Trying to beat the market during a major economic downfall

The effects of the 2007 crisis on the returns of specialized and diversified REITs

by

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Abstract

The 2007 recession showed that investing in health care real estate has the most potential for a good payoff. Also REITs that specialize in residential and industrial property provide a good investment option in times of economic adversity since they all had a higher return compared with diversified REITs. REITs that invest in hotel, retail and office real estate are less attractive investment option in times of crisis. Investing in a diversified REIT, however, remains a safe choice since they are only significantly outperformed by health care REITs. Furthermore, the sudden drops in REIT stock prices which are caused by market sentiment creates investment opportunities for investors who follow the value added strategy.

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1. Introduction

'The crisis is over'. This was the headline of the Dutch newspaper NRC Handelsblad on the 7th of May 2014. These four words spoken by the Dutch Minister of Finance made many people breathe a sigh of relief. Since the crisis began halfway 2007 in the US as the so called 'subprime mortgage crisis' it triggered a worldwide economic recession that lasted for seven years. Being one of the instigators of the crisis, the real estate market is hit hard. In the Netherlands the average house price has fallen with 20 percent and there are more than one million houses that have a market value that is below the outstanding mortgage debt (NRC, 2014). A so called 'underwater' mortgage.

A severe economic crisis usually forces economists and scholars to rethink economic theories that were taken for granted at that time. Or to state it like Frank (2012) when describing the change caused by the 1930s depression: "…and so the catastrophe of 1929–33 did to the certainties of laissez-faire economics what science did to nineteenth-century religion and what the slaughter of World War I did to old-fashioned patriotism: it knocked out the props."

In the field of economics we witness an ongoing battle between the dominance of liberal oriented versus the more social oriented theories. Prior to the Great Depression the prevailing economic paradigm was determined by the neoclassical theory. After the 1930s, the Keynesian economics replaced the neoclassical economics as mainstream economic thought. Subsequently the 1973 oil crisis and the following stagflation gave rise to the monetary economics of Friedman to become the standard economic paradigm. The initial thought was that the 2007 recession did not show signs of a shift in the prevailing economic paradigm (Frank, 2012). Time will tell what the impact of Piketty's 'Capital in the Twenty-First Century' will be. It is currently one of Amazon's bestsellers and according to some economists it may have the potential to cause a shift in the focus of economic policy (Economist, 2014).

A recession has also major impact in the field of finance. The 1930s crisis inspired Graham and Dodd to write their famous book titled 'security analysis'. It was the theory explained in this book that provided Warren Buffet with an investment strategy, called the 'value added' theory that made him one of the most successful investors of all time (Frazzini et al., 2012). The 'efficient market hypothesis' (EMH) introduced by Fama (1970), in turn, led many scholars to believe that the average investment fund manager cannot constantly beat the market. In the financial investment literature there is still an ongoing debate about the added value of fund managers. Some scholars argue that passively managed index funds do generate a better return than actively managed investment funds (e.g. Phalippao & Gottschalg, 2009) while others claim that actively managing does result in a higher return (e.g. Ippolito, 1989). The most recent economic crisis, again, caused a shift in the general opinion in the efficiency of markets. Shiller (2008), Fox (2009) and Nocera (2009) all argue that a strict believe in efficient markets is one of the causes of the crisis, however, the vast majority of these kind of research questions is focused on the stock market in general.
What would be the outcome of this debate if we compare the 'passive' and the 'active' investment strategy when looking at the real estate market instead of the stock market? The real estate market is often said to be less efficient compared to the stock market. According to Evans (2004) the real estate market is inefficient because contrary to the 'perfect market' the real estate market: (1) offers heterogeneous products, (2) has a limited amount of buyers and sellers and (3) market participants are not fully informed about the products offered. This leads us to think that the real estate market provides potential for the value added strategy.

The aim of this thesis is to investigate whether the claim of the EMH that markets are efficient also holds for the real estate market in times of recession. It should therefore be classified as a theory-

testing thesis. The real estate market, which is generally seen as an inefficient market, combined with a time span that represents a severe recession provides the perfect context for a close look at the durability of the EMH.

The real estate market is represented by a sample of 86 U.S. based Real Estate Investment Trusts (REITs). The choice for the American market is based on the fact that it is a large real estate market with, contrary to European market, a great uniformity in legislation and culture. This enables a better interpretation of the findings since all the sample firms are operating in the same investment climate, it ensures a 'leveled playing field'. REITs are used since these publicly listed companies are obliged to publish their results and therefore guarantee the availability of data.

Since their creation in the 1960s, Real Estate Investment Trusts (REITs) have become a major player in the Real Estate market. A REIT basically allows an individual investor to passively invest in real estate equity (Geltner et al., 2014). A REIT has a professional management team that is responsible for developing, managing, buying and selling properties. REITs that specialize in one type of real estate can be seen as actively managed funds since they try to take advantage of their specific managerial knowledge in that sector. REITs that diversify their investments over different kinds of real estate can be viewed as passively managed funds because they lack the specific managerial knowledge on one type of real estate. One would therefore expect many REITs to pursue the 'value added strategy' and specialize in one type of asset. The strong belief in the EMH, however, also has many REITs invest in different types of real estate with the main focus on diversification.

The concept of diversification is designed to alleviate the poor returns of one, or a few assets in an investment portfolio (Markowitz, 1952). But what if the entire stock market collapses, as during the 2007 recession? How does a diversified real estate portfolio perform in this scenario compared with an actively managed portfolio focused on one type of real estate? There are some signs indicating a diminishing belief in efficient markets, after the recession the Dutch REIT Wereldhave, for example, is has changed their investment strategy from a diversified portfolio to a more specialized one (Annual report Wereldhave, 2013).

The structure of this thesis is as follows: chapter two summarizes the main literature on (1) why an investor should invest in real estate and (2) how the best results can be achieved. Chapter three deals with the financial instruments that belong to the EMH, furthermore the process of gathering and analyzing the sample data is discussed. At the end of chapter three the null hypothesis and the alternative hypothesis are stated. In chapter four statistics are used to analyze the gathered data, subsequently, the most remarkable results are commented upon. In chapter five the results are discussed in detail and put in to perspective by a comparison with findings of previous studies. Chapter six gives a summary of the main findings and helps to interpret the results for investors, furthermore, the limitations and possibilities for future research are discussed.

2. Research framework

2.1 Introduction

In this section the main scientific work about investing in real estate is discussed. First the topic of 'diversification' is explained, furthermore, the literature about how to put the diversification concept into practice is discussed. The second part is devoted to literature about REITs, and the advantages and disadvantages of this investment vehicle. Then a short overview of the work on efficient markets and the value added theory is provided. The insights of these led to the creation of specialized and diversified REITs. The remainder of the literature review discusses the most important findings of studies that compared the performance of specialized REITs with the performance of diversified REITs.

2.2 Literature review

2.2.1 Real estate as an asset class

At the heart of investing in real estate lies the modern portfolio theory developed by Markowitz in 1952. Markowitz found that, in order to gain maximum returns with minimal risks, an investor should spread his investments among multiple assets. One key assumption is that the returns of these assets should not be perfectly correlated. This correlation is measured on a scale ranging from -1 to +1, the former indicating the complete opposite behavior of the asset movement and the latter the exact same behavior. In a portfolio with two equally represented assets a correlation of -1 would mean that the movement of one asset neutralizes that of the other, resulting in a risk-free portfolio.

This can be achieved by investing in a broad range of assets that are all different from each other. In practice these strategic portfolio decisions are used to divide investments in the following categories: T-bills, bonds, real estate and stocks (Hoevenaars et al, 2008). With at one end of the spectrum T-bills being almost risk-free and yielding a low return, while stocks, being the riskiest and best yielding asset, located at the other end. The risk and return characteristics of real estate fall in-between stocks and T-bills.

It is also possible to further diversify within one asset type. Investment in real estate can be split up between several types of property. Most scholars use the following classification: industrial, offices, housing and retail (Miles & McCue, 1984; Hartzell et al, 1986; Eichholtz et al, 1995; Geltner et al, 2014). Miles & McCue (1984) and Fisher and Liang (2000) are of the opinion that property types are an efficient way to diversify within a portfolio.

2.2.2 Specializing: property type versus geographical

In the literature about REITs the word 'specialized' is used extensively. It can fundamentally indicate two things: a specialization in a particular geographical area, or the focus of a REIT on a specific type of property. In this thesis the latter meaning is used. A REIT pursues a specialized investment strategy when it invests mainly in one type of real estate. According to Boer et al. (2005) there are differences in the way real estate companies diversify their investments. In the U.S. there is a tendency towards a focus on property type while European real estate companies are more likely to focus on geographical regions. Furthermore, Boer et al. (2005) mention that in the nineties, diversified REITs contained on average more than three different property types. Nowadays, this number has decreased. So diversified REITs are less diversified than they were before. Eichholtz et al. (1995) finds that geographically diversifying has the most potential for retail properties.

2.2.3 Types of real estate

2.2.3.1 Industrial

The market for industrial buildings is the smallest compared to the other categories. Industrial real estate requires the highest yield since buildings are often tailor made to the end user (Van Gool et al, 2007). These dedicated investments also result in long-term leases for industrial property up to 30 years. Since most industrial buildings are relatively simple constructions it is possible to build quickly in order to meet rising demand, resulting in only a small lag between demand and supply (Wilkinson et al, 2008). This sector comprises primarily warehouses, light-manufacturing and distribution (Hoag, 1980).

2.2.3.2 Offices

The office market is characterized by large fluctuations of supply and demand (Van Gool et al, 2007). The demand of office space is strongly dependent on employment in the service sector (e.g. Dipasquale & Wheaton, 1992). Since services are difficult to transport and require face-to-face contact the specific site of an office is important (Wilkinson et al, 2008). Recent trends in the office market are the creation of energy efficient, or 'green' buildings (Eichholtz et al, 2010) and rise of flexible workspaces lowering the square meter demands per employee. (Duffy et al, 2012).

2.2.3.3 Residential

The demand drivers for residential real estate are demographic characteristics like household-size, number of households, average age and income (Wilkinson et al, 2008). Also economic factors like consumer confidence and interest rate are important for predicting demand for residential real estate (Haughwout et al, 2011). Although generally seen as a safe investment, the housing market is also subject to severe price fluctuations (Sommervoll et al, 2010). Which is the second most valuable sector in the U.S. (Florance et al, 2010).

2.2.3.4. Retail

The retail market requires the lowest average yield of these four categories (Fuerst et al, 2011). In the U.S. retail is the most valuable sector (Florance et al, 2010). Just as with residential real estate, demand is dependent on demographic characteristics like the number of households in the catchment area and on economic elements like consumer confidence (Wilkinson et al, 2008). Also technological and social developments like the fact that more and more consumers are shopping online influence the demand for retail space (Wang et al, 2010).

2.2.3 Low correlation with stocks and bonds

The advantages of investing in real estate are mainly located in the fact that the returns are not influenced by market forces that have an impact on the stock and bond market, the so called 'market sentiment' (Geltner et al, 2014). This gives real estate the potential to gain diversification benefits in a multi-asset portfolio (Georgiev et al. 2003).

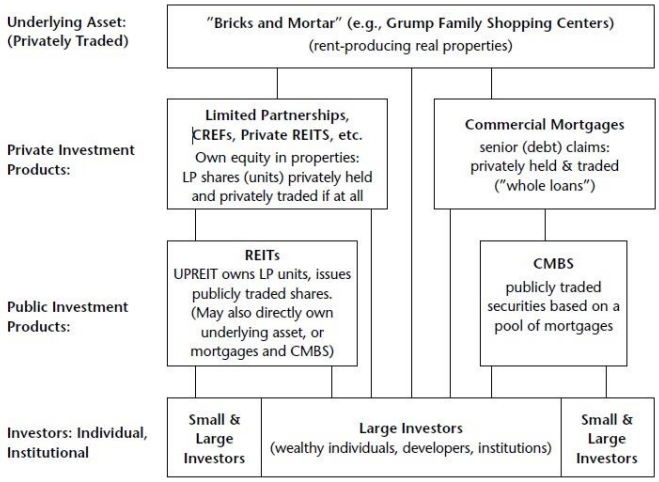
The major disadvantage of the real estate market is the fact that it is an inefficient market, especially compared to the stock market. The real estate market offers heterogeneous products, (2) has a limited amount of buyers and sellers and (3) market participants are not fully informed about the products offered for sale (Evans, 2004). This makes it difficult for investors to determine the right price for a real estate asset and results in high transaction costs (Georgiev et al., 2003). Other disadvantages of direct investing in real estate are the illiquidity of the assets and the large lot sizes (Georgiev et al. 2003). An investor must actively manage his property in order to get the optimal returns (Geltner et al, 2014).

2.2.4 Real estate investment trusts (REITs)

A real estate investment trust is an 'investment vehicle' developed in 1960 by the U.S Congress. REITs are designed to combine the best of both worlds and thereby to overcome the disadvantages of directly investing in real estate. On the one hand REITs are supposed to benefit from the market efficiency of the stock market since REIT shares are traded on the stock market. On the other hand, REIT shares are based on real estate in order to retain a diversification advantage compared with regular stocks and bonds.

Following the conception of diversification theory developed by Markowitz in 1952, REITs were designed to provide small individual investors the possibility to invest in a diversified multi-asset portfolio (Geltner et al, 2014). A REIT is a way to indirectly invest in real estate, this means that an investor does not directly own the underlying asset but indirectly via a series of layers, see figure 2.1. A REIT makes it possible to buy a share of a building, something not possible before. An indirect asset is not in itself productive, but lays a claim on the cash flow on the underlying asset (Geltner et al, 2014). This can be a 'primary' claim as is the case with a debt asset, see figure 2.2, or this claim can be 'residual' as is the case with an equity asset. The major difference between these two is that a primary claim entitles the holder to a fixed return, whereas the owner of a residual claim has a variable return depends on how the underlying asset did perform.

Figure 2.1: Securitization in the real estate market



Source: Geltner et al., 2008

Figure 2.2: The capital market

	Public Markets	**Private Markets**
Equity Assets	Stocks REITs Mutual funds	Real property Private equity Hedge funds
Debt Assets	Bonds MBS Money instruments	Bank loans Whole mortgages Venture debs & LBOs

Adapted from: Geltner et al.,2008

Until the early 1990s publicly traded REITs remained a relatively small player in the real estate market. From 1992 on we witness an increasing growth in the importance of REITs. One of the reasons is the early 1990 crisis which forced many private REITs to enlist on the stock market in order to attract more capital, the so called 'IPO-boom' (Geltner et al, 2014). Another explanation for the sudden rise of REITs as investment vehicle is the 'securitization trend' starting in the early 1990s (Sabarwal, 2006). In order to understand this trend, we need to assume that investors are heterogeneous. This investor heterogeneity lays the foundation for the investment market (Geltner et al, 2014).

Securitization made it possible to create a great variety of financial products with different risk-return characteristics all based on the same underlying asset (Jones, 2000). This provided the financial market with the possibility to tailor financial products for each investor (Geltner et al, 2014). Figure

2.1 depicts how this securitization process looks like in case of a real estate asset. The left side represents equity investment vehicles and the right side portrays financial products based on dept.

The major driver behind the success of a REIT is the fact that they are exempted from corporate taxes. To qualify as a REIT, the company needs to pay out 90 percent of their taxable income to the shareholders in the form of dividends (U.S. Securities and Exchange Commission, n.d.). Other important requirements of a REIT are that: it needs to have a minimum of 100 shareholders and invest at least 75 percent of its total assets in real estate assets and cash (U.S. Securities and Exchange Commission, n.d.). Compared with directly investing in real estate there are some advantages in purchasing securitized REIT shares. According to Geltner et al. (2014) these are:

1. REIT shares are small, enabling individual investors to participate in commercial property investment.
2. REIT shares are usually publicly traded, and therefore they provide the investor with more liquidity than directly investing in the underlying real estate asset.
3. Unless the investor purchases a large proportion of the shares, the investor will have little management burden.

The major disadvantage of securitized real estate compared to direct real estate is the influence of market sentiment on the valuation of REIT shares (e.g. Barkham et al, 1995; Clayton et al, 2000; Cotter et al, 2006). This causes a higher covariance with stocks and bonds and therefore a less effective way to diversify in a multi-asset portfolio (Ambrose et al, 2007).

2.2.5 Passive investing (EMH)

According to Cremers and Petajisto (2009) passive portfolio management ‘”consists in replicating the return on an index with a strategy of buying and holding all index stocks in the official index proportion”’. The underlying assumption is that markets are efficient. This assumption is called the ‘Efficient Market Hypothesis’ (EMH). The EMH can take three forms: weak, semi-strong and strong. The weak form states that analyzing past stock prices will not help investors in determining the direction of future stock prices. In the semi-strong form no published information is believed to help investors select undervalued stocks, whereas in the strong form “there is no information, public or private, that would benefit investors” (Klarman, 1991). The consequence of the semi-strong and strong form is that it is pointless to conduct a fundamental analysis of a company since uninformed investors will achieve the same returns as that achieved by experts (Malkiel, 2003). Or, to put in a more cynical way: “a blindfolded chimpanzee throwing darts at the Wall Street Journal could select a portfolio that would do as well as the experts” (Malkiel, 1999). It is this concept that is countered by the value added theory. At the start of the 21st century, after the ‘internet bubble’, the dominance of the EMH has become less universal (Malkiel, 2003). The EMH is, however, deeply rooted in the financial literature. Indicators like the Sharpe-ratio, CAPM and beta are all concepts invented by scholars who are strong believers of an efficient market. Although there is much discussion about the practical use of the EMH it remains a very important scientific paradigm. This can be indicated by the following facts: the articles of and Fama (1970) and Fama and French (1993) have been cited respectively fourteen thousand and thirteen thousand times whereas Graham & Dodd are only cited seventeen hundred times. As will be explained in the next section, the EMH implies that in times of crisis the best investment strategy is to diversify.

2.2.6 Active investing (Value added)

The value added strategy states it is possible for a fund manager to outperform the fund’s benchmark (Cremers and Petajisto, 2009). This is why it called ‘active investing’. Within the financial literature there is an ongoing debate about the added value of fund managers. Some scholars argue that active

portfolios ran by fund managers do not outperform passive index funds (e.g.Phalippao and Gottschalg, 2009). Other studies find that active managed funds do perform better, but these initial gains are offset by the higher management costs (Malkiel, 1995). The point of view from the value added theory, however, is that an actively managed portfolio can get a higher return while taking into account the extra cost of fund managers (e.g. Ippolito, 1989). The concept of active investing is based on the notion that markets are not efficient. The value added theory thus is the opposite of the EMH. The founders of the 'value added theory' are Graham & Dodd who presented this theory in their book titled "Security analysis" (1934). Proponents of the value added theory refer to it as "the bible of value investing" (Klarman, 1991). Following the value added strategy investors should only buy shares if a company is undervalued by the market. In order to determine whether a company is being undervalued investors need to perform a so called 'fundamental analysis'. This can be done by examining the price-earnings ratio, the net present value of future income or the liquidation value (Graham & Dodd, 1934). For REITs the liquidation value will be high compared to, for example, financial companies or other service providers. According to these authors the point of a fundamental analysis is not to estimate the exact value of a company but to determine how the market price relates to the intrinsic value of the firm. If the market value is lower than the intrinsic firm value than it might be a good stock to buy. Advocates of the valued added approach acknowledge that the financial market is efficient most of the time. It is, however, not always efficient (Cunningham & Buffet, 2001). This belief forms the foundation of the value added strategy. According to the value added theory it is not possible to beat the market by earning more than the market, it is, however, possible to beat the market by losing less than the market. The focus of the value added theory is thus on risk reduction. It should be noted that this risk is not the same as risk in commonly used in the financial literature. Buffet & Cunningham (2001) define risk as "the possibility of loss" whereas most academics define "risk" as the relative volatility of a stock or portfolio compared to the market (Cunningham & Buffet, 2001). Klarman (1991) nicely summarizes in which way investing according to the value added principle differs from other investment strategies: "Most investors are primarily oriented toward return, how much they can make, and pay little attention to risk, how much they can lose…… value investors, by contrast, seek a margin of safety, allowing room for imprecision, bad luck, or analytical error in order to avoid sizable losses over time". Subsequently, the value added theory has a different view on the risk-minimizing differentiation strategy as practiced by EMH scholars. According to Buffet "their view is that if no single position is large, losses from unanticipated events cannot be great. My view is that an investor is better off knowing a lot about a few investments than knowing only a little about each of a great many holdings" (Cunningham & Buffet, 2003).

2.2.7 Specialized REITs versus diversified REITs.

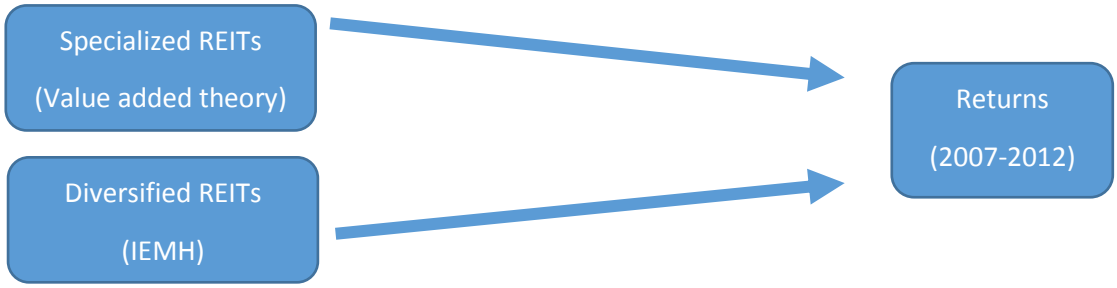
According to Ro and Ziobrowski (2009) the difference between specialized REITs and diversified REITs lies in the fact that the former "limit their holdings to a single property type and typically defend their lack of diversification by claiming the management possesses special investment expertise in that particular property type". Since the objective of specialized REITs is to use management expertise in one type of property to gain the optimum returns out of this asset it can be seen as a form of active investing. Diversified REITs invest in multiple assets types in order to diversify and gain the optimum risk-return relation and do not actively manage their property as is the case with specialized REITs. Diversified REITs can therefore be considered as a passive way to invest. According to the EMH it should not be possible for specialized REITs to outperform diversified REITs. Ro and Ziobrowski (2009) compared the returns of specialized and diversified REITs from 1997-2006 and found no significant difference. Capozza and Seguin (1999) examined the cash flow of diversified and specialized REITs in order to compare the two investment strategies. They found that, although, a diversification strategy did generate a higher cash flow the gains were offset by higher

expenses. The results of Gallo et al. (2000) indicated that their sample of real estate funds outperformed the index benchmark because of the fund's manager decisions to invest more in well performing assets. A study of Benefield et al. (2008) showed that diversified REITs did perform significantly better than specialized REITs in the years 1995-2000. Some scholars do, however, argue that it is difficult to compare the performance of funds that do not have the same mix of property types (Riddiough et al. 2005; Pagliari et al., 2005). One of the few papers that investigates the differences between specialized REITs and diversified REITs during an economic crisis is the study of Dekker (2010). However, due to a small sample size he doesn't find significant differences between the two types of investment strategy. Dekker (2010) does also compare the performance of REITs during economic prosperity (2004-2007) with the REIT performance during the early crisis years (2007-2010). He finds that in times of crisis the standard deviation of the REITs almost doubles compared with the pre-crisis years. The 2007 crisis caused several scholars to question the existence of efficient markets (e.g. Krugman, 2009). After 2007 we witnessed several REITs changing their investment strategy. Wereldhave, originally a multi-market player on two continents, now only invests in shopping areas in Belgium, Finland and the Netherlands and offices in Paris (annual report Wereldhave, 2013). According to Clayton et al. (2009) this move may be related to the fact that the recession showed the 'failure of diversification'. This present study uses data from 2007-2012 to investigate whether there are significant differences between the returns of specialized REITs and diversified REITs. Thus if the move from diversified to specialized can be backed up with evidence in the form of significant difference in returns. Although this may look a mere theoretic question because it will take a REIT a lot of time to change their investment strategy, the question may also be relevant for individual investors buying REIT shares. Because, in contrast to REITs, these individual investors do have the possibility to act quickly.

From the literature we can conclude that real estate assets plays an important role in reducing the risk of a portfolio that mainly consists of stocks and bonds. This is based on the principle of 'diversification'. It is also possible to compose a diversified portfolio that includes only real estate assets. Thus to diversify between real estate assets that are different from each other. In the U.S. this is mostly achieved by investing in various types of real estate, like a portfolio that consist of retail properties and retail properties. In Europe, however, the focus lies on more on geographical differentiation. Furthermore, REITs are an efficient way to overcome the traditional problems related to investing in real estate, for example, the indivisibility of property and the fact the market for real estate is far from efficient. REITs are, however, susceptible for market sentiment, which reduces their diversification advantage.

In this thesis the focus lies on a portfolio that consists of only real estate assets. Diversification is achieved by investing in different types of real estate. The EMH stimulates a diversified investment strategy whereas the value added theory recommends a specialized investment strategy. In order to compare these different views sample data is collected for 86 U.S. based REITs for the years 2007-2012.

2.3 Conceptual model



2.4 Research question:

To what extend are specialized REITs able to outperform diversified REITs during an economic crisis?

3. Methodology

3.1 Introduction

This chapter describes the process of data gathering and data analysing. The first part of this chapter is dedicated to the underlying theory that forms the foundation of the EMH like the Sharpe-ratio, the CAPM model and the Carhart model. This section has a lot of resemblance with the previous literature chapter since the EMH does not use a strict distinction between theory and methodology. The underlying statistical models play such an important role in the EMH ideology that one could also argue to place some of this information in the literature chapter.

In order to clarify that this thesis discusses both the EMH investment strategy and the value added investment strategy the decision is made to place the more statically oriented information in the methodology chapter. Since the outcomes of these models are also used for drawing conclusions that affect the value added strategy it is better positioned in the 'methodology' chapter. This section is concluded by the formulation of the null and alternative hypothesis. Furthermore, the more standard statistical tools like the 'Mann-Whitney U-test' and the 'regression' analysis are discussed and the process of selecting and collecting the sample data is explained in detail.

3.2 EMH related financial models

3.2.1 Modern Portfolio Theory (MPT)

The risk-return relation is essential for the well-functioning of financial markets. Markowitz found that the risk of an investment consisted of two parts: market risk and specific risk. Market risk is caused by events that influence the entire market, for example inflation or a terroristic attack. Other risks such as fraud or a flood will only have impact on specific companies, this is called 'specific risk'. Markowitz found that it is possible to virtually eliminate this specific risk by creating a portfolio which consist of a large amount of assets that all differ from each other. To measure how various assets are related to each other we look at the covariance between these assets. A positive covariance means that asset returns move together, while a negative covariance indicates that the returns move in the opposite direction. The covariance ranges from +1 till -1.

If your portfolio has shares of BMW and Daimler (Mercedes-Benz) we would expect a pretty high covariance since the companies are both German premium automotive producers. If the portfolio consist of shares of BMW and Tesla Motors (producer of electric cars) we would expect a lower covariance since these companies differ more from each other: BMW uses (mostly) traditional fuel to power their cars while Tesla produces electric cars and BMW is a German based while Tesla is located in the United States. An even lower covariance is expected if the portfolio consist of BMW shares and, for example, Smith & Wesson which is an American gun producer and therefore not related to the automotive industry. The formula to calculate the portfolio variance is:

$$\sigma^2_p = w^2_a\sigma^2_a + w^2_v\sigma^2_v + 2w_a w_v \, covariance(a,v)$$

This formula gives the optimum risk-return relation. This can be visualized in the creation of a graph with an 'efficient frontier'. Figure 3.3 displays the risk-return characteristics of three different portfolios. One portfolio consist of real estate and bonds, this is a relative safe portfolio with low risk and low returns. The second portfolio is comprised of stocks and bonds and has mediocre risks and returns. The last portfolio consist of real estate and bonds and offers the highest return but also is the most risky. The most efficient portfolio, however, consist of mix of all the assets, thus of bonds, real estate and stocks. This combination gives the best risk-return combination and is called the 'efficient frontier'. In figure 3.1 the efficient frontier is displayed by the heavy dark line.

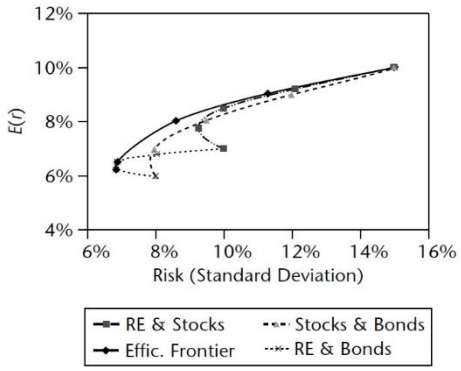


Figure 3.1
Source: Geltner et al, 2007

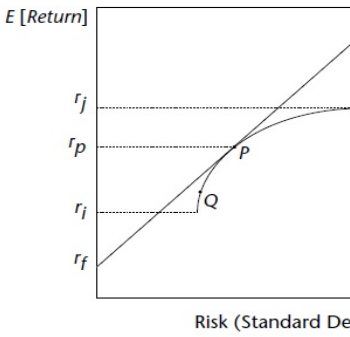


Figure 3.2

Source: Geltner et al,. 2007

3.2.2 Sharpe ratio

The Sharpe ratio differs from the Modern Portfolio Theory (MPT) since it introduces the possibility of investing in a risk-free asset (Rf). The optimum risk-return relation is now calculated by combining the risk-free asset with the risky portfolio. Suppose a situation with a portfolio P that is composed of several risk bearing assets. Whereas the MPT offered several points along the efficient frontier that, according to the risk-return characteristics of the investor all were equally efficient, the Sharpe ratio only has one efficient portfolio. Point P in figure 3.2. Although point Q faces less risk compared to point P this is offset by a disproportionate lower return. It is now more efficient to invest in the risk-free asset since this offers a better risk-return relation. Investors with a risk-return preference that lies to the left of point P are advised to, partially, invest in the risk-free asset. On the other hand, investors with a higher risk-return preferences should borrow money and also invest in portfolio P. This assumption is called the "two-fund theorem and means that all investors (no matter what their risk preferences) should want to hold the same portfolio of risky assets, as long as those investors have the same risk and return expectations" (Geltner et al, 2013). Important to remember is that the volatility of the risk-free asset is zero (0). This has the arithmetical consequence that the risk of the entire portfolio is determined solely by the volatility of portfolio P. Because the risk is only determined by the portfolio and not by the risk-free asset it is possible to create a linear line that touches the 'efficient frontier'.

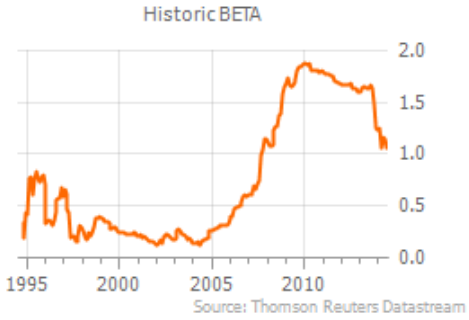
3.2.3 Capital asset pricing model (CAPM)

The capital asset pricing model (CAPM) is developed by Sharpe and Lintner in the early 1960s and builds upon the formerly mentioned theories. According to Geltner et al. (2013) "the main insight provided by the CAPM is the irrelevance of, and therefore lack of compensation for, diversifiable risk". A dichotomy is made between 'systematic risk' and 'specific risk'. Systematic risk cannot be diversified away, whereas specific risk can be diversified away in a large portfolio. The consequence is that an investor should only be compensated for the systematic risk of his assets. This is often represented by the so called beta (β). Beta measures the systematic risk of an asset in comparison with the total asset market. A beta of 1 means the asset moves synchronic with the market, a beta <1 indicates that the asset is less volatile compared with the market and an asset with a beta >1 is more volatile in comparison with the market.

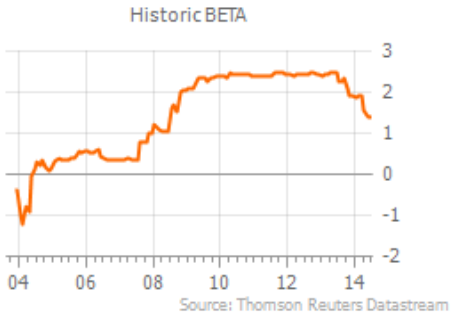
3.2.4 Beta

The CAPM calculation is dependent on, among others, the beta (β). The beta indicates the volatility of a specific stock in relation to the overall market. In this thesis the historical Beta from Datastream is used. The historical beta is calculated over the last 5 years. In general the beta of real estate assets is thought to be low since real estate is supposed to be less volatile compared with stocks (Geltner et al, 2013). The data from Datastream shows, however, that the average REIT Beta was 1,1. Yahoo! Finance and Worldscope also came up with an average REIT beta of more than 1 for the years 2007-2012. And although the exact method of calculating the beta does change from source to source, it is clear that the beta is much higher than initially expected. In graph 3.2 and 3.3 the development of beta throughout time is displayed for two REITs. It is clearly visible that after 2007 the beta has risen substantially and only drops back since about the year 2012.

The fact that the average beta is close to 1 according for both Datastream and Yahoo! Finance gives reason to think this beta is not based on the total stock market but on a market that consist of real estate investment funds. This may provide a plausible explanation for the sharp movements of the beta through time as can be seen in graph 3.31 and 3.4.



Graph 3.3
Beta of 'Apartment Investment and Management (AIV) throughout time



Graph 3.4
Beta of 'Ashford Hospitality Trust (AHT) throughout time

3.2.5 Carhart model

Another model that helps explaining excess stock returns is the Carhart four-factor model. This model is based on the Fama-French free factor model, with the only difference that the 'momentum' factor is added as an explanation for possible excess returns. Although the Carhart model is not specifically developed for a portfolio with only real estate assets, the model is often used by scholars investigating REIT performance (e.g. Ro and Ziobrowski, 2009). The four factors in the Carhart model are: (I) Rp-Rf, (II) SMB, (III) HML, and (IV) UMD.

I. Four factor Beta: "The 'four factor' beta is analogous to the classical beta but not equal to it, since there are now two additional factors to do some of the work" (Moneychimp, n.d.)
II. SMB stands for 'small minus big'.
Theory → Stocks of smaller firms tend to perform better that stocks of larger firms. Size is determined by the market capitalization (Investopedia, n.d.)
Practice → Buy small cap stocks and sell big cap stocks.
III. HML stands for 'high minus low'.
Theory → There are firms that are undervalued by the market, the so called 'value stocks'. There trading price is relative low compared to its fundamentals, for example dividend (Investopedia, n.d.)
Practice → Buy high-book-to market stocks and sell low-book-to market stocks.
IV. UMD stands for 'up minus down'. This is the 'momentum' factor.
Theory → There is a "tendency for rising asset prices to rise further, and falling prices to keep falling" (Kallianiotis, 2013).
Practice → Buy last year's winners and sell last year's losers.

The underlying reason of the Fama-French model and the Carhart four-factor model is that a large share of excess returns should not be attributed to managerial excellence but to market factors instead. In the context of the EMH versus 'value added' this model ensures that the influence of existing market factors should be determined before accrediting the excess returns are to a fund manager who's beating the market.

The corresponding regression formula is: $Rp\text{-}Rf = \alpha_p + \beta p*(Rm\text{-}Rf) + spSMB + hpHML + upUMD + \varepsilon$.

On the left-hand side we find the difference between the portfolio return and the risk-free return, the so called 'risk premium'. The risk premium is the dependent variable. On the right-hand side we find the four factors (1) Rm-Rf (2) SMB, (3) HML and (4) UMD. Like with the beta in the CAPM formula, the values of these four factors are determined in advance of the regression. In this case, Kenneth French has constructed a database with the values for all four factors for all the years since 1926. These factors can be found in the online library of Dartmouth College. In this study the monthly ratings for the U.S. market were used to match the monthly stock returns of U.S REITs.

3.2.6 Addendum beta

After composing the Carhart model we have more information about the general REIT beta. Based on commonly traded shares on the major U.S. stock markets the overall REIT beta is for the years 2007-2012 is 0,23. Table 3.5 shows the beta for each REIT sector, as calculated by the Carhart model. Note that these beta's are not directly comparable with the beta's used in the CAPM. In the CAPM beta is the only explanatory variable for excess returns, whereas the Carhart model also uses the factors: 'small-minus-big', 'high-minus low' and 'up-minus-down' to explain excess returns.

Table 3.5

REIT sector	**Diversified**	**Health care**	**Hotel**	**Industrial**	**Offices**	**Residential**	**Retail**
Beta	0,18	0,20	0,08	0,28	0,31	0,32	0,23

3.3 Theory and practice

In time more and more scholars criticized the sole use of financial models to predict and determine investment strategies. Mainly because many practitioners did not pay enough attention to the underlying assumptions of these financial models. This resulted in a complete faith in economic modelling. In times of crisis, when the shortcomings of these models become clear the discussion about theory and practice flares up. In this section the difference between theory and practice will be explained by looking at a few key assumptions that lay at the heart of the aforementioned financial models.

3.3.1 Risk and uncertainty

As mentioned earlier it is theoretically possible to compose a risk-free portfolio. In this light it is worthwhile to mention the work of Frank Knight who, almost a decade ago, made a clear distinction between risk and uncertainty. Diebold et al. (2010) summarized his work as follows:

- *"Risk refers to a situation where the probability distribution is completely specified. For example, the distribution of automobile or life insurance claims for an insurance company is more or less known.*
- *"Uncertainty refers to a situation where probabilities cannot be assigned to at least some events. The systemic risk to financial systems and terrorism risk might fall into this category. This is Knight's definition of uncertainty where events are known but probabilities are not".*

Thus according to Knight we should speak of 'risk' when the outcome of an event is unknown but the probability distribution is known. Speaking of 'uncertainty' is only appropriate in case both the probability distribution and the outcome of an event are unknown.

After the 2007 recession this distinction between risk and uncertainty, also known as 'knightian' uncertainty, became more popular. Looking back on the pre-crisis period there are now economist who argue that this distinction is never properly made in the financial sector (e.g. Hansen and Sargent, 2010). According to Ruffino (2014) investors dislike uncertainty even more than they dislike risks, suggesting that returns on investments have been too low since they compensated only for risk and not for uncertainty.

3.3.2 Risk-free rate (Rf)

The risk-free rate (Rf) plays an essential role in all of the aforementioned financial models. As mentioned earlier the risk-free return is characterized by the absence of volatility. There is an ongoing debate about the practical use of the risk-free asset because in reality there is no such thing as a truly risk-free asset (Geltner et al., 2013). Nonetheless, "what the CAPM loses as a result of its unrealistic assumptions is more than made up by the ability to simplify the world so that we can understand it better" (Geltner et al, 2013). Most scholars use the American T-bill as a proxy for the risk-free asset (Eicholtz, 2001). Since the T-bill does show some volatility over time Spiegel and Stanton (2000) advise to take T-bills with a longer maturity. In this thesis T-bills with a 3-month maturity are used and subsequently converted to a monthly rate to match the monthly stock data. The average T-bill return over the period 2007-2012 is used as proxy for the risk-free rate (Rf).

3.4 Hypotheses

According to the EMH we expect that there is no difference between the risk adjusted returns of diversified REITS and specialized REITs, thus:

H0: $\bar{x}_1 = \bar{x}_2$

The alternative hypothesis assumes that the EMH doesn't hold in practice, thus:

H1: $\bar{x}_1 \neq \bar{x}_2$

A potential pitfall for testing this hypothesis is that the average return of diversified REITs are compared with the average return of all specialized REITs. REITs that are classified as 'specialized' can be very different from each other. Some REITs are specialized in health care real estate, whereas others specialize in residential real estate. In order to correctly compare the performance of specialized REITs with the performance of diversified REITs, the latter needs to be split into multiple groups. Each group consists of REITs that specialize in the same type of real estate. This means that the initial typology of diversified and specialized is no longer sufficient, a subdivision needs to be made for the category specialized REITs. A distinction is now being made between on one hand diversified REITs and on the hand REITs that specialize in: health care, hotel, industrial, office, residential and retail properties.

Each time the average result of the group of diversified REITs is compared with the average result of another group of specialized REITs. Table 3.6 provides a more detailed overview of this procedure.

Table 3.6

$\bar{x}_1$	$\bar{x}_2$
Diversified –	Health care
Diversified –	Hotels
Diversified –	Industrial
Diversified –	Offices
Diversified –	Residential
Diversified -	Retail

3.5 Data description

There are many REITs active on the U.S. market. Since it is not feasible to collect and analyze te data from all these firms a sample is of 86 REITs is taken. Most scholars investigating the performance of REITs use the GPR 250 REIT index as guideline for their sample selection. The GPR 250 REIT index is composed of the 250 largest REITs worldwide. The firms in the GRP 250 REIT comply with the following requirements:

- Size: > 50 million U.S Dollar free float market cap
- Investability: > 15% free float
- Property activity: >75% operational turnover
- Rental income: >25% operational turnover
- Structure: Real Estate Investment trust

The GPR 250 REIT index indicates whether a REIT can be classified as diversified or as specialized. Furthermore, if a REIT is found to be specialized in one type of property, the GPR 250 REIT index also shows the relevant real estate category. In order to categorize the REITs, the GPR 250 REIT index applies the following basic rules:

i. If a REIT gains more than sixty percent of its operational turnover from one specific sector it is classified as a specialized REIT.
ii. When a REIT gains less than sixty percent turnover from one specific sector the REIT is classified as a diversified REIT.

Of the 250 REITs in the GPR index there are 81 REITs located in the U.S. In this initial sample some REIT categories that were better represented than others. REITs that specialized in retail properties formed the largest group with twenty-one companies, whereas the GPR 250 index included only three REITs that specialized in hotel properties. The goal was to have approximately ten REITs for each category in order to overcome the problem that the results of an individual firm would distort the average of that specific REIT category. Therefore an additional five hotel REITs are included in the sample. These five REITs were selected since they were of similar size. The sample used for this thesis thus includes 86 REITs. The exact composition the sample is shown in table 3.7.

Table 3.7

REIT focus	**# REITs**
Diversified	10
Health care	09
Hotels	03 (08)
Industrial	09
Offices	15
Residential	14
Retail	21

3.6 Data collection

Monthly stock returns from January 2007 till December 2012 are collected by making use of the following sources: Datastream, Bureau van Dijk and Yahoo! Finance. Where Yahoo! Finance acted as the main data source Datastream and Bureau van Dijk were only used in case Yahoo! Finance did not have the required data. The opening prices for each month are used. Because not all REITs have a fiscal year that starts on the first of January it was sometimes not possible to collect the data for these companies for the year 2013. Therefore December 2012 was used as closing date. In total we ended up with 72 closing prices for each REITs since data was collected monthly for six years. In case dividend is paid, these are reinvested.

The following formula is used to convert the monthly returns into log returns that make the data more suitable for analysis*: LN (It+DVt) – LN (It-1).*

It: price of the index at the beginning of the month
It-1: price of the index at the beginning of the previous month
DVt: paid dividend, when applicable

This method of collecting monthly stock data was not suited for conducting the Carhart four factor analysis. Based on monthly closing prices the model output was not satisfactory. The explanatory power (R2) was very low, furthermore, the model coefficients were very different from what we expected. A thorough analysis of the data pointed out that the problem lies in the fact that the collected 72 monthly closing prices did not provide enough information for the Carhart model in order to produce useful results. To solve this problem daily data was used for the Carhart model with a total of 1507 closing prices were used for each REIT.

Table 3.8 displays the steps needed in order to correctly interpret the REIT returns. After the data collection the above mentioned formula was used to compare the REIT stock price with the stock price a month earlier. The output only shows the variation in stock price compared with the preceding month. In order to put these returns into perspective financial tools such as the Sharpe-ratio and Capital Asset Pricing Model (CAPM) are needed to analyze the data.

Table 3.8

Step	Input	Action	Output
1	Monthly stock prices	Catalogue data	Overview monthly stock prices 2007-2012 for each REIT
2	Catalogued REIT data	Compare REIT stock price with stock price of a month earlier	REIT performance for 2007-2012
3	REIT performance	Application of financial models in order to bring REIT performance in perspective	- CAPM - Sharpe-ratio - Carhart

3.7 Testing

3.7.1 Mann-Whitney U test

Most REIT categories in this sample contain about ten individual REITs. In order to directly compare the results of two different groups a T-test is often used. The T-test is based on the assumption that data is normally distributed. Furthermore, a null- and alternative hypothesis are used. The null hypothesis states that there is no significant difference between the two groups, whereas the alternative hypothesis states the exact opposite. In order to perform a good T-test a sample size of at least twenty REITs per category is needed. Otherwise there is a large threat of wrongly accepting the null hypothesis, the so called 'type II error'. In this case the ten REITs per category are thus not enough to conduct a proper T-test. Since the average number of REITs for each category is too low for a proper T-test another method to compare the results of diversified and specialized REITs is needed. Baarda et al. (2014) suggest the use of a nonparametric test for small sample sizes. In this case the Mann-Whitney ranking test is used as two independent groups are compared: diversified REITs and specialized REITs. The Mann-Whitney U test ranks the values of all the selected REITs. The Mann-Whitney U test uses the following formulas:

$U_1=n_1n_2+[n_1(n_1+1)/2]-R1$ (diversified REITs)
$U_2=n_1n_2+[n_2(n_2+1)/2]-R2$ (specialized REITs)

The Mann-Whitney U test uses the 'mean rank' of each group and the total sample size to determine whether the returns between diversified REITs and specialized REITs differ significantly.

3.7.2 Regression

A more thorough way to investigate whether the returns of diversified REITs differ from the returns of specialized REITs we use a regression analysis. In this analysis the dependent variable is always based on the REIT return. The independent variable differs according to which financial pricing model is used. In the following sections the most important financial pricing models are discussed in order to get a better understanding of the outcomes of the regression models.

3.8 Assumptions

Financial markets are complex. In order to answer the research question some assumptions have to be made in order to reduce this complexity. The most important assumptions are that: (1) leverage is not taken into account, (2) the exact portfolio composition of a diversified REIT is not taken into account and (3) the arithmetical average of the risk-free rate is used which represents a savings account with a fluctuating interest rate.

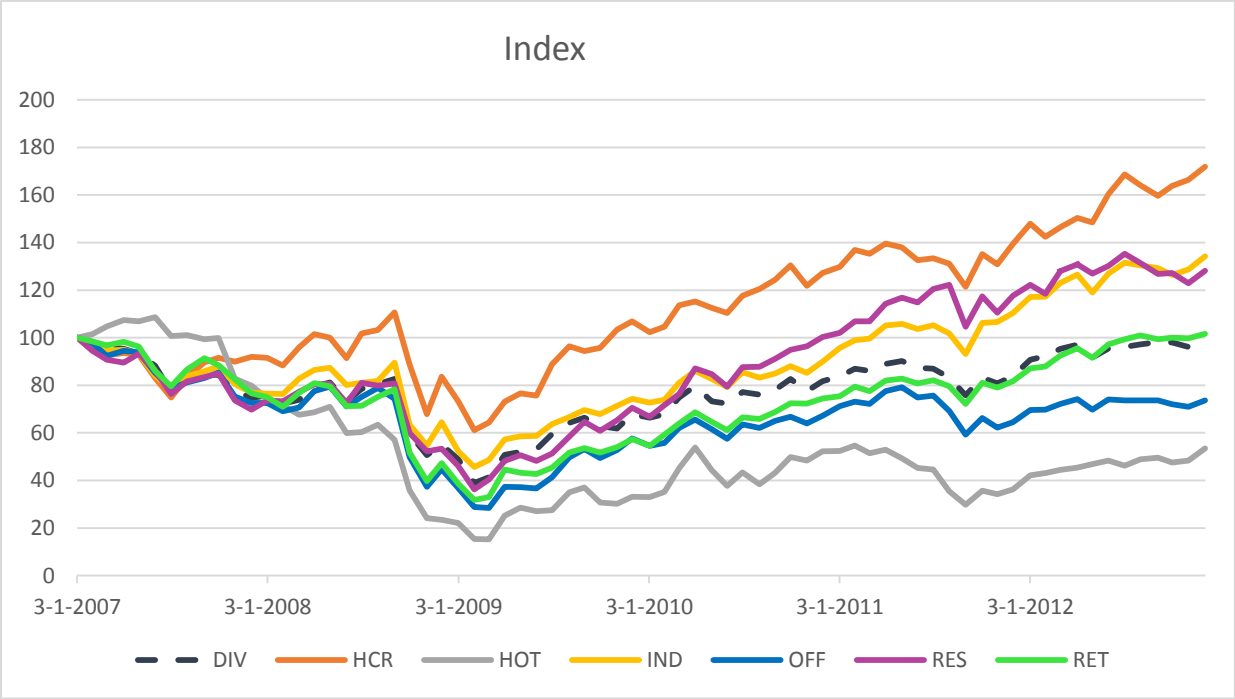
4. Analysis

4.1 Introduction

Several statistical models are used to analyze the data. They are listed in ascending order of the difficulty. The chapter starts with an index of the stock prices for each REIT category for the years 2007-2012 accompanied by a short description of the state of the global economy during these years to put the price movement into perspective. A first comparison of the REIT returns is made by comparing the average Sharpe-ratio and beta for the years 2007-2012. The Mann-Whitney test is used to investigate whether there are significant differences between the returns of the groups. Furthermore, a regression analysis is conducted to investigate the exact relation between the type of REIT and the return. The chapter is concluded by performing a Carhart four-factor analysis which is an extension of the CAPM since it also takes into account the size of the firm, the relation between market price and book value of the firm and the so called 'momentum' factor.

4.2 Index

In graph 4.1 the relative performance of each type of REIT is displayed. The average returns of each sector is indexed. The stock value on the beginning of January 2007 is given the value of 100. Henceforth, we can see how the different sectors performed throughout time till the end of 2012. From 2007 till 2009 it becomes that the crisis affects all sectors since the returns all go downwards. After the beginning of 2009 they seem to recover. The REITs which invest in healthcare, residential and industrial property provide in the end a higher return than in 2007. The REITs which invest in offices and hotels are still not on the pre-crisis level.



Graph 4.1
REIT returns for January 2007 – December 2012

The dotted index line, representing diversified REITs, constantly runs in the middle of the graph. This is not surprising since a diversified REITs holds a portfolio that consist of real estate assets from multiple sectors and is therefore relatively stable. So if a diversified REIT has, for example, invested in both health care assets and hotel property it is expected that a situation in which the positive returns

for health care compensates the poor performance of the hotel sector. Thus diversified REITs will almost always end up with an average result.

The index displayed in graph 4.1 can be divided into four different time periods:

I. It is generally assumed the decision of BNP Paribas to block withdrawals from three hedge funds in August 2007 marks the beginning of the most recent economic crisis (Guardian, 2012). At that moment, however, nobody realized how hard the crisis would hit the economy. This can be traced back in graph 4.1 where we see how the stocks gradually fall in the period of august 2007 till September 2008.

II. The second time frame runs from September 2008 till early 2009. In September 2008 the Lehman Brothers went bankrupt. The fact that one of the largest financial institutions in the U.S. couldn't handle the problems caused by bad mortgages made clear what a disastrous impact the subprime mortgage crisis had on the entire economy.

III. The third period runs form early 2009 till end 2011. After the fall of Lehman Brothers people are well aware of the seriousness of the economic crisis. The government is trying to control the situation by bailing out large companies that are in financial trouble in order to prevent more bankruptcies. Simultaneously, the European Central Bank (ECB) faces a lot of trouble since countries like Greece, Spain and Ireland are having severe financial problems. This causes tensions in the worldwide financial market and therefore prevent the U.S and worldwide economy to recover.

IV. From the end of 2011 onwards there are signs of recovery. It starts to looks like the ECB and IMF have the situation in Europe under control and meanwhile the U.S. economy is growing stronger.

4.3 Mann-Whitney

Table 4.2 displays the Mann-Whitney scores of diversified and specialized REITs for both the Sharpe-ratio and the CAPM. More details about the Mann-Whitney scores can be found in the appendix.

Table 4.2
The 'mean rank' of the Sharpe ratio and the expected rate of return based on CAPM.

REIT category		**N**	**Sharpe ratio**	**Mean rank**	**Monthly E(r) (in %)**	**Mean rank**
Diversified –	Health care	10 - 09	-0,0098 vs. 0,0762	06,90 – 13,44**	0,052 - 0,061	07,10 – 13,22**
Diversified –	Hotels	10 - 09	-0,0098 vs. -0,0430	10,40 – 08,38	0,052 - 0,038	12,10 – 06,25**
Diversified –	Industrial	10 - 09	-0,0098 vs. 0,0315	08,40 – 11,78	0,052 - 0,056	08,90 – 11,22
Diversified –	Offices	10 - 15	-0,0098 vs. -0,0499	15,40 – 11,40	0,052 - 0,050	14,10 – 12,27
Diversified –	Residential	10 - 14	-0,0098 vs. 0,0329	08,90 – 15,07**	0,052 - 0,063	07,90 – 15,79***
Diversified -	Retail	10 - 21	-0,0098 vs. 0,0040	15,40 – 16,29	0,052 - 0,054	15,00 – 16,48

*significant at .90 interval
**significant at .95 interval
*** significant at.99 interval

4.3.1 Sharpe-ratio

The results show that health care REITs have a significant higher Sharpe-ratio compared to diversified REITS with a mean ranking score of 6,90 versus 13,44. Although diversified REITs do have a higher Sharpe-ratio compared to hotel REITs, this difference is not significant (mean ranking score of 10 40 versus 8,38). Diversified REITs do have on average a lower Sharpe-ratio compared to industrial REITs, although not significant (mean ranking score of 8,40 versus 11,78). Residential REITs have a

significant higher Sharpe-ratio compared to diversified REITs, a mean ranking score of 15,07 for residential REITs and a mean ranking score of 8,90 for diversified REITs. Retail REITs do have a Sharpe-ratio that is slightly higher compared to that of diversified REITs, the difference is not significant with a mean ranking score of 15,40 for diversified REITs and a score of 16,29 for retail REITs.

4.3.2 CAPM (expected return)

Health care REITs do have a significant higher expected rate of return compared to diversified REITs, with a mean ranking score of respectively 13,22 and 7,10. Hotel REITs, on the other hand, have a significant lower expected rate of return compared to diversified REITs. Hotel REITs have a mean ranking score of 6,25 whereas the diversified REITs score 12,10, indicating no significant difference in the height of the expected return. The expected return of industrial REITs is compared with the expected return of diversified REITs, the difference between the ranking score of diversified REITS (8,90) and industrial REITs (11,22) is, however, not significant. Although the expected return of diversified REITs is higher than that of office REITs, the mean ranking scores of respectively 14,10 and 12,27 are too small to be significant. Residential REITs show a significant higher mean ranking score for beta compared to diversified REITs, respectively 15,79 and 7,90. There are no significant differences between the expected return of diversified and that of retail REITs. The first has a mean ranking score of 15,00 and the latter a mean ranking score of 16,48.

4.4 Regression

Ro and Ziobrowski (2009) use regressions based on the CAPM and Fama-French three-factor model with momentum to measure differences between specialized en diversified RETIs. This thesis builds further upon the research of Ro and Ziobrowksi (2009) by, besides using regressions based on CAPM and the Fama-French model, also including a model with dummies for every type of REIT. The dependent variable in all models is the REIT return minus the risk-free rate, this results in the so called 'risk premium'. The risk premium is used since an important building block in the financial theory is that investors should only be rewarded for investments made in risky assets.

4.4.1 CAPM

Table 4.3 shows that both alpha and beta are negative. Morningstar (2014) defines Jensen's alpha as "the difference between a realized rate of return and its expected position on the security market line given its risk level" A positive Jensen's alpha means that a fund has a higher return than should be expected according to the CAPM and thus gains excess returns. Indicating that these returns are not risk related. A negative Jensen's alpha, however, means a lower return than expected according to CAPM. The negative value for beta indicates that a higher beta leads to lower return. Table 4.3 shows two different CAPM regressions. The first uses only Beta as explanatory variable, with the corresponding formula as used by Mitchell and Stanford (2000):

$$Rp\text{-}Rf = \alpha + \beta * (Rm\text{-}Rf) + \varepsilon.$$

The second regression also includes a dummy for the different types of REITs:

$$Rp\text{-}Rf = \alpha + \beta * (Rm\text{-}Rf) + \lambda_{(i)} + \varepsilon.$$

In the regression formula for the CAPM model with dummies, the variable 'i' can take values of 1, 2, 3, 4, 5, 6 and 7. Each number represents a REIT group. The diversified REIT category is not displayed since it acts as the so called 'suppressed variable'.

Table 4.3. The impact of beta and REIT category on risk-adjusted returns.

CAPM			**CAPM with dummies**		
Alpha	-0,073	***	Alpha	-0,074	***
Beta	-0,010	***	Beta	-0,009	***
			Health care	0,004	**
			Hotels	-0,0006	
			Industrial	0,0027	
			Offices	-0,0033	
			Residential	0,0007	
			Retail	-0,0007	
R2	0,51		R2	0,59	
Adj. R2	0,51		Adj. R2	0,56	

*significant at .90 interval
**significant at .95 interval
*** significant at.99 interval

Compared with the standard CAPM model the CAPM with dummies for each REIT category has a higher explanatory power. This indicates that the categorization of the REITs helps in explaining the REIT returns. The only type of REIT that does show significant different returns in comparison with diversified REIT is the health care category REIT. This type of REIT does perform significantly better. Residential REITs and industrial REITs also perform better compared with diversified REITs, although not significantly. REITs specialized in hotels, offices and retail do perform worse compared with diversified REITs, though these are no significant differences.

Although this difference between theory and practice is not expected according to EMH, it is also not something that will surprise economists. In finance, for example, portfolio performance assessments are often measured by making use of Jensen's alpha (Murthi et al, 1997). A more unusual result is that of a higher beta leading to a lower return. This result is the exact opposite of the usual financial theories, namely that more risk means a higher return. This remarkable finding is probably caused by the economic recession, where REIT returns were negative for the years 2007-2012, see also figure 4.3 and figure 4.5. Simultaneously, the average monthly risk-free return over 2007-2012 proved to be 0,08%. Thus the risk-free investment had a higher average return compared with the average REIT return during the economic recession. The finding that a higher beta leads to a lower return might seem strange at first sight, but can be explained be looking at the market situation. Scholars like Fletcher (2000) and Elsas et al (2001) both state that: "If the market return falls short of the riskless rate, stocks with a higher beta have lower returns". To solve this problem, Elsas et al. (2001) advise to take a sample period of at least 30 years in order to minimize the effect of economic downturns.

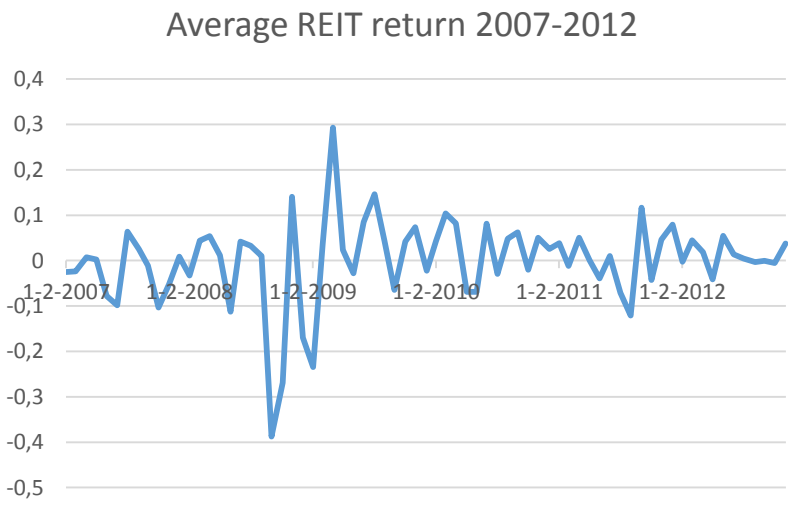


Figure 4.4
REIT returns graphically displayed

Date	Average REIT performance
1-2-2007	0,007005283
1-3-2007	-0,019383867
2-4-2007	0,003552402
1-5-2007	0,034846731
4-9-2012	-0,003484899
1-10-2012	-0,000729586
1-11-2012	-0,00557262
3-12-2012	0,0374002
Average	*-0,000638061*

Figure 4.5
Monthly REIT returns 2007 and 2012

4.4.2 Carhart model

In order to investigate differences between the several REIT categories, Ro & Ziobrowski (2009) apply the Carhart model. To determine the influence of the four factors of the Carhart model, the following regression formula is used: $Rp\text{-}Rf = \alpha_p + \beta p*(Rm\text{-}Rf) + s_pSMB + h_pHML + u_pUMD + \varepsilon$. The regression is performed separately for each REIT category.

A short recap of the four factors used in the Carhart model is provided since the model is not as widely known as the CAPM. A more detailed description of the Carhart model can be found in the literature chapter.

I. Alpha: also called the 'four-factor alpha' stands for the managerial influence in explaining excess returns.
II. Beta (Rm-Rf): difference between market return and the risk-free return.
III. SMB: 'small minus big'
IV. HML: 'high minus low'
V. UMD: 'up minus downs'

The reasoning behind the Carhart model is that, apart from risk (beta), there are other factors influencing the return of a portfolio. According to the Carhart model it matters whether a portfolio consist mainly out of (1) shares of small firms, (2) stocks with a high book-to-market value and (3) stocks that are considered to be 'last years winners'. The impact of these four factors is on the returns should be known before excess returns are to be attributed to managerial excellence. Table 4.6 displays the outcomes of the Carhart model.

Table 4.6 Carhart model

	DIV		HCR		HOT		IND		OFF		RES		RET	
Alpha	-0,01		0,00		-0,01	*	-0,00		-0,02		-0,02		-0,01	
Beta	0,18	***	0,20	***	0,08	***	0,28	***	0,31	***	0,32	***	0,23	***
SMB	0,14	***	0,13	***	0,05	***	0,22	***	0,20	***	0,24	***	0,16	***
HML	0,01	***	0,11	***	0,03	***	0,14	***	0,17	***	0,18	***	0,12	***
UMD	-0,01	**	0,01		0,00		-0,02	*	-0,03	**	-0,00		-0,02	***
R2	0,78		0,71		0,55		0,73		0,72		0,68		0,72	
Adj. R2	0,78		0,71		0,55		0,73		0,72		0,68		0,72	

*significant at .90 interval
**significant at .95 interval
*** significant at.99 interval

A first look at the table suggests a good 'model fit' since the 'R2' and 'adjusted R2' are quite high. The 'R2' and 'adjusted R2' represent the amount of variation in the dependent variable that can be explained by the model. For most categories the Carhart model is able to explain almost 70 percent of the variation in the REIT return. An exception are the hotel REITs, were the model only explains 55 percent of the variance. The other REIT categories all show a model fit of about 70 percent.

For all REIT types, the alpha lies around zero. Except for the hotel REITs, the impact of alpha on the excess return is not significant. This findings is in line with the EMH since it proves that the managerial influence on the excess returns is neglectable. Furthermore, the beta for most REIT categories lies between 0,20 and 0,30. The beta for diversified REITs is with 0,18 somewhat lower, whereas the beta for hotel REITs is only 0,08. The second Carhart factor 'SMB' is significant and positive for all type of REITs. This indicates that REITs are relatively small companies. Table 4.7 compares the market capitalization of the largest sample REITs with a few large S&P 500 firms. Compared to these firms REITs can be considered to be relatively small companies.

Table 4.7
Market capitalization of REITs compared with large S&P 500 firms.

Large S&P 500 firms	Market cap (in billions)	Largest REITs in the sample	Market cap (in billions)
Apple	$643.55	Simon property group	$56.08
Google	$351.84	Public storage	$31.44
Shell	$196.94	Equity residential	$25.76
Coca-Cola	$179.19	Health care REIT	$24.95

The third Carhart factor 'HML' is also significantly positive for all REITs, indicating that all portfolios contain REITs with a relative high book-to-market value. The last Carhart factor 'UMD' is also called the 'momentum' factor. With a significance level of 1% the momentum factor is only significant for retail REITs, at respectively 5% and 10% it is also significant for diversified REITs, office REITs and industrial REITs. For all these REIT categories the momentum factor is negative which means that there is no tendency that rising stock prices keep rising and falling stock prices to keep falling. Although the momentum factor has a significant influence on the REIT returns for some REIT types, the effect is very small.

The Carhart model shows some strange outcomes for the hotel REITs. A significant alpha combined with a very low scores for beta, SMB, HML indicate that the hotel sector is unalike the other sectors. Moreover, the model fit is only 0,55 which is considerably less than the model fit for the other REIT categories. A possible explanation is the fact that the sample for hotel REITs initially contained only three REITs, later on the sample size was expanded so that it contained eight REITs. Another explanation may be that the structure of the hotel sector is just different compared to the other real estate categories. It may, for example, be very small since the sample taken from the GRP 250 REIT index contained only three hotel REITs.

4.5 Conclusion

The index of the stock prices showed that healthcare REITs, Residential REITs and industrial REITs all had higher stock prices compared to diversified REITs during the recession. Stocks prices of REITs that specialized in retail, offices or hotels were relatively more influenced by the recession.

The Mann-Whitney test showed that health care REITs and residential REITs had a significant higher Sharpe-ratio compared to diversified REITs. Furthermore, the Mann-Whitney test showed that health care REITs and residential REITs had a significant lower beta compared with diversified REITs. Hotel REITs, on the other hand, have a significant higher beta compared with diversified REITs. Also REITs that specialize in industrial and residential real estate outperformed the diversified REITs, although not significantly. REITs that specialize in hotels, offices and retail had a lower return compared to diversified REITs, although this difference is not significant.

The CAPM regression analysis indicated that REITs with a higher beta performed worse during the recession compared to REITs with a lower beta. This is caused by a risk-free rate that lies above the average REIT return. The extended CAPM model showed that health care REITs is the only category that significantly outperforms diversified REITs. The Carhart model learned that REITs: (1) have a relative low beta, (2) are considered small compared to other S&P 500 firms, (3) have a high book-to-market value and (4) encounter a very small impact of the ‘momentum’ factor. The Carhart model also

5. Discussion

5.1 REIT performance

The previous section clearly showed which REIT categories fared well during in the recession and also which REIT categories did not. REITs who invested in health care, industrial or residential properties gained the highest returns. REITs that invested in hotels, offices and retail performed much worse. REITs that split their investments among multiple real estate categories gained mediocre returns. Bringing to mind that the sample data was collected during the recession, the difference in REIT returns can, therefore not be accounted for.

The health care sector is the least affected by the recession. Intuitively this makes sense since, even in an economic crisis, people get sick and need to visit a doctor. Health care expenses are thus fairly independent of the state of the economy. This finding is in line with the current investment literature that classifies health care as a 'defensive sector' (Morningstar, 2011).

Another real estate sector that performs, relatively, well during the recession is industrial real estate. Unlike other types of real estate, industrial buildings often have long lease terms and are built for a specific tenant (Wilkinson, 2008). That's why industrial real estate stays relatively unaffected by the traditional real estate 'cycle' (Wheaton & Torto, 1990). In a global recession one would, however, expect that lower consumer expenses would eventually lead to a decline in the returns of respectively warehouses, manufacturing and distribution. A possible explanation for the positive returns during the recession is that the industrial real estate sector comprises more types of real estate than only warehousing, manufacturing and distribution. Relative new participants in this sector are, for example, datacenters and self-storage units. Despite the recession, the IT-sector is still growing and its influence on the economy increases each year (Baily & Bosworth, 2014). Self-storage companies benefit from the recession since, due to mortgage problems and foreclosures, a lot of people were forced to move to a smaller house with less space for their furniture and other possessions. Hiring relative cheap additional storage units proved to be a suitable solution for the need for extra storage space.

REITs that specialized in residential property also performed well during the recession. At first this may seem an unusual finding since the crisis started as the subprime mortgage crisis and, precisely residential market, was hit hard. Furthermore, the literature generally states that income (Wilkinson, 2008) and the availability of credit (Krainer, 2000) are important drivers of the residential real estate market. So why this apparent discrepancy between theory and practice? The answer may be that most U.S. policy and research was directed towards the 'American Dream' of homeownership for everyone (Shlay, 2006). During the recession it were the people that owned a home and couldn't pay their mortgage who got into trouble. The recession caused 'a transition from homeowners to renters' '(DiPasquale, 2011).

REITs that invested in hotels, offices and retail had a difficult time during the recession. The crisis resulted in the disappearance of the middle class buyers and also affected the purchasing behavior of the elite (Kapferer & Bastien, 2008). Both the hotel and retail sector are very susceptible for these changes (Kapferer & Bastien, 2008; Alonso-Almeida & Bremser, 2013). Especially the hotel sector was hit hard. Hotels have relative high fixed costs and almost no fixed income, a relative small decrease in the occupation rate can thus get a hotel in deep financial trouble (Alonso-Almeida & Bremser, 2013). Demand in the retail sector is dependent on economic elements like consumer confidence (Wilkinson et al, 2008). Furthermore, Dees & Brinca (2010) show that "the contribution of confidence in explaining consumption expenditures increases during periods of uncertainty". Uncertainty thus causes people to save out of precaution.

Returns from office real estate did suffer from the recession as well. The demand of office space is strongly dependent on employment in the service sector (e.g. Dipasquale & Wheaton, 1992). According to Goodman & Mance (2011) the 2007 recession was "unique with regard to the breadth and depth of the employment decline in private service-providing industries". Furthermore, the office sector has to deal with recent trends like that of flexible workspaces lowering the square meter demands per employee (Duffy et al, 2012).

Concluding: only healthcare REITs are able to significantly outperform diversified REITs during times of recession.

5.2 EMH vs Value added theory

In order to compare the Efficient Market Hypothesis with the Value Added Theory this thesis investigated the performance of diversified and specialized REITs. According to Fama the financial market is efficient. This should result in a lower return and lower risk for diversified REITS, the Sharp-ratio, on the other hand, should be higher. Furthermore, an efficient market implies that it is impossible for fund managers to outperform the market (Malkiel, 2003). Ro & Ziobrowski (2009) measure the market risk by taking the beta of a REIT. The results of the Carhart model show indeed that diversified REITs have on average the lowest beta off all the REIT classes, assuming we omit the biased hotel results. Diversified REITs, however, do not have the lowest returns as predicted by the EMH. Furthermore, the Shape-ratio is relatively low compared to some specialized REITs, also an outcome that is not in line with the EMH. The results of the Carhart model, however, show a very small and insignificant alpha indicating that fund managers do not affect the REIT returns. Moreover, the recession was the cause of some abnormal findings that are not in line with the EMH. First of all, in the years 2007-2012 the risk-free return was higher than the portfolio return. Second, the CAPM model showed that those REITs with the highest beta had the poorest returns. These results violate the essential financial principle that a higher risk requires a higher return.

So what outcomes do we expect to see according to the value added strategy? Before answering this question it is important to remember that financial instruments like the CAPM, Sharpe and beta are invented by proponents of the EMH. It is therefore hard to link the outcomes of these measuring instruments to the value added investment theory. All of this does, however, not prevent us from trying to interpret the results from a value added approach. Two important aspects of the value added strategy are: (1) the ability of a manager to unlock the full potential of a company, and (2) only invest in companies that are undervalued by the market. Both concepts are captured in the Carhart model. Scholars often use Jensen's alpha to measure the managerial impact on REIT returns (Eichholtz et al., 2000; Benefield et al., 2009). The outcome of the Carhart model shows that the values for Jensen's alpha are negligible for all REIT categories. However, according to the value added theory it is a prerequisite that a company can be bought for a relative low price in order to accomplish a significant managerial impact. The factor 'High minus Low' demonstrates the relation between market value and book value. For all REIT categories, except diversified REITs, the HML factor is significantly positive. Diversified REITs are thus a less attractive investment option for value added investors since the market value closely approaches the intrinsic value. This finding is consistent with the view of Warren Buffet who states that: "an investor is better off knowing a lot about a few investments than knowing only a little about each of a great many holdings" (Cunningham & Buffet, 2003).

Since there is not a single 'specialized REIT' group it is difficult to give an unambiguous response to the question whether specialized REITs do outperform diversified REITs during the 2007 recession. Based on indicators like CAPM, Sharpe-ratio and beta it is not possible to give a definite answer.

When looking at the larger picture, however, it becomes clear that the value added approach offers a firmer ground for investing than the EMH does in times of crisis. Comparing the two investment strategies from a broader perspective we can conclude that the efficient market hypothesis is outward directed and focused on relative performance. It relies heavily on the stock market as a whole and the risk-free rate in order to construct fundamentals like CAPM, the Sharpe-ratio and beta. The value added approach, on the other hand, is much more inward focused by looking at the absolute value of a company. This is an essential difference since the recession caused the whole market to implode. It practically blows away the foundation of the efficient market hypothesis. Thus although the EMH makes sense in 'normal' times it is susceptible in times of crisis. The value added approach is less vulnerable for a recession since investors who follow the value added approach "are aware that the world can change unexpectedly and sometimes dramatically" (Klarman, 1991).

6. Conclusion

6.1 General conclusion

The introduction started with the sentence "the crisis is over". There are indeed signs of recovery: the house prices in the Netherlands are rising again, and the unemployment ratio is slowly rising. This does not mean, however, that the economy is back at its pre-crisis level. At the beginning of 2014 investors in German bonds were still satisfied with a negative return on their 10-year loans (Bloomberg, 2014) and nowadays there is a real chance for deflation in the EU region. Although the worst part of the crisis is over, it still remains a 'hot' topic. The popularity of Piketty's book *Capital in the 21st century* and, even more recently, *limits of the market* written by professor de Grauwe from the London School of Economics indicate a shift in the general opinion towards a less liberal view of the financial market.

The most important findings are that:

I. REITs that specialize in health care real estate do significantly outperform diversified REITs during a recession.
II. REITs that specialize in industrial and residential properties gain higher returns compared with diversified REIITs in times of economic adversity. These differences are, however, not significant.
III. REITs that specialize in offices, retail and hotel real estate do perform worse compared to diversified REITs in times of recession, although these differences are not significant.
IV. The market value of REITs is severely impacted by market sentiment.
V. The average REIT return was negative for the years 2007-2012.

The recession revealed that there is an important difference between theory and practice. This doesn't mean, however, that the EMH has become redundant from now on. It is not the theory about efficient markets in itself that has caused the financial crisis, but the blind acceptance of this theory by regulators and central bankers (Fox, 2009). This blind faith in efficient markets deterred market regulators in 2007 from a timely interference (Time, 2009). In general we can conclude that the pitfall of applying the EMH in practice is that it can create a false feeling of security.

So, what are the implications for real estate investors? First of all, that investing in health care real estate has the most potential for a good payoff. A second conclusion is that diversifying in times of crisis is not a bad option. If you're not willing to actively manage your stocks, a diversified portfolio is a safe choice. A third implication is that market sentiment is not necessarily a bad thing. The resulting gap between market valuation and the intrinsic value creates investment opportunities for investors who follow the value added strategy. Especially for companies with a high liquidation value such REITs.

6.3 Reflection, limitations and future research

The process of gathering and analysing sample data is performed with great accuracy. By relying on multiple data sources the chance of conclusion based on faulty data is minimized. The stock prices, for example, are collected from both Yahoo! Finance and Bureau van Dijk. The latter is only used to make sure the structure of the sample data gathered form Yahoo! Finance was correct. Furthermore, the beta used in the CAPM originates from DataStream but is also checked against the beta of Yahoo! Finance and Bureau van Dijk. Moreover, the data and calculations are inspected by an econometrician in order to prevent mathematical errors that may eventually lead to wrong implications.

This thesis used sample data of American based REITs during an economic recession. With a focus on property type instead of geographical specialization. The results and conclusions are therefore not directly applicable for other continents and other ways of specialization. An interesting topic for future research is therefore to investigate the differences between diversified and specialized REITs in Europe during the recession. Another interesting topic for future research is to compare geographical specialization is the U.S. during the recession. The most important limitation of this thesis is that it does not encompass pre-crisis data. If that was the case, a better interpretation of the 2007-2012 could be given. A topic for future research would therefore be to compare the 2001-2007 returns with the 2007-2012 returns for a sample of diversified and specialized REITs

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Appendix 1

Mann-Whitney Sharpe ratio

1.1.1 Diversified – Health care

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	6,90	69,00
	1	9	13,44	121,00
	Total	19		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	14,000
Wilcoxon W	69,000
Z	-2,531
Asymp. Sig. (2-tailed)	,011
Exact Sig. [2*(1-tailed Sig.)]	,010[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.1.2 Diversified – Hotels

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	10,40	104,00
	2	8	8,38	67,00
	Total	18		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	31,000
Wilcoxon W	67,000
Z	-,800
Asymp. Sig. (2-tailed)	,424
Exact Sig. [2*(1-tailed Sig.)]	,460[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.1.3 Diversified – Industrial

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	8,40	84,00
	3	9	11,78	106,00
	Total	19		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	29,000
Wilcoxon W	84,000
Z	-1,306
Asymp. Sig. (2-tailed)	,191
Exact Sig. [2*(1-tailed Sig.)]	,211[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.1.4 Diversified – Offices

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	15,40	154,00
	4	15	11,40	171,00
	Total	25		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	51,000
Wilcoxon W	171,000
Z	-1,331
Asymp. Sig. (2-tailed)	,183
Exact Sig. [2*(1-tailed Sig.)]	,196[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.1.5 Diversified – Residential

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	8,90	89,00
	5	14	15,07	211,00
	Total	24		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	34,000
Wilcoxon W	89,000
Z	-2,108
Asymp. Sig. (2-tailed)	,035
Exact Sig. [2*(1-tailed Sig.)]	,036[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.1.6 Diversified – Retail

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
Sharpe-ratio	0	10	15,40	154,00
	6	21	16,29	342,00
	Total	31		

Test Statistics[a]

	Sharpe-ratio
Mann-Whitney U	99,000
Wilcoxon W	154,000
Z	-,254
Asymp. Sig. (2-tailed)	,800
Exact Sig. [2*(1-tailed Sig.)]	,819[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

Mann-Whitney CAPM

1.3.1 Diversified – Healthcare

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	7,10	71,00
	1	9	13,22	119,00
	Total	19		

Test Statistics[a]

	CAPM
Mann-Whitney U	16,000
Wilcoxon W	71,000
Z	-2,368
Asymp. Sig. (2-tailed)	,018
Exact Sig. [2*(1-tailed Sig.)]	,017[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.3.2. Diversified – Hotels

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	12,10	121,00
	2	8	6,25	50,00
	Total	18		

Test Statistics[a]

	CAPM
Mann-Whitney U	14,000
Wilcoxon W	50,000
Z	-2,310
Asymp. Sig. (2-tailed)	,021
Exact Sig. [2*(1-tailed Sig.)]	,021[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.3.3 Diversified – Industrial

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	8,90	89,00
	3	9	11,22	101,00
	Total	19		

Test Statistics[a]

	CAPM
Mann-Whitney U	34,000
Wilcoxon W	89,000
Z	-,898
Asymp. Sig. (2-tailed)	,369
Exact Sig. [2*(1-tailed Sig.)]	,400[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.3.4 Diversified – Offices

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	14,10	141,00
	4	15	12,27	184,00
	Total	25		

Test Statistics[a]

	CAPM
Mann-Whitney U	64,000
Wilcoxon W	184,000
Z	-,610
Asymp. Sig. (2-tailed)	,542
Exact Sig. [2*(1-tailed Sig.)]	,567[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.3.5 Diversified – Residential

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	7,90	79,00
	5	14	15,79	221,00
	Total	24		

Test Statistics[a]

	CAPM
Mann-Whitney U	24,000
Wilcoxon W	79,000
Z	-2,693
Asymp. Sig. (2-tailed)	,007
Exact Sig. [2*(1-tailed Sig.)]	,006[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

1.3.6 Diversified – Retail

Ranks

	Dummy gespreid	N	Mean Rank	Sum of Ranks
CAPM	0	10	15,00	150,00
	6	21	16,48	346,00
	Total	31		

Test Statistics[a]

	CAPM
Mann-Whitney U	95,000
Wilcoxon W	150,000
Z	-,423
Asymp. Sig. (2-tailed)	,673
Exact Sig. [2*(1-tailed Sig.)]	,693[b]

a. Grouping Variable: Dummy gespreid

b. Not corrected for ties.

Appendix 2

Regressions CAPM

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,715846256							
R-kwadraat	0,512435863							
Aangepaste kleinste kwadraat	0,506631528							
Standaardfout	0,005593841							
Waarnemingen	86							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	1	0,002762531	0,002762531	88,28502581	9,46978E-15			
Storing	84	0,002628448	3,12911E-05					
Totaal	85	0,00539098						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,073274609	0,001399969	-52,34014952	6,78595E-66	-0,076058602	-0,070490617	-0,076058602	-0,070490617
Beta	-0,01066303	0,001134846	-9,396011165	9,46978E-15	-0,012919797	-0,008406263	-0,012919797	-0,008406263

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,77103116							
R-kwadraat	0,594489049							
Aangepaste kleinste kwadraat	0,558097041							
Standaardfout	0,005294048							
Waarnemingen	86							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	7	0,003204879	0,00045784	16,33570323	4,67345E-13			
Storing	78	0,002186101	2,80269E-05					
Totaal	85	0,00539098						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,074753397	0,002236731	-33,42082072	5,54386E-48	-0,079206387	-0,070300407	-0,079206387	-0,070300407
Dummy HCR	0,004981635	0,002473075	2,014348209	0,047420235	5,81201E-05	0,009905149	5,81201E-05	0,009905149
Dummy HOT	-0,000629515	0,002620924	-0,240188258	0,810814447	-0,005847375	0,004588344	-0,005847375	0,004588344
Dummy IND	0,002712081	0,002437899	1,112466787	0,269354423	-0,002141402	0,007565565	-0,002141402	0,007565565
Dummy OFF	-0,003333521	0,002164114	-1,54036287	0,127519227	-0,00764194	0,000974899	-0,00764194	0,000974899
Dummy RES	0,00078388	0,002261823	0,346570066	0,729847548	-0,003719063	0,005286823	-0,003719063	0,005286823
Dummy RET	-0,00076348	0,002034859	-0,375200548	0,708529656	-0,004814574	0,003287613	-0,004814574	0,003287613
Beta	-0,009430193	0,00126094	-7,478702421	9,55364E-11	-0,011940531	-0,006919855	-0,011940531	-0,006919855

Appendix 3.
Fama-French and Carhart model

Fama-French regression output for diversified REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,883130273							
R-kwadraat	0,779919079							
Aangepaste kleinste kwadraat	0,779479796							
Standaardfout	0,186174851							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	184,6155007	61,53850022	1775,435404	0			
Storing	1503	52,09559617	0,034661075					
Totaal	1506	236,7110968						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,007709792	0,00479688	-1,607251455	0,108209257	-0,017119081	0,001699497	-0,017119081	0,001699497
MKT-RF	0,186093402	0,003528914	52,73390715	0	0,179171284	0,19301552	0,179171284	0,19301552
SMB	0,140955853	0,007710153	18,28184856	1,40818E-67	0,125832052	0,156079655	0,125832052	0,156079655
HML	0,09437433	0,007924127	11,90974542	2,5697E-31	0,07883081	0,109917849	0,07883081	0,109917849

Carhart regression output for diversified REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,8834994							
R-kwadraat	0,780571189							
Aangepaste kleinste kwadraat	0,779986825							
Standaardfout	0,185960698							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	184,7698624	46,1924656	1335,761155	0			
Storing	1502	51,94123444	0,034581381					
Totaal	1506	236,7110968						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,007751602	0,004791403	-1,617814676	0,105912508	-0,017150153	0,001646949	-0,017150153	0,001646949
MKT-RF	0,183942683	0,003668905	50,1355865	0	0,176745963	0,191139403	0,176745963	0,191139403
SMB	0,141584089	0,007707023	18,37078897	3,73728E-68	0,12646642	0,156701759	0,12646642	0,156701759
HML	0,085277968	0,009010236	9,464565683	1,09642E-20	0,067603989	0,102951948	0,067603989	0,102951948
MOM	-0,01063431	0,005033391	-2,112752665	0,034786565	-0,02050753	-0,000761089	-0,02050753	-0,000761089

Fama-French regression output for health care REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,841045674							
R-kwadraat	0,707357826							
Aangepaste kleinste kwadraat	0,70677371							
Standaardfout	0,24324116							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	214,9489653	71,64965511	1210,988373	0			
Storing	1503	88,92689147	0,059166262					
Totaal	1506	303,8758568						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	0,001663951	0,006267219	0,265500672	0,790660203	-0,010629473	0,013957375	-0,010629473	0,013957375
MKT-RF	0,201397741	0,004610596	43,6814977	9,0441E-270	0,192353856	0,210441626	0,192353856	0,210441626
SMB	0,133817546	0,010073469	13,28415709	3,69974E-38	0,114057997	0,153577094	0,114057997	0,153577094
HML	0,109677364	0,010353029	10,59374592	2,4307E-25	0,089369445	0,129985282	0,089369445	0,129985282

Carhart regression output for health care REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,841121485							
R-kwadraat	0,707485352							
Aangepaste kleinste kwadraat	0,706706352							
Standaardfout	0,243269096							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	214,9877175	53,74692938	908,1963983	0			
Storing	1502	88,88813926	0,059179853					
Totaal	1506	303,8758568						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	0,0016849	0,006267993	0,268810092	0,788112744	-0,010610047	0,013979847	-0,010610047	0,013979847
MKT-RF	0,202475352	0,004799568	42,1861576	3,45E-257	0,193060784	0,21188992	0,193060784	0,21188992
SMB	0,13350277	0,010082133	13,24152057	6,17378E-38	0,113726216	0,153279324	0,113726216	0,153279324
HML	0,114235067	0,011786963	9,691645323	1,38127E-21	0,091114413	0,137355722	0,091114413	0,137355722
MOM	0,005328288	0,006584555	0,80921006	0,418522494	-0,00758761	0,018244186	-0,00758761	0,018244186

Fama-French regression output for hotel REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,74441592							
R-kwadraat	0,554155062							
Aangepaste kleinste kwadraat	0,553265152							
Standaardfout	0,120556688							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	27,15120218	9,050400725	622,7090677	5,3008E-263			
Storing	1503	21,8444744	0,014533915					
Totaal	1506	48,99567658						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,008712481	0,003106198	-2,804869886	0,005098493	-0,014805424	-0,002619538	-0,014805424	-0,002619538
MKT-RF	0,075508408	0,002285132	33,04334438	1,8997E-180	0,071026022	0,079990795	0,071026022	0,079990795
SMB	0,047034799	0,004992675	9,420761165	1,62573E-20	0,03724145	0,056828149	0,03724145	0,056828149
HML	0,024242935	0,005131233	4,724583177	2,5213E-06	0,014177799	0,034308071	0,014177799	0,034308071

Carhart regression output for hotel REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,74441736							
R-kwadraat	0,554157206							
Aangepaste kleinste kwadraat	0,552969875							
Standaardfout	0,120596524							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	27,15130726	6,787826814	466,7251191	1,4316E-261			
Storing	1502	21,84436932	0,014543522					
Totaal	1506	48,99567658						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,00871139	0,003107251	-2,803568399	0,005119051	-0,014806402	-0,002616379	-0,014806402	-0,002616379
MKT-RF	0,075564523	0,002379305	31,75907931	8,9587E-170	0,070897411	0,080231635	0,070897411	0,080231635
SMB	0,047018408	0,004998046	9,407357649	1,83538E-20	0,037214517	0,056822299	0,037214517	0,056822299
HML	0,024480268	0,005843187	4,189540487	2,95791E-05	0,013018596	0,03594194	0,013018596	0,03594194
MOM	0,00027746	0,003264181	0,085001374	0,932271626	-0,006125377	0,006680297	-0,006125377	0,006680297

Fama-French regression output for industrial REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,851825001							
R-kwadraat	0,725605833							
Aangepaste kleinste kwadraat	0,72505814							
Standaardfout	0,324999658							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	419,8079701	139,93599	1324,840562	0			
Storing	1503	158,7540411	0,105624778					
Totaal	1506	578,5620112						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,000714167	0,008373764	-0,085286241	0,932045189	-0,01713967	0,015711337	-0,01713967	0,015711337
MKT-RF	0,2778277	0,006160315	45,09959379	1,3219E-281	0,265743974	0,289911426	0,265743974	0,289911426
SMB	0,216435181	0,013459375	16,08062631	8,24529E-54	0,19003403	0,242836332	0,19003403	0,242836332
HML	0,150360117	0,013832902	10,86974528	1,51617E-26	0,123226278	0,177493957	0,123226278	0,177493957

Carhart regression output for industrial REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,852183608							
R-kwadraat	0,726216902							
Aangepaste kleinste kwadraat	0,725487785							
Standaardfout	0,324745624							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	420,1615112	105,0403778	996,0236701	0			
Storing	1502	158,4005001	0,10545972					
Totaal	1506	578,5620112						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,000777441	0,00836729	-0,092914362	0,925983987	-0,017190255	0,015635372	-0,017190255	0,015635372
MKT-RF	0,27457283	0,006407057	42,85475348	8,5544E-263	0,262005102	0,287140557	0,262005102	0,287140557
SMB	0,217385946	0,013458876	16,15186509	3,10528E-54	0,19098576	0,243786131	0,19098576	0,243786131
HML	0,1365938	0,015734694	8,681058661	1,0029E-17	0,105729496	0,167458105	0,105729496	0,167458105
MOM	-0,016093829	0,008789877	-1,830950485	0,067305947	-0,033335565	0,001147907	-0,033335565	0,001147907

Fama-French regression output for office REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,846801463							
R-kwadraat	0,717072718							
Aangepaste kleinste kwadraat	0,716507993							
Standaardfout	0,378105902							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	544,5957704	181,5319235	1269,773027	0			
Storing	1503	214,8750015	0,142964073					
Totaal	1506	759,4707719						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,01554312	0,009742071	-1,595463707	0,110818811	-0,034652617	0,003566376	-0,034652617	0,003566376
MKT-RF	0,317779905	0,007166935	44,33972196	2,8615E-275	0,303721649	0,33183816	0,303721649	0,33183816
SMB	0,197733616	0,015658691	12,62772342	8,12871E-35	0,167018412	0,228448821	0,167018412	0,228448821
HML	0,192207105	0,016093253	11,94333449	1,77764E-31	0,160639487	0,223774722	0,160639487	0,223774722

Carhart regression output for office REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,847469726							
R-kwadraat	0,718204936							
Aangepaste kleinste kwadraat	0,717454483							
Standaardfout	0,377474186							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	545,4556571	136,3639143	957,0286635	0			
Storing	1502	214,0151148	0,142486761					
Totaal	1506	759,4707719						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,0156418	0,009725877	-1,608266285	0,107987031	-0,034719543	0,003435942	-0,034719543	0,003435942
MKT-RF	0,312703756	0,007447363	41,98852218	1,5716E-255	0,298095421	0,32731209	0,298095421	0,32731209
SMB	0,199216386	0,015644177	12,73421926	2,38821E-35	0,168529633	0,229903138	0,168529633	0,229903138
HML	0,170737775	0,018289517	9,335280478	3,49906E-20	0,13486207	0,206613479	0,13486207	0,206613479
MOM	-0,025099213	0,010217079	-2,456593878	0,014138571	-0,045140469	-0,005057957	-0,045140469	-0,005057957

Fama-French regression output for residential REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,825519895							
R-kwadraat	0,681483097							
Aangepaste kleinste kwadraat	0,680847334							
Standaardfout	0,41195097							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	545,7234849	181,9078283	1071,914952	0			
Storing	1503	255,0645136	0,169703602					
Totaal	1506	800,7879986						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,001800362	0,010614104	-0,1696198	0,865331976	-0,022620391	0,019019666	-0,022620391	0,019019666
MKT-RF	0,316849958	0,007808463	40,57776426	1,0101E-243	0,301533318	0,332166598	0,301533318	0,332166598
SMB	0,23908811	0,017060334	14,01426924	4,98143E-42	0,205623522	0,272552699	0,205623522	0,272552699
HML	0,175501079	0,017533795	10,00930392	7,0873E-23	0,141107777	0,209894382	0,141107777	0,209894382

Carhart regression output for residential REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,825521461							
R-kwadraat	0,681485683							
Aangepaste kleinste kwadraat	0,680637442							
Standaardfout	0,412086408							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	545,7255561	136,431389	803,4108995	0			
Storing	1502	255,0624425	0,169815208					
Totaal	1506	800,7879986						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,001805205	0,010617685	-0,170018736	0,865018299	-0,022632268	0,019021857	-0,022632268	0,019021857
MKT-RF	0,31660083	0,008130243	38,94112618	6,7337E-230	0,300652994	0,332548665	0,300652994	0,332548665
SMB	0,239160882	0,017078659	14,00349301	5,71772E-42	0,20566033	0,272661434	0,20566033	0,272661434
HML	0,174447403	0,019966561	8,736977714	6,27104E-18	0,135282101	0,213612704	0,135282101	0,213612704
MOM	-0,001231825	0,011153926	-0,11043867	0,91207624	-0,023110749	0,0206471	-0,023110749	0,0206471

Fama-French regression output for retail REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,849023307							
R-kwadraat	0,720840575							
Aangepaste kleinste kwadraat	0,720283371							
Standaardfout	0,27831039							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	3	300,6109186	100,2036395	1293,673421	0			
Storing	1503	116,4173799	0,077456673					
Totaal	1506	417,0282986						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,006746375	0,007170794	-0,940812846	0,346951956	-0,0208122	0,00731945	-0,0208122	0,00731945
MKT-RF	0,235918768	0,005275328	44,72116031	1,8813E-278	0,225570983	0,246266553	0,225570983	0,246266553
SMB	0,163263003	0,011525809	14,1649931	7,56163E-43	0,140654626	0,185871379	0,140654626	0,185871379
HML	0,135228239	0,011845675	11,41583247	5,25425E-29	0,111992431	0,158464046	0,111992431	0,158464046

Carhart regression output for retail REITs

SAMENVATTING UITVOER								
Gegevens voor de regressie								
Meervoudige correlatiecoëfficiënt R	0,849939284							
R-kwadraat	0,722396786							
Aangepaste kleinste kwadraat	0,721657497							
Standaardfout	0,27762594							
Waarnemingen	1507							
Variantie-analyse								
	Vrijheidsgraden	*Kwadratensom*	*Gemiddelde kwadraten*	*F*	*Significantie F*			
Regressie	4	301,2599028	75,31497569	977,1500476	0			
Storing	1502	115,7683958	0,077076162					
Totaal	1506	417,0282986						
	Coëfficiënten	*Standaardfout*	*T- statistische gegevens*	*P-waarde*	*Laagste 95%*	*Hoogste 95%*	*Laagste 95,0%*	*Hoogste 95,0%*
Snijpunt	-0,006832104	0,00715322	-0,955108886	0,339676325	-0,020863464	0,007199256	-0,020863464	0,007199256
MKT-RF	0,231508847	0,005477411	42,26611213	7,3628E-258	0,220764662	0,242253033	0,220764662	0,242253033
SMB	0,164551163	0,01150603	14,30129743	1,36217E-43	0,141981571	0,187120756	0,141981571	0,187120756
HML	0,11657669	0,013451634	8,666359275	1,13415E-17	0,09019071	0,14296267	0,09019071	0,14296267
MOM	-0,021805021	0,00751449	-2,901729969	0,003765174	-0,036545029	-0,007065013	-0,036545029	-0,007065013