds general. Also, the research questions were introduced. In third chapter, the prior literature was explored and compiled in efforts to gain knowledge of used methods in the analysis and potential variables for the analysis. The fourth chapter presented the methodology. With knowledge from previous studies, the data was gathered and presented in chapter 5. Empirical analysis in chapter 6, shed light on the data with panel analysis and selected models.

Purpose for this last chapter is to aggregate research content and discuss of empirical analysis findings. The research questions from chapter 1.2 are also explicitly answered in this chapter and discussed their potential meaning. The study is concluded with limitations of the thesis and possible future research topics presentation.

7.1 Main findings and contributions

In recent years, Finnish economy has been growing, with assistance of invigorating monetary policy. The interest rates have been lowering for a decade. With cheap financing available, real estate investment market in Finland has been growing to new heights. Also, real estate funds in Finland have been growing in numbers and in assets under management. The panel analysis in chapter 6 gave insight of the

real estate funds in Finland and their total return drivers. Purpose of the results was to answer main research question, which is as followed:

- *What are key elements found in explaining Finnish real estate fund returns in chosen period?*

From the panel analysis results in chapter 6.3, in table 8 and 9, high leverage, threshold at 25 percent, in real estate funds have a positive effect on total returns of the funds. The results were statistically significant in all models, coefficients around 0.39 to 0.62. Interpretation of the results is that funds with leverage above 25 percent, have around 39 to 62 percent higher total returns. From previous studies Heuvel & Morawski (2014) among others found positive relationship with leverage and fund returns. In this thesis, examined time period has been in Finland rather stable. Generally, more debt means more risk. With the results can be indicated that when there is economic turbulence, the funds with higher leverage might be negatively impacted more than the funds with lower leverage. However, in Finnish real estate fund market, as discovered also in Australian real estate fund market by De Francesco (2007), leverage ratios have been rather conservative, considering real estate sector attributes. This suggests, at least partially, that fund companies and managers manage the risk associated with the use of debt financing. On the other hand, not using the full potential of assets in favorable conditions leads to weaker total returns, which is not in the favor of investors. Overall, this thesis results give understanding to investors and fund companies regarding the use and effect of leverage in real estate funds in Finland and its effects to total returns.

Considering return drivers in Finnish real estate funds, growth of the funds has also statistically significant positive effect on fund returns, stated in empirical analysis in table 8 and table 9. Growth variable represents growth in number of owners and is used as a proxy for growth and fund capital flows. There were mixed results from literature concerning growth and fund capital flows, thus leaving results ambiguous. Tables 8 and 9 results indicate that 1 percent change in growth results parallel 0.95

to 1.42 percent change in total return. Thinking the results in broader meaning, it can be said that growing the real estate funds is important to all participants. Fund companies receive more recourses in terms of fees to develop their operation. The fund itself gets more broadly diversified when more investments are introduced. Investors receive higher total returns as the fund grows and more investment projects are started, which can be considered a natural phase of the funds. One interesting investor perspective remark is, that there might be potential for optimizing investment timing to funds high growth period in effort to achieve above average total returns in real estate funds. Obviously, thesis empirical analysis does not cover all complex situations, where multiple simultaneous effects shape fund returns. Also, the selected time period itself influence fund return behavior. However, in this thesis, fund growth is one of the key return drivers.

Size on the other hand, in terms of total net assets, have no significant effect on total returns of the funds in this study, as can see in table 8 and 9. Coefficients interpretations of the panel analysis are close to zero, stating no statistically significant causality in variables. Previous literature shows mixed results, O'Neal & Page (2000) study size had no effect on returns. Mattarocci & Siligardos (2015) instead found negative causality in pre-crisis period, positive causality in crisis period and statistically not significant causality for the whole sample period in their study. The timeframe selected in this thesis is not the most turbulent time for investments, which might be one factor for size to play no role in total returns. In crisis period it seems logical for larger funds to have better diversification and thus better returns. Also, from the thesis data it seems, that the variation of total returns is smaller for bigger, and older, funds and returns seem to converge to around average return. This might indicate diversification benefits for bigger funds.

Fees, as in operating expenses in percentage, seem to have negative effect on total returns, but results were not statistically significant in the models in table 8. According to the created high fee variable with threshold of 2.25 percent, funds with high fees seem to have lower returns around 5 to 9 percent. In previous studies

results were mixed, still for example O'Neal & Page (2000) stated in their study that that expense ratio had negative and significant relation to return and Philpot & Peterson (2006) discovered in their study, that funds with higher alpha, have higher management fees. Interpretation of results is that higher fees might cause lower total returns in general as the fund company charges their fees. Nevertheless, the variable was not found significant and thus strong evidence of causality is missing.

From the panel analysis results in chapter 6.3 table 8, we can see that in Finnish real estate fund returns, change in created real estate company index returns, ΔREAL, have no statistically significant dependency in panel analysis. In panel analysis M1 RE in table 8, the results were not significant at 5 percent risk level. The coefficient is around 0.9, stating that one percent change in REAL causes around 0.9 percent parallel change in real estate fund total returns. The Helsinki stock exchange ΔOMXH variable has no statistically significant explanatory power in panel analysis done and the coefficient results were between 0.11 to 0.62. Overall, results are kindred to previous literature, where index or stock markets are used in explaining fund returns even though results were not statistically significant in empirical results. Fuerst & Matysiak (2013) found that stock market has significant parallel lagged explanatory power to fund returns. Many studies used fund indexes, when available, such as Tomperi (2010), ANREV (2013), Mattarocci & Siligardos (2015), and found also positive relationship with index performance and the performance measures of funds. When considering results in broader sense, it seems that Finnish stock markets and real estate stocks conditions can be influential to real estate funds' performance. This is important notion when considering timing investing into real estate funds. Carefully examining real estate companies in relevant stock market, investor can have unique insight before effects are visible in real estate funds. Observed causality also verifies that real estate funds cannot fully avoid stock market sentiment or shocks to investment markets. Also, when raising a diversified portfolio, the results can be helpful.

Adding macroeconomic variables to the model, change in gross domestic product is found significant variable in explaining real estate fund returns, as can be seen in empirical analysis at table 8 M4 FE and table 9 M2 RE. However, the variable was not statistically significant in every model. As stated in the results section 6.3, results indicate that 0.1 percent change in GDP, compared to previous year, results parallel change of 1.2 to 2.2 percent in fund returns. From previous literature, Fuerst & Matysiak (2013) and Tomperi (2010) among others found GDP to be significant in explaining fund returns. One reason for effect of GDP change and fund returns is the examined time period. As market is performing well or the economy is being revived, funds are established and invested in. Contrary, as the economy slows down, the negative effects will be visible. Nevertheless, results point out that economic conditions are influential to Finnish real estate fund returns and should be considered. For the fund companies and managers, examining GDP changes can give information to risk management. For investors GDP changes in relation to real estate funds returns, imply about investment timing and real estate fund return behavior considering portfolio allocation.

As with GDP change, mortgage spread, but with a lag, is also found statistically significant variable affecting Finnish real estate fund total returns in this thesis. In table 8 where no lagged values were used, the results were not statistically significant. From previous literature, for example Akinsomi et al. (2016) found term spread to have predictive power to the REIT returns. Hännikäinen (2016) found that mortgage spread has even better predictive power to economic activity than term spread. In table 9, this thesis results indicate that 0.1% change in mortgage spread one quarters earlier, drives 10 to 12 percent contrary change in total return of real estate funds, ceteris paribus. Interpretations of results are similar to GDP change. The selected period reflects only part of the mortgage spread effect to real estate fund total returns. Also, period examined has started from reviving economic phase, which is reflected in the mortgage spread effect on real estate fund returns. Overall, as this thesis demonstrates, interest rates should also be considered, when studying Finnish real estate fund performance. Especially mortgage spread shows nuances, which might not be visible for example in key ECB interest rates.

Changes in Finnish housing prices is found not significant at explaining Finnish real estate fund returns in empirical analysis table 8 and table 9. Results point out, though without statistically significant proof, that one percent change in housing prices causes around 4 percent parallel change in real estate fund returns. Variable lagged with one quarter was also studied in table 9 second model, but results were not statistically significant. Also, inflation effects were examined in table 8 third model. Results were not statistically significant or logical. In broader sense, housing prices and inflation can be considered to reflect appraised values of real estates in real estate funds. Every time when fund value is evaluated, real estates are valued at market values. Obviously, these market values reflect current real estate market state, as real estate investors use conservative valuations, sales comparison method is most used, but also income approach is used (Hall, 2014). One of the reasons for the results being statistically insignificant, might be that examined funds invest to all kinds of real estates, not just houses. This was recognized, but in lack of better proxy accepted. In analysis, changes in housing prices results were more logical with positive causality. This thesis results on housing prices and inflation effects on fund returns give some insight for fund companies as well as investors, of general potential and direction of real estate fund return development by looking at local real estate markets and inflation.

Also, sub-research questions widen and deepen understanding of the results. The first sub-question was:

- *How well discovered key variables explain Finnish real estate fund returns in chosen period?*

The first models in table 8 explain around 15 to 16 percent of the variation in Finnish real estate fund total returns. The second set of models in table 9 with selected variables and lagged values explains around 20 to 24 percent of the variance in

Finnish real estate fund total returns. Results and interpretations of the coefficients are similar for relevant variables in different models. The explanatory power of the models can be compared with previous literature. Obviously, these studies used different models and thus cannot be fully compared but can give perspective in respect to this thesis findings. The best models regarding R-squared, Fuerst & Matysiak (2013) model explained around 70%, Tomperi (2010) model explained around 57% of the variation, Mattarocci & Siligardos (2015) model explained around 36%, Heuvel & Morawski (2014) model around 25%. With these results, the thesis models R-squared can be considered satisfactory.

The second sub-question was as followed:

- *Can some of the chosen variables be used as an index for Finnish real estate funds?*

Comparing potential indexes in table 8 and 9, it is considered that Finnish housing prices, inflation, local stock market or created real estate stock index could explain Finnish real estate funds returns. Interesting was that Helsinki stock exchange total return index as well as REAL did not provide explanatory power to the Finnish real estate fund returns. Also changes in housing prices and inflation were not statistically significant in explaining fund return variations. Examining previous literature indexes used, Rodriguez & Romero (2014) found that index explanatory power to be around 90%. Alcock et al. (2013) discovered also that fund performance is almost directly comparable to the return on the underlying real estate market. This indicates that much improvement for accurate benchmark index in Finnish real estate funds is needed in further research. Perhaps as the number of Finnish real estate funds increases and the assets invested in them, the funds themselves can be used to create comprehensive index for general Finnish real estate fund performance. With these results, it seems, that fund specific factors and macroeconomic variables such as GDP and mortgage spread explain majority of the variation in Finnish real estate fund total returns in this thesis.

7.2 Limitations and suggestions for further research

The main limitation of this study can be argued to be lack of accessible extensive data. Clearly, this can be explained, at least partially, with the fact that current real estate funds in Finland are quite young. Nevertheless, amount of data limits usable methods to more static models. Age of the fund limits also examined period. Since the time period for some of the funds is less than five years, the changes in fund characteristics or market conditions are not fully visible. In examined period, the market conditions have been rather stable. This creates a research gap to study Finnish real estate funds in economic turbulence, which is the state in 2020, because of corona virus.

In further studies, as the funds mature, there are possibilities to create more dynamic models with big data. For example, it would be interesting to study Finnish real estate funds with dynamic models, such as vector autoregressive model, used by Downs et al. (2016). Also, with more extensive data, for further studies, quest and creation of accurate benchmark index would be useful for the fund companies and for the investors.

One aspect to be considered in further studies, might be geographical locations of the investments. Kurzrock et al. (2009) studied German real estate funds returns compared with tailored property databank benchmark. They found that main explanatory variables to the returns were asset allocation geographically and fund type classification, institutional funds performing better. For example, the Finnish real estate funds invest to different areas in Finland and thus have different portfolio allocations, which could be used in explaining fund returns. Also, this thesis does not separate funds regarding the property sector. With more accurate definitions to different categories, there is possibility to achieve greater explanatory power to the model.

All things considered; this thesis provides common performance drivers for Finnish real estate funds in selected period. Especially fund specific attributes of Finnish real estate funds are rarely compiled together for quantitative analysis.

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APPENDICES

Appendix 1. Sources of the empirical research

eQ (2013a) eQ hoivakiinteistöt Q2 2013. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2013b) eQ hoivakiinteistöt Q3 2013. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2014a) eQ hoivakiinteistöt Q4 2013. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2014b) eQ hoivakiinteistöt Q1 2014. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2014c) eQ hoivakiinteistöt Q2 2014. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2014d) eQ hoivakiinteistöt Q3 2014. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015a) eQ hoivakiinteistöt Q4 2014. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015b) eQ hoivakiinteistöt Q1 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015c) eQ hoivakiinteistöt Q2 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015d) eQ hoivakiinteistöt Q3 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015e) eQ liikekiinteistöt Q1 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2015f) eQ liikekiinteistöt Q3 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016a) eQ hoivakiinteistöt Q4 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016b) eQ hoivakiinteistöt Q1 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016c) eQ hoivakiinteistöt Q2 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016d) eQ hoivakiinteistöt Q3 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016e) eQ liikekiinteistöt Q4 2015. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016f) eQ liikekiinteistöt Q1 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016g) eQ liikekiinteistöt Q2 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2016h) eQ liikekiinteistöt Q3 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017a) eQ hoivakiinteistöt Q4 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017b) eQ hoivakiinteistöt Q1 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017c) eQ hoivakiinteistöt Q2 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017d) eQ hoivakiinteistöt Q3 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017e) eQ liikekiinteistöt Q4 2016. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017f) eQ liikekiinteistöt Q1 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017g) eQ liikekiinteistöt Q2 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2017h) eQ liikekiinteistöt Q3 2017. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2018a) eQ hoivakiinteistöt Q4 2017. Helsinki, eQ-Rahastoyhtiö Oy.
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eQ (2019c) eQ hoivakiinteistöt Q2 2019. Helsinki, eQ-Rahastoyhtiö Oy.

eQ (2019d) eQ hoivakiinteistöt Q3 2019. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2019e) eQ hoivakiinteistöt KIID. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2019f) eQ liikekiinteistöt Q4 2018. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2019g) eQ liikekiinteistöt Q1 2019. Helsinki, eQ-Rahastoyhtiö Oy.
eQ (2019h) eQ liikekiinteistöt Q2 2019. Helsinki, eQ-Rahastoyhtiö Oy.
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Ålandsbanken (2019d) Ålandsbanken asuntorahasto KIID. Maarianhamina, Ålandsbanken Rahastoyhtiö Oy.
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Appendix 2. Real estate index companies

Company	Beginning in the index
YIT	2013Q1
SRV	2013Q1
CAVERION	2013Q4
LEHTO	2016Q3
INVESTORS HOUSE	2013Q1
CITYCON	2013Q1
OVARO KIINTEISTOSIJOITUS	2014Q1
HOIVATILAT	2016Q3