The performance of the Real Estate Mutual Fund industry: an empirical examination from 2003 to 2015

Auteur : Jehin, Kévin
Promoteur(s) : Bazgour, Tarik
Faculté : HEC-Ecole de gestion de l'ULg
Diplôme : Master en sciences de gestion, à finalité spécialisée en Banking and Asset Management
Année académique : 2015-2016
URI/URL : http://hdl.handle.net/2268.2/1847

The performance of the Real Estate Mutual Fund industry: an empirical examination from 2003 to 2015

Jury:
Promoter:
Tarik BAZGOUR
Readers:
Marie LAMBERT
David PAWELKOWSKI

Master's Thesis presented by
Kévin JEHIN
For a Master in
Management specialized in
Banking and Asset Management
Academic year 2015/2016

HEC Liège
Ecole de Gestion de l'Université de Liège

The performance of the Real Estate Mutual Fund industry: an empirical examination from 2003 to 2015

Jury:
Promoter:
Tarik BAZGOUR
Readers:
Marie LAMBERT
David PAWELKOWSKI

Master's Thesis presented by
Kévin JEHIN
For a Master in
Management specialized in
Banking and Asset Management
Academic year 2015/2016

ACKNOWLEDGEMENTS

After devoting the last eight months to completing this paper, the writing of acknowledgements marks the end of my thesis, as well as of my studies at HEC-Ulg. It was definitely an enriching experience on both personal and professional levels, allowing me to become more independent in my work and to develop my critical thinking. I would also like to thank all the people who supported and helped me to carry out this project.

I would like to express my sincere appreciation and thanks to my promoter, Mr. Tarik Bazgour, for giving me the opportunity to work with him, for his presence, availability, sympathy, patience, enthusiasm and his great scientific knowledge. I have really appreciated his valuable assistance over the last few months.

Likewise, let me also thank the other members of my jury, Pr. Marie Lambert and Mr. David Pawelkowski. I am very grateful for their support and for taking the time to review my Master's thesis.

I also want to thank Mr. Jonathan Breuwer, a graduate of the University of Liege, for his help in the correction and formatting of my paper.

Finally, my special thanks go to my family for their unconditional support throughout my studies, and especially during the writing of this paper.

LIST OF TABLES

LIST OF APPENDICES

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

1.1. BACKGROUND DESCRIPTION

The housing bubble crisis, whose roots can be traced to the mid-1990s, grew along with the stock market bubble in US industry. When the latter collapsed in early 2000, it pushed the US stock market downward and, consequently, led to a clear loss of confidence among investors. Surprisingly, this fuelled the US housing bubble, therefore causing interest rates to further decrease and the real estate market to reach record levels. This gave rise to the quick expansion of the subprime market and the development of new financial instruments, especially the MBS[1] and CDO[2], whose value sharply increased over the years.

The first evidences of the bubble originated in the second half of 2006 with the significant increase of default rates on mortgages, which led banks both to strengthen their standards and to require substantial down payments, therefore putting even more pressure on debt holders, especially subprime borrowers. On top of this, MBS and CDO, whose value is closely related to that of mortgages, plummeted alongside the payment failure of borrowers. Therefore, as many people and institutions worldwide had massively invested in these instruments, they faced significant losses that affected the global economy.

The true beginning of the collapse of the housing bubble dated back to mid-2007, when the real estate market reached a peak. From this point on, the default rates on borrowings rocketed and the industry faced significant losses (i.e. mainly due to the decrease in value of MBS and CDO). As a consequence, several major financial institutions, such as Lehman-Brothers, went bankrupt. On top of this, most people

[1] Mortgage Backed Securities.
[2] Collateralized Debt Obligation.

around the world lost confidence, not only in the real estate market but, more broadly in the financial and economic system.

As these financial instruments poisoned the global economy, this occasioned a world recession that had disastrous consequences. Generally speaking, it is viewed as one of the greatest crises in recent history.

While the crisis "officially" ended in 2009, with some indications of slow recovery, one should reasonably consider its impact on the economy the following years, from 2010. Therefore, it is interesting to analyse the performance of the global real estate mutual fund industry before, during and after the housing bubble crisis. Furthermore, as it is still a hot topic at the present time and highly mediatized, it definitely represents an exciting subject to cover.

1.2. PURPOSE OF THE THESIS

The aim of my Master's thesis is to study the performance of global real estate mutual funds against a comparable market index, representing the world's housing market from 2003 to 2015. Then, in order to determine the impact of the economic downturn between 2007 and 2009, the period will be split into three sub-periods, respectively representing the pre-crisis (01/01/2003-31/12/2006), crisis (01/01/2007-31/12/2009) and post-crisis (01/01/2010-31/12/2015) situations.

In doing so, this paper is contributing to the scientific research on the topic and is helping to improve knowledge of this specific industry in several ways. Firstly, while there have been many well-conducted researches studies analysing the performance of the broad mutual fund industry over time, only a few economic papers have focused on mutual funds investing in real estate securities. Secondly, in the large majority of the cases, these delimited their scientific investigations to industry in the US. Consequently, by extending the investment area to the world, this paper is definitely adding to the knowledge concerning this specific industry. Finally, the greatest benefit of the thesis is definitely the period under review. Indeed, as the vast majority of articles have focused on the end of the 20th century and therefore have not included the impact the recent economic crisis, it is bringing something new to current literature.

On top of this, I decided to include an additional research topic in my thesis. I briefly analysed the potential relationship existing between the global real estate market, as represented by a world property index, and the global stock market, which is materialized through a worldwide stock benchmark. Therefore, the aim is to give evidence of the potential diversification benefits of this investment vehicle, as well as an eventual close connection between both industries. To this end, it uses the same approach as previously, which consists of dividing the timeframe into three parts in order to ascertain the effect of the housing bubble crisis. It thereby provides evidence of its impact on the correlation coefficients and the eventual lagged response between both industries.

1.3. ORGANISATION OF THE PAPER

In order to analyse the performance of real estate mutual funds over each sub-period, this thesis adopts a two-pronged approach. On the one hand, I use both single and multiple linear regression models to assess fund's alphas, respectively the CAPM, the Fama-French and the Carhart models. Moreover, this allows for an explanation of the incremental explanatory power of each factor, when added to the benchmark. Indeed, while the CAPM only accounts for the market index, Fama-French three-factor model and Carhart four-factor model respectively take into account the SMB[3], HML[4] and MOM[5]. On the other hand, I compute some well-known performance metrics, such as the Sharpe ratio, the Information ratio, and the Sortino ratio, to name but a few. The latter analysis is mainly used to complement the regression models.

A preliminary analysis of the literature and newspaper articles evidenced some key features. Firstly, as notably suggested by J. Gallo, L. Lockwood and R. Rutherford (2000) and J. Kallberg, C. Liu and C. Trzcinka (2000), the real estate mutual fund industry showed evidence of inefficiencies during the 1990s, therefore allowing managers to significantly and constantly produce positive abnormal performances and beat their respective benchmarks. However, this assumption does not seem to hold from the year 2000 and thereafter (Lin & Yung, 2004). Consequently, this specific market tends to standardize and comes in line with the broad mutual fund industry.

Secondly, one should note the special features of supply and demand on this market. First of all, it usually takes a long time to fund, design, obtain necessary permissions and build the new supply. Then, the degree of variation in demand is very slow, when compared to other "more reactive" industries that immediately adjust to changes in market conditions. This implies time lags in the market adjustment process, which usually lead to short-term disequilibrium.

Thirdly, C. Lin and K. Yung (2004) and J. Hartzell, T. Mulhoffer and S. Titman (2010) gave evidence that, when using a suitable real estate index as

[3] Small Minus Big.
[4] High Minus Low.
[5] Momentum.

benchmark, other explanatory factors, such as SMB, HML or MOM, have a really low explanatory power (as measured by the r-squared).

All of the above allows me to make some predictions about the results of the performance of global REMFs[6]. Over the years 2003-2007, I can reasonably expect REMFs to produce neither positive nor negative abnormal performance, as the above-mentioned studies provided evidence that this industry progressively became efficient and competitive in the early 2000s.

As most markets are reacting sharply and immediately to the effect of the 2007-2009 downturn, I obviously expect REMFs to significantly underperform with respect to their respective benchmark. However, I believe fluid markets are more impacted by the effects of the crisis. Therefore, I assume a great number of negative alphas, with a certain proportion of significant results.

If my anticipation is correct, almost all, if not all, REMFs will underperform their benchmark during the post-crisis years, from 2010 to 2015. As mentioned above, the consequences of the housing bubble crisis will take a little longer to make their presence felt, which means the industry will be sharply affected over this period.

In addition to this, I also measure the performance of an equally weighted portfolio over the same sub-periods. As it is composed of all available REMFs at that time, I expect it to experience similar results, with no evidence of out- or under-performance during the pre-crisis years and under-performance during both the crisis and post-crisis periods, with poorer performance during the latter.

Finally, as I use a global real estate index as benchmark, I expect the CAPM single-factor model to have a strong explanatory power. Therefore, I assume both the Fama-French three-factor model and Carhart four-factor model to have a low incremental impact on the r-squared.

The second part of my research studies the determinants of REMF's alphas through the cross-sectional regression model introduced by E. Fama and J. McBeth (1983). To this end, I successively analyse the impact of the expense ratio, the turnover ratio and the size (as represented by the logarithm of fund's NAV) on fund performance.

[6] Real Estate Mutual Fund.

In looking at the literature, I expect to find a negative relationship between the TER[7] and REMF's performance. This suggests financial planners should look for REMFs with the lowest expense ratio, as studies suggested the former generated better performances.

Moreover, while studies carried out on the REMF industry suggested a positive relationship between fund turnover ratio and alphas, I expect to find contradictory results, as demonstrated by research on the broad mutual fund industry. Indeed, as I assume the real estate market has been efficient since 2000, the results will likely be close to that of the broad mutual fund market.

Finally, I expect to demonstrate a positive relationship between fund size and alphas. As evidenced by the literature related to REMFs, larger funds tend to generate better performance as they have access to cutting-edge financial tools and to both the best managers and traders.

I decided to include an additional topic in my Master's thesis in order to highlight the existing correlation between the broad stock market and the real estate mutual fund industry at the global level. To this end, the study gathered monthly returns from several representative benchmarks (i.e. MSCI World index, MSCI World Real Estate index, General GPR index[8] and Russell 3000 index) and then, plotted price data on a chart in order to have a clear overview of the major trends. Once again, I divide the timeframe into three parts in order to give evidence of possible differences between different periods. When looking at the composition of the two benchmarks, one should note the predominance of US industry, which accounts for more than 50% of the sample in each case.

As evidence by D. Baker (2008), the US was affected by a stock market crash in 2002 that led to sharp downturns in world stock exchanges, and especially in Asian, European and North American countries. Since investors had lost confidence in the stock market, they invested heavily in the real estate industry, which they considered as a good alternative investment. This in turn further fuelled the housing bubble that achieved record growth rates until peaking in the mid-2007.

Obviously, I expect a de-correlation between those two industries during the 2003-2007 period (i.e. a lower correlation degree than in the two other periods

[7] Total Expense Ratio.
[8] General Global Property Research Index.

considered) as one achieved strong performances and the other has tended to experience a slow recovery.

Since the housing bubble crisis from 2007 to 2009 heavily affected almost every economy worldwide, I assume that both the broad stock market and the real estate industry plummeted over this period. Obviously, while the latter would likely be more impacted by this downturn, I expect to demonstrate a high correlation between them (i.e. the highest when compared to other periods).

Finally, I assume that both markets were still suffering from the effects of the crisis over the 2010-2015 period. Therefore, I still expect a strong correlation between both industries, as they experienced a certain economic recovery phase.

1.4. THESIS STRUCTURE

In this last section, I will provide some details on the structure of my Master's thesis.

Following the introduction, I will give some insight into the existing literature related to the performance of the real estate and mutual fund industries, the determinants of the alphas, the relationship between the broad stock market and the housing and property markets and the economic environment at that time. It is worth noting that I use several tables in order to highlight the main findings of these studies.

Then, I will outline the different performance metrics and regression models used to conduct my research. Additionally, I will provide some information about the Morningstar Direct© database, the set-up of my sample of funds and portfolios and my reference benchmark.

In the next section, I will give details of the results of my research as well as an interpretation of my findings. Once again, for the sake of clarity and coherence, I use several tables to summarize the information.

I will end up with the conclusions of my thesis, in which I make a comparison between my expectations, as presented in the introduction, and the results of my research. In the event of any potential conflict, I will try to identify the reasons for these discrepancies.

CHAPTER II

LITERATURE REVIEW

2.1. WHAT IS A GLOBAL REAL ESTATE MUTUAL FUND?

Before going into detail, let me state the definition of a mutual fund.

A mutual fund is a professionally managed pooling investment vehicle that collects money from individuals and institutions in order to invest in stocks, bonds, short-term money market instruments, and/or other securities. Each share represents a proportionate ownership of the fund's holdings and therefore, gives its owner the right to share in the profits and losses of the mutual funds. In addition, it offers several advantages such as professional management, economy of scale, portfolio diversification and alternative investment opportunities (Gremillion, 2005).

Real Estate Mutual Fund (i.e. REMF) is a specific type of mutual fund, which, as its name indicates, invests in real estate securities from around the world. It typically invests in REIT securities, real estate bonds, real estate related securities, and/or a mix of them. While a REIT can be considered as a mutual fund of real estate properties, REMF can be viewed as a fund of funds (Kallberg, Liu & Trzcinka, 2000).

2.2. PERFORMANCE OF THE BROAD MUTUAL FUND INDUSTRY

Mutual Fund Performance			
Study	**Period**	**Funds**	**Findings**
F. Brown & D. Vickers	1953-1958	115	- Mutual funds did not under- or out-perform the market. - Negative relationship between turnover and fund size.
W. Sharpe	1954-1963	34	- Highest and lowest Sharpe ratios respectively equal to 0.78 and 0.43. - High degree of variability in the Sharpe ratios.
J. Treynor & K. Mazury	1953-1962	57	- Fund managers were unable to beat the market.
M. Jensen	1945-1964	115	- Introduced the concept of Alpha. - No evidence of mutual fund's ability to outperform the benchmark. - The only positive and significant alphas can only be attributed to chance.
J. McDonald	1960-1969	123	- Mutual funds were not able to outperform the benchmarks.
E. Chang & W. Lewellen	1970-1979	67	- Managers had neither market timing abilities nor stock picking skills.
B. Lehmann & D. Modest	1968-1982	130	- The choice of the benchmark is crucial when analysing the performance of mutual funds.
M. Grinblatt & S. Titman	1975-1984	130	- Transaction costs were negatively related to the mutual fund's size. - Mutual funds were not able to beat the benchmark.
M. Grinblatt & S. Titman	1975-1984	155	- On average, the high transaction costs and fund expenses offset mutual fund abnormal performance.
B. Malkiel	1971-1991	239	- Expense ratio was inversely related to mutual fund's performance. - No evidence of recurring positive and significant alphas. - Mutual funds underperformed the benchmark (before and after adjusting for expenses).
M. Gruber	1985-1994	270	- Mutual funds underperformed the benchmarks.
D. Indro, C. Jiang, M. Hu & W. Lee	1993-1995	683	- Expense ratio was inversely related to mutual fund's performance. - Negative relationship between mutual fund's performance and the turnover ratio.

R. Wermers	1975-1994	241	- Mutual funds were not able to beat the benchmark.
M. Beechey, D. Gruen & J. Vickery	2000	/	- During the 1950s and 1960s, mutual funds were unable to beat the market (gross and net of expenses). - Recurrently, some managers were able to achieve better performances than their peers. - More and more funds were passively managed. - Under the efficient market hypothesis, actively managed funds tended to underperform their respective benchmarks.

Before examining the specific literature related to the real estate industry, one should note the features of the broad mutual fund industry. The above table provides a summary of the papers selected to illustrate their performance since the middle of the 20th century. Generally, the findings are quite similar over time, suggesting some key trends in this industry. First of all, it briefly highlights the key characteristics of the efficient market hypothesis. Then, it presents in greater depth the results from the above-mentioned studies.

According to E. Fama (1970), the large majority of markets were efficient. This means share prices always contained and reflected all available information. Under this hypothesis, transactions between investors and firms were achieved at a fair value and there were no arbitrage opportunities.

M. Breechey, D. Gruen and J. Vickery (2000) further provided evidence that managers operating in very competitive markets were not able to outperform their respective benchmarks (that is, to generate positive and significant alphas) on a recurrent basis. Therefore, as it was impossible to beat the market, the only way to generate above average returns was to invest in riskier assets.

The performance of the broad mutual fund industry, especially in the US, has been widely discussed by economic and financial professionals over time. As it benefits from a huge coverage, it is interesting to present its major trends and compare them with those of the specific real estate mutual fund industry.

As illustrated in the summary table, no study gave evidence of managers' abilities to outperform their respective benchmarks during the second part of the 20th century. While F. Brown and D. Vickers (1963) suggested that mutual funds did not

experience returns that significantly differed from their benchmark (neither better nor worse) over the 1953-1958 period, other papers explicitly demonstrated that managers usually underperformed the market.

However, this did not mean mutual fund performances were always below the market. In their works, M. Jensen (1968) and M. Beechay, D. Gruen and J. Vickery (2000) demonstrated that, even if some managers experienced positive and significant alpha over the period under consideration, the proportion was not sufficient to prove any ability to beat the market. Instead, according to them, these outperformances could only be attributed to chance. They further showed that some mutual funds tended to consistently and constantly experience better returns than their peers over the period.

These findings were consistent with the above-mentioned efficient market hypothesis, thus suggesting that the broad mutual fund industry has been efficient, at least since the 1950s. However, most of these studies were very specific to American industry, as they mainly analysed the performance of US mutual funds and they did not make any distinctions among the various investment types.

The first part of this chapter ends up with an analysis of the determinants of the performance of the broad mutual funds industry, helping to identify various factors impacting mutual fund's alphas.

F. Brown and D. Vickers (1963) and M. Grinblatt and S. Titman (1989) suggested a negative relationship between fund size and respectively, turnover ratio and transaction costs in that larger funds tend to trade less frequently and, as a matter of fact, to have lower transaction costs.

In their paper, D. Indro, C. Jiang, M. Hu and W. Lee (1999) provided evidence of a negative relationship between mutual fund performance and the turnover ratio. B. Malkiel (1995) found an inverse relationship between mutual fund performance and the total expense ratio. This suggests that mutual funds that charged the highest TER were less likely to perform well, with respect to their peers. The same applied to the turnover ratio.

2.3. PERFORMANCE OF THE REMF INDUSTRY

Real Estate Mutual Fund Performance			
Study	**Period**	**Models**	**Findings**
A. Kaushik & A. Pennathur	1990-2008	- Single-factor - Carhart	- Studies made during the 1990s showed mixed results. - They analysed the impact of the 2007-2008 housing bubble crisis. - When accounting for this downturn, REMFs experienced positive and insignificant returns. - On removing the effects of this 2-year period, REMFs generated positive and significant returns.
C. Lin & K. Yung	1993-2001	- Single-factor - Fama-French - Carhart	- Rapid growth in the REMF industry during the 1990s. - Very few studies made on REMFs. - The majority of REMF alphas were negative (before/after fees). - REMFs were not able to beat the benchmark. - Benchmark was the major factor explaining the REMF's performance.
E. O'Neal & D. Page	1996-1998	- Multi-factor	- Close relationship between the benchmark and REMF performance. - Managers did not under- or out-perform the benchmark.
J. Hartzell, T. Mulhoffer & S. Titman	1990-2005	- Single-factor - Multi-factor	- Rapid growth in this industry. - Actively managed REIT mutual funds experienced positive abnormal performances.
J. Gallo, R. Lockwood & R. Rutherford	1991-1997	- Sharpe ratio - Single-factor	- REMFs produced positive and significant alphas (after adjusting for risk). - The real estate industry was not efficient during the 1990s.
J. Kallberg, C. Liu & C. Trzcinka	1987-1998	- Single-factor - Multi-factor	- REIT mutual funds were able to outperform the benchmark. - REIT mutual funds produced positive and significant alphas.

Before analysing the performance of the real estate mutual fund industry, one should note the lack of literature related to this specific sector. In contrast with the broad mutual fund industry, which has been heavily discussed over time, the first research on this topic dates back to the 1990s. Indeed, the numbers of REMFs picked

up considerably from that time on and progressively became a common investment vehicle. This paper purposely presents first the studies explaining the performance of REMFs before the 2000s, as they suggest the market was not efficient during this period. Afterwards, it examines the results provided by researches covering both the 1990s and 2000s.

J. Kallberg, Crocker H. Liu and C. Trzcinka (2000) examined the performance of real estate mutual funds against two benchmarks, representing respectively the real estate sector and the broad mutual fund industry, from 1987 to 1998. This study included all vehicles with at least 12 months of monthly returns and it used both the single-factor and multi-factor models. When compared to the real estate market, actively managed REMFs, on average, generated positive and significant alphas. They found similar results when using the broad mutual fund industry as benchmark. These conflicting results (i.e. with respect to the broad mutual fund industry) suggested that the real estate market was not efficient and therefore, that actively managed REMFs could take advantage of these inadequacies to generate above average returns.

While using a substantially different approach, J. Gallo, L. Lockwood and R. Rutherford (2000) showed the same results as in the previous paper. They included all REMFs with a minimum of 15 months of monthly returns available between 1991 and 1997. The paper also analysed the performance of both the sample of funds and an artificially created equally weighted portfolio through the Sharpe ratio and a single-factor model. On average, they found that both the portfolio and the funds systematically outperformed the benchmark. Indeed, the great majority was able to generate statistically significant and positive alphas over the period, whether after adjusting for risk relative to the index or not. According to the authors, "there is little evidence that RE market was so seriously inefficient during the 1991-1997 period that fund managers could systematically identify mispriced real estate assets" (Gallo, Lockwood & Rutherford, 2000, p. 175). They also found that REMF managers possessed superior allocation skills across property types, which was not true within property types.

When examining the paper written by E. O'Neal and D. Page (2000), one should note that it created a survivorship bias. Indeed, it analysed the performance of REMFs (fund by fund and equally weighted portfolio approach) over a 3-year period, between 1996 and 1998, while only including funds with at least 36 months of monthly returns available. It used a multi-index model in order to include the

systematic exposure to risk factors represented by the indices. As opposed to the papers analysed above, it did not find any evidence of positive abnormal performance in the industry, as the only positive and significant alphas could be attributed to chance. Moreover, the paper demonstrated a strong correlation between the sample of REMFs and the REIT index (i.e. REIT Wilshire). This suggests they invested a significant part of their assets in REIT vehicles.

C. Lin and K. Yung (2004) analysed the performance of REMFs between 1990 and 2005. To do so, they used three different models, respectively the CAPM single-factor model, Fama-French three-factor model and Carhart four-factor model. The sample contained funds with at least 24 months of monthly returns available over the period. First of all, they demonstrated that nearly all REMFs produced negative alphas over the period, even after accounting for the impact of expenses (i.e. by adding the trading costs of indexing to the alpha). This was consistent with the results provided by E. O'Neal and D. Page (2000) and with the literature related to the broad mutual fund industry, which suggested that managers were unable to outperform the market. Secondly, the previous conclusion remained valid no matter if the benchmark represented the real estate industry or the whole stock market. Finally, when using a real estate index as benchmark, the explanatory power of other risk factors (i.e. SMB[9], HML[10] and MOM[11]) was not significant. Therefore, it showed that the CAPM was sufficient to explain the performance of these investment vehicles.

Using a single-factor and multi-factor model, J. Hartzell, T. Mulhoffer and S. Titman (2010) illustrated the impact of fees on the performance of REMFs. To this end, they selected all REMFs with a minimum of 24 months of monthly returns available between 1990-2005. As already shown in previous papers, they highlighted the strong correlation between fund returns and the REIT index (namely Dow Jones REIT Wilshire), as well as the strong explanatory power of REIT benchmark. It further suggested that actively managed REMFs tended to charge substantial amounts of fees, which in turn prevented fund outperformances on a net basis.

The most recent article of the literature review was produced by A. Kaushik and A. Pennathur (2012) to analyse the impact of the 2007-2008s downturn on the performance of REMF industry. To do so, it used both single and multiple factor

[9] Small Minus Big.
[10] High Minus Low.
11 Momentum

models (i.e. the CAPM, the Fama-French and the Carhart model). In addition, it added a dummy variable in order to take into account the economic slump. The sample was constituted of all REMFs with at least 36 months of monthly returns over the 1990-2008 period. When considering the whole period (including the economic downturn), all performance measures demonstrated positive and non-significant alphas. On the opposite side, when excluding the 2007-2008 downturn from the sample, REMFs tended to generate positive and significant abnormal returns. Furthermore, the analysis of the dummy variable highlighted the strongly negative impact of this 2-year slowdown period on the performance of the REMFs, therefore confirming their previous results. However, one should pay attention to the timeframe of this paper, which could lead to misleading results. In fact, as it included the 1990s, during which time the REMF market tended to be inefficient, it was more than likely that this period strongly affected the results for the whole period, from 1990 to 2008. Therefore, it suggested that managers were able to outperform the real estate market, except during downturns in the economy.

To end up with this second part of the literature review, one should highlight the main trends identified by the literature.

Firstly, it provided mixed results with respect to the performance of REMF industry since 1990s. While J. Kallberg, C. Liu and C. Trzcinka (2000), J. Gallo, R. Lockwood and R. Rutherford (2000), J. Hartzell, T. Mulhoffer and S. Titman (2010) and A. Kaushik and A. Pennathur (2012) suggested REMF's ability to outperform the market, E. O'Neal and D. Page (2000), C. Lin and K. Yung (2004) gave contradictory results. However, there was some evidence that REMF industry was very inefficient during the 1990s.

Secondly, C. Lin and K. Yung (2004), J. Hartzell, T. Mulhoffer and S. Titman (2010), E. O'Neal and D. Page (2000) demonstrated that REMFs tended to invest a great part of their assets in REITs. In fact, they found that REMF performances were very sensitive to movements in REIT market.

2.4. DETERMINANTS OF THE ALPHAS OF THE REMF INDUSTRY

Real Estate Mutual Funds Determinants							
Study	**Period**	**Expense ratio**	**Turnover**	**Size**	**Mgnt. fees**	**Cash holding**	**Age**
A. Kaushik & A. Pennathur	1990 - 2008	-	+	+	Not + Not -	Not + Not -	
J. Hartzell, T. Mulhoffer & S. Titman	1990 - 2005	No powerful results					
C. Lin & K. Yung	1993 - 2001	Not + Not -	Not + Not -	+			Not + Not -
E. O'Neal & D. Page	1996 - 1998	-	+	+			-
J. Kallberg, C. Liu & C. Trzcinka	1987 - 1998		+	+			

The third part of this chapter shows the determinants of the performance of the REMFs. To this end, it successively presents the different factors impacting fund's alpha, as well as the results provided by the literature. The above table provides a short summary of results given by the literature.

All papers used the cross-sectional approach provided by E. Fama and F. Mcbeth (1973) in order to assess REMF's determinants. Briefly, it consists of regressing fund's alpha against various factors such as the total expense ratio, the turnover, the size to name a few.

Firstly, A. Kaushik and A. Pennathur (2012) and E. O'Neal and D. Page (2000) established a negative and significant relationship between fund's alphas and TER[12]. To a certain extent, C. Lin and K. Yung (2004) mitigated this result, as it documented neither a positive nor a negative link between them. These findings were not surprising as they suggested that fund's alpha decreases when the TER increases.

Secondly, J. Kallberg, C. Liu and C. Trzcinka (2000), E. O'Neal and D. Page (2000) and A. Kaushik and A. Pennathur (2012) demonstrated a strong and positive correlation between fund performance and the turnover ratio. As was the case with the TER, Lin and Yung (2004) did not find evidence of any relationship (neither positive, nor negative). This suggested that a fund tends to generate better performances as its

[12] Total Expense Ratio.

trading activity increases, and vice versa. This is in contradiction with the broad mutual fund industry literature, which suggests an inverse relationship.

Thirdly, J. Kallberg, C. Liu and C. Trzcinka (2000), E. O'Neal and D. Page (2000), C. Lin and K. Yung (2004) and A. Kaushik and A. Pennathur (2012) investigated the impact of REMF size on performance. They all showed a positive relationship, meaning that larger REMFs were likely to perform better than smaller ones. This was in line with the findings from the broad mutual fund industry. In fact, as the largest funds had more financial means, they were able, for instance, to hire highly skilled managers and to benefit from large economies of scale, which allowed them to generate better performance.

Fourthly, while C. Lin and K. Yung (2004) did not show any link between REMF performance and manager tenure, E. O'Neal and D. Page (2004) found a negative relationship.

Fifthly, A. Kaushik and A. Pennathur (2012) gave evidence of the existing relationship between REMF's alpha and respectively the management fees and the cash holdings. In either case, research suggested neither a positive nor a negative relationship. However, these findings require comparison, as this was the only article which studied this specific point.

Finally, when trying to identify the relationship between fund's alpha and other explanatory factors, J. Hartzell, T. Mulhoffer and S. Titman (2010) did not provide any powerful results.

2.5. RELATIONSHIP BETWEEN THE GLOBAL STOCK MARKET AND THE GLOBAL REAL ESTATE MARKET

Finally, the literature explaining the existing relationship between the broad stock market and the real estate market at the global level should be examined. To this end, the correlation between those two sectors, the development of the housing bubble and the impact of financial crisis of 2007-2009 will be successively identified.

D. Quan and S. Titman (1999) analysed the potential relationship between the stock market and the real estate market, the variation in property values and the evolution of rents over time. At first glance, they expected both the level of the economy and the level of interest rates to be positively impacted by the real estate and the stock market, while some other factors, such as labour costs, would produce a negative correlation.

To this end, they collected information about real estate prices, stock prices and macroeconomic variables from 17 countries over the 1983-1996 period. These included some of the largest industrial economies worldwide and some smaller economies in Asia's emerging markets.

This paper gave evidence of a significant and positive relationship between both stock and real estate markets. In fact, they were both driven by upward and downward expectations about future economic growth, and especially the level of rents and GDP[13]. It further demonstrated the huge impact of national factors (such as the country's business cycles and the political authorities) on the global real estate market.

In the last part of the paper, they made a case for a strong relationship between rental rates and both the GDP growth rates and the stock market returns. On top of this, they highlighted a significant and positive correlation between the GDP and real estate prices, while the inflation and the interest rates were economically and statistically insignificant over the period.

Finally, the paper demonstrated that future profits and rents shifted in the same direction if economic experts had the same expectations about these two factors. In such a case, both stock and real estate market would be strongly correlated. In fact,

[13] Gross Domestic Product.

the significant and positive correlation shown during some periods was primarily due to economic and financial variables influencing both markets. Therefore, it was not surprising that their strong correlation with the GDP was demonstrated.

In his paper, D. Baker (2008) illustrated the several stages of the housing bubble, from its inception in the mid-1990s to its collapse in 2007. The housing bubble, whose origins developed in the mid-1990s, grew along with the stock bubble in the US economy. It allowed people who had made substantial gains during the stock bubble to massively invest in the real estate market. Thus, it put a lot of pressure on the demand side and led to an increase in housing prices. On top of this, the market consensus anticipated a continuous increase in house prices over time. The combination of the two situations fuelled the bubble over the period. As evidenced by the authors, while house prices tended to remain stable over the 1900-1995 period, they faced a sharp increase of more than 30 % (after adjusting for inflation) in 2002.

The second phase of the housing bubble can be summarized in three points. First of all, the crash of the stock market bubble had a varied impact. Surprisingly, as opposed to Japan, this did not lead to the end of the housing bubble. On the contrary, it further fuelled the bubble. Indeed, investors who had lost confidence in the stock market massively invested in the real estate market, as a good and safe alternative. Secondly, in order to accelerate the recovery process during the 2001's recession, the Federal Reserve kept on cutting interest rates to stimulate the economy. This led the level of mortgage interest rates to decrease. Finally, in 2001, Alan Greenspan (board chairman of the Federal Reserve) spurred borrowers to go for floating rate (instead of fixed rate) mortgages. As a matter of fact, this brought interest rates to reach extraordinary low levels, which further fuelled the housing bubble.

During the 2002-2006 years, the author showed dramatic movements in the real estate market. First of all, the real house price increased by 31.6%, which represents a CAGR[14] of 7.1%, thereby stimulating the construction sector, which reached a peak in 2005 with more than 2,070,000 new projects (50% more than prior to the pre-bubble years).

In 2006 and 2007, the default rate began to rocket, which led banks to make their standards more stringent and to require larger down payments. Therefore, the

[14] Compound Annual Growth Rate.

vast majority of subprime borrowers were unable to pay back their loans, as they usually did not have money set aside.

After reaching a peak in mid-2007, real estate prices started to decline due to the over-supply in the industry. This situation further accelerated during the second half of the year 2007 and in 2008.

The paper also demonstrated that real housing prices had declined by more than 15 % between mid-2007 and the end of 2007. It further gave evidence that, since the mid-2007 peak in real estate market, the housing bubble has lost more than 7 billion USD, which represents a loss in wealth of approximately half of the GDP.

Since the early 1990s, one should note the increasing popularity of floating rate mortgages and the emergence of new types of non-standard mortgages, especially subprime loans and Alt-A mortgages[15]. The author noted an exceptional growth in the subprime market, from 9 % in 2002 to 25 % in 2005. At the culmination point of the bubble, both Alt-A and subprime mortgages represented more than 40 % of all loans issued, which is unreasonable assuming their respective levels of risk.

Moreover, the weak regulatory system had strongly encouraged the development of the housing bubble. Its primary consequence was directly related to MBS[16] (the issuing, securitization and subsequent repackaging of these instruments). Because subprime borrowers faced difficulties in paying back their loans, it led to a sharp decline in the value of these MBS, as they contained a great part of subprime loans. One should also note the terrific growth of the subprime market, the controversial situation in which banks paid rating agencies to rate their bonds, the growing interest for SIVs[17] and the lack of intervention of the Federal Reserve and other regulatory agencies.

Finally, K-H. Kim and B. Renaud (2009) analysed the impact of the housing bubble at the global level. The housing bubble crisis from 2007 was undoubtedly the worst crisis in the US economy since the Great Depression of 1929. Because of all existing interconnections among financial marketplaces, it had a global impact. However, one should note that some countries were more impacted than others, as each of them had their own individual real estate markets and financing systems.

[15] It is a particular type of US mortgage that is considered as less risky than subprime loans but riskier than prime loans.
[16] Mortgage-Backed Security.
[17] Structured Investment Vehicle.

The global credit easing from the mid-1990s to 2006 led to sharp rises in housing prices, which therefore reached record levels in several countries (such as the US). On top of this, the general credit easing supported the growth of the whole real estate and mortgage markets in most advanced as well as many emerging countries. Over this period, the global economy reached record growth rates.

The paper started with an explanation of the different trends during the housing bubble period. Firstly, it showed substantial co-movements of housing prices in industrialized countries, suggesting its impact was not limited to the US but rather to the global economy. Secondly, it noted strong increases in real estate prices over the whole period, with an acceleration of this phenomenon in most countries during the years from 2002-2006. Thirdly, while historical data demonstrated that housing prices tended to move at the same path as the inflation rate, they increased at much higher rates during housing bubble years. Fourthly, it pointed out the crucial impact of financial deregulation and low interest rates on the global economy.

According to the authors, there were basically three key factors that led to the boom in global real estate prices. First of all, the huge transformation of the global economy, which began in the early 1980s, led to the financial and trade liberalization, the emergence of new macroeconomic policies, the IT revolution, the quick growth of global trade and financial innovation. This gave rise to the expansion of both long-term financing and the mortgage market, which precipitated exceptionally low interest rates and very high growth rates. This in turn put great pressure on the demand side in the real estate market.

Then, the expansion of the mortgage market induced the development of new and complex loan instruments, especially floating-rate loans and hybrid products (combining both fixed and floating rates). As it became even more competitive over the years, it put a downward pressure on the borrowing rates and interest margins, encouraging households to get into a lot of debt. One should note that Japanese and German economies did not follow this general global trend. In fact, they did not face a huge expansion of their mortgage market, as opposed to other countries.

Finally, as the market consensus expected real estate prices to keep on rising over time, the demand in the housing market sharply increased, which in turn fuelled the bubble.

The authors concluded their paper by highlighting countries that had suffered the most from this housing crisis. While the USA was obviously the most affected, it

also made it clear that both Nordic and Anglo-Saxon economies were more vulnerable to shock/stress situations. It further demonstrated that, even if some countries were slightly affected by the crisis, it actually hit the whole global economy.

CHAPTER III

METHODOLOGY

3.1. FOREWORD

Within the framework of my Master's thesis, I analysed the global REMF industry from 2003 to 2015. In order to provide the best possible answer to this issue, I divided it into four parts. Firstly, I ran three different linear regression models (i.e. CAPM single-factor model, Fama-French three-factor model and Carhart four-factor model) to review the performance of REMFs. Secondly, I computed some well-known performance metrics in order to supplement my previous analysis. Thirdly, I examined the determinants of the alphas (i.e. computed through the Carhart four-factor model) to identify factors impacting the performance. Finally, I analysed the potential relationship between the stock market and the real estate mutual fund industry at the global level.

In this section, I present the various performance ratios and the linear regression models used throughout my thesis.

3.2. PERFORMANCE METRICS

3.2.1. THE SHARPE RATIO (EX-POST)

Often considered one of the most relevant performance metrics, it has become over the years a key strategic indicator to measure the risk-adjusted return of a fund.

The Nobel laureate William F. Sharpe created it in 1966 under the name of the "reward-to-variability" ratio. As stated by its author, the ex-post Sharpe ratio "indicates the historic average differential return per unit of historic variability of the differential return" (Sharpe, 1994, p. 51). In other words, it measures the average excess-return of a fund over the risk-free rate per unit of total risk or volatility.

In accordance with the original formula (Sharpe, 1966), I use the risk-free rate as benchmark for the computation of the excess-return. Furthermore, as my Master's thesis is related to the analysis of historical data, I only use the ex-post (or historical) Sharpe ratio.

The ex-post Sharpe ratio is computed as described below.

Firstly, the excess-return ER_t at time *t* is measured as

$$ER_t = R_t - R_{ft}$$

Where R_t is the return of the fund in period *t* and R_{ft} is the return of the risk-free rate in period *t*.

Secondly, the average excess-return $\overline{ER}$ for the period *T* is equal to

$$\overline{ER} = \frac{1}{T}\sum_{t=1}^{T} ER_t$$

Thirdly, the standard deviation of the excess-return over the risk-free rate σ for the period T is equal to

$$\sigma = \sqrt{\frac{\sum_{t=1}^{T}(ER_t - \overline{ER})^2}{T-1}}$$

Finally, the ex-post or historical Sharpe ratio is

$$SR = \frac{\overline{ER}}{\sigma_D}$$

The benefits and drawbacks of the Sharpe ratio have been widely discussed by the financial and economic world over time. Some argued that its greatest advantage lies in its convenience. Indeed, it does not require complex computation and its results can be easily interpreted. This explains its popularity among financial analysts (Cogneau & Hübner, 2009).

However, it has also faced many criticisms. Several highlighted its unrealistic assumptions, as it relies on the mean-variance paradigm of Markowitz. Firstly, it implies that fund's returns are normally distributed around the mean and that investment risks are only measured by the standard deviation of excess-returns (Bernardo & Ledoit, 2000; Cogneau & Hübner, 2008). Secondly, as pointed out by W. Sharpe (1994), it does not take into account the correlation among assets. In addition, when comparing two funds, the one with the largest Sharpe ratio does not necessarily have the largest excess return per unit of total risk. Indeed, he demonstrated that this only holds for the positive ones.

3.2.2. THE TREYNOR RATIO

J. Treynor (1965) created the Treynor ratio in 1965. In one respect, it is an adaptation of the Sharpe ratio, as the only change lies in the definition of the risk, which is represented by the beta. Therefore, it only takes into account the idiosyncratic risk while the Sharpe ratio includes both market and idiosyncratic risk (Hübner, 2003).

D. Kidd evidenced that, under the assumptions of the CAPM, a manager should not be rewarded for the market risk because it could be diversified away by

investing in the fully diversified market portfolio (Kidd, 2011). To sum up, Treynor ratio measures the excess-return over the risk-free rate per unit of idiosyncratic risk.

Treynor ratio is calculated as follow.

Firstly, the excess-return ER_t at time *t* is measured as

$$ER_t = R_t - R_{ft}$$

Where R_t is the return of the fund in *t* and R_{ft} is the return of the risk-free rate in *t*.

Secondly, the average excess-return $\overline{ER}$ for the period *T* is equal to

$$\overline{ER} = \frac{1}{T}\sum_{t=1}^{T} ER_t$$

Thirdly, the beta of the portfolio β_T for the period is given by

$$\beta_T = \frac{cov(R_T, R_m)}{var(R_m)}$$

Where β_T is the beta of the fund for the period *T*, $cov(R_T, R_m)$ is the correlation between the returns of the fund and the returns of the market for the period *T* and $var(R_m)$ is the variance of the returns of the market for the period *T*.

Finally, the Treynor ratio is measured as

$$TR = \frac{\overline{ER}}{\beta}$$

Since the Treynor ratio is a commonly used performance metric in the financial world, it has been the subject of a many studies over time.

W. Sharpe challenged the use of beta as measure for the risk. To this end, he compared the returns of a sample of mutual funds with the return of their respective benchmarks and then he analysed their variances from 1954 to 1963. His results showed that, even if there is quite a strong relationship between returns, the ratio is unable to capture the part of volatility due to the lack of diversification. Therefore, this performance metric is more relevant when used to compare well-diversified portfolios (Sharpe, 1966).

Some authors have illustrated the importance of selecting the right benchmark. Indeed, as it is used in the computation of the beta, the choice has a very big impact on the value of the denominator. The Treynor ratio relies on the assumptions of the CAPM, while some of them are considered to be unrealistic (Hübner, 2009; Kidd, 2011).

3.2.3. SORTINO RATIO

A. Sortino and L. Price created the Sortino ratio in 1994, by introducing two new elements into the Sharpe formula (Sortino & Price, 1994).

First of all, they integrated the notion of MAR[18], that is the minimum rate of return that must be earned by the investor in order to achieve some "reasonable objectives". This has an impact on both the numerator and the denominator. Secondly, the risk is measured through the downside deviation (i.e. semi-variance). It is an asymmetric measure that only takes into account the standard deviation of returns that lies below the MAR (Chaudhry & Johnson, 2008).

To summarize, Sortino ratio measures the average excess return over the MAR per unit of risk of not achieving the MAR.

Within the framework of my Master's thesis, I exclusively use the ex-post Sortino ratio. I compute it by using both the risk-free rate and the rate of return of the benchmark as indicators for the minimum acceptable return.

The Sortino ratio is calculated as follows.

Firstly, the excess-return ER_t at time *t* is measured as

$$ER_t = R_t - MAR_t$$

Where R_t is the return of the fund in *t* and MAR_t is the MAR in *t*.

[18] Minimum Acceptable Return.

Secondly, the average excess-return $\overline{ER}$ for the period *T* is equal to

$$\overline{ER} = \frac{1}{T}\sum_{t=1}^{T} ER_t$$

Thirdly, the downside deviation for the period *T* is equal to

$$DD = \sqrt{\frac{\sum_{t=1}^{T}(R_t - MAR)^2}{T}} \; for\ all\ R_t < MAR$$

Finally, the Sortino ratio for the period *T* is equal to

$$SR = \frac{\overline{ER}}{DD}$$

The Sortino ratio offers several advantages over the Sharpe ratio. When using the excess return as a function of the MAR, a difference can be made between good and bad outcomes from the pure investor's point of view. Indeed, any return that falls below the MAR is considered a bad one, while otherwise, it is viewed as a good one (Nawrocki, 2000; Chaudry & Johnson, 2008). Since the only threat for an investor is related to the occurrence of bad outcomes (as opposed to good outcomes that are considered as opportunities), the Sortino ratio uses the downside deviation as a measure for the risk. On the contrary, the Sharpe ratio does not make any distinction between upside and downside volatility. Therefore, managers are rewarded for positive alphas through a greater Sortino ratio (Chaudhry & Johnson, 2008; Cogneau & Hübner, 2009).

3.2.4. INFORMATION RATIO

J. Treynor and F. Black created the original version of the Information ratio in 1973, as a refinement of the Sharpe ratio. It measures the excess-return as the difference between the return of a portfolio and a specific benchmark. The risk is considered as the standard deviation of the excess return over the benchmark (i.e. the tracking error). The underlying idea of this metric is to gauge manager's ability to outperform the benchmark (Hübner, 2009).

The Information ratio is calculated as follow.

Firstly, the excess-return ER_t at time *t* is measured as

$$ER_t = R_t - R_{Bt}$$

Where R_t is the return of the fund in period *t* and R_{Bt} is the return of the specific benchmark in period *t*.

Secondly, the average excess-return $\overline{ER}$ for the period *T* is equal to

$$\overline{ER} = \frac{1}{T}\sum_{t=1}^{T} ER_t$$

Thirdly, the standard deviation of the excess-return over the benchmark σ for the period *T* is measured as follow:

$$\sigma = \sqrt{\frac{\sum_{t=1}^{T}(ER_t - \overline{ER})^2}{T-1}}$$

Finally, the Information ratio is calculated as

$$IR = \frac{\overline{ER}}{\sigma}$$

It is considered as one of the most important and powerful tools for evaluating a manager's ability to outperform its respective benchmarks (Grinold, 1989; Goodwin, 1998). Although it is a commonly used performance metric, it can lead to misleading interpretations, especially when it is negative. In his paper, C. Israelsen (2004) compared two funds with negative Information ratios over the same period of time. He found that the one with both the slowest excess return (i.e. deeply negative) and highest standard deviation (i.e. highly positive) had a greater Information ratio than the other one. In other words, the less attractive fund is considered to be the better choice. In order to address this concern, the author proposed an alternative metric called the modified Information ratio.

3.3. LINEAR REGRESSION MODELS

3.3.1. CAPM SINGLE-FACTOR MODEL

W. Sharpe and J. Lintner created the CAPM single-factor model in the early 1960s. It relies on the mean-variance paradigm developed by Markowitz in 1959.

In 1964 and 1965 respectively, W. Sharpe and J. Lintner complemented the Markowitz paradigm by assuming the existence of a complete agreement on the market by which investors can borrow and lend money at the risk-free rate. Consequently, they will hold a portfolio combining a risky tangency portfolio and risk-free assets (Sharpe, 1964; Lintner, 1965).

The CAPM has three implications. Firstly, it assumes the existence of a linear relationship between the expected returns of an asset and its beta. Secondly, people must be rewarded for investing in the risky portfolio, which implies a positive beta premium (i.e. the expected return on the market minus the risk-free rate). Thirdly, assets that are not correlated with the market have a beta that is equal to zero.

One must now introduce the concept of Jensen's alpha, which allows for measuring the performance of an investment tool. To this end, it assesses a manager's ability to forecast a security price and then to generate positive abnormal returns. This is materialized by a positive and significant alpha (Jensen, 1968).

The CAPM is calculated as follow:

$$R_{i,t} - Rf_t = \alpha_i + \beta_i(Rm_t - Rf_t) - \epsilon_{i,t}$$

Where $R_{i,t} - Rf_t$ is the excess monthly return of the fund *i* over the risk-free rate at time *t*, α_i is the measure of the performance of the fund *i*, β_i is the sensitivity of the fund's return to change in market returns, $Rm_t - Rf_t$ is the excess monthly return of the benchmark over the risk-free rate at time *t* and $\epsilon_{i,t}$ is the random error coefficient of the fund *i* at time *t*.

Nowadays, it is still a very popular measuring tool for several reasons. Firstly, it is based on simple assumptions and can therefore be easily computed. In addition to this, as the beta is supposed to have a sufficient explanatory power to determine the

expected return of an asset, it reinforces the relevance of the CAPM approach (Fama & McBeth, 1973).

However, the ability of the model to provide relevant results has been questioned since its inception, thereby paving the way for the development of new models in order to address the inadequacies of the CAPM. To this end, in 1973, F. Black and R. Merton created their own adjusted version of the CAPM by removing the notions of riskless borrowing and lending (Black, 1973; Merton, 1973).

As it assumes the expected return of an asset is fully explained by one factor, that is its expected risk premium, Jensen's alpha should be null. This hypothesis was rejected as one suggesting that some other factors had an explanatory power. This concern has been heavily documented by several empirical studies (Jensen, 1968).

In 1977, a study highlighted an empirical relationship between the performance of an investment in equity securities and their respective P/E[19]. To do so, it demonstrated the behaviour of security prices over a 14-year period. It showed that portfolios with a low P/E exhibited superior excess returns on a risk-adjusted basis. By doing so, it confirmed the existence of a potential relationship (Basu, 1977).

In 1984, a research examined the potential relationship between the total market capitalization of a firm and its returns. To this end, it compared the risk-adjusted returns of small-cap common stocks versus large-cap common stocks between 1936 and 1975. It found that small-cap common stocks experienced higher risk-adjusted returns and it referred this to as the "size effect" (Barry & Brown, 1984).

Another paper gave evidence of the existence of a positive relationship between the DER[20] of a firm and its expected return (Bhandari, 1988).

Finally, some researches used empirical data to evidence a link between the B/M[21] of a firm and its performance. They noted that the stocks of companies with high B/M ratios experienced, on average, higher risk-adjusted returns (Stattman, 1980; Rosenberg, Reid & Lanstein, 1985).

[19] Price-earning ratio.
[20] Debt-to-equity ratio.
[21] Book-to-market ratio.

3.3.2. FAMA-FRENCH THREE-FACTOR MODEL

Eugene Fama and Kenneth French created this regression model in 1992 in order to address some of the problems of the CAPM. In particular, they added some explanatory factors, on top of the market beta, to determine the forecasting abilities of managers.

They realized a cross-sectional analysis of the average returns on US common stocks in order to give evidence of a relationship with some predefined explanatory factors (i.e. the beta, the firm's size, the leverage, the P/E and the B/M). On the one hand, they found that the market beta provided a relatively small explanatory power on the average returns of the sample (either used alone or with other variables). On the other hand, they demonstrated the strong explanatory power of both B/M and firm size to describe the cross-section of average returns of the sample. As these two variables had never been considered in other conventional asset pricing models prior to that, they realized they should be taken into account (Fama & French, 1992).

For the first time in 1996, they demonstrated the ability of the Fama-French three-factor model to explain the anomalies from the Sharpe Lintner approach (Fama & French, 1996).

This model is mainly built upon these two papers and is calculated as follow:

$$R_{i,t} - Rf_t = \alpha_i + \beta_i(Rm_t - Rf_t) + \beta_{SMB,t}(SMB_t) + \beta_{HML,t}(HML_t) - \epsilon_{i,t}$$

Where SMB_t is the difference between the returns on a diversified portfolio of small and big stocks at time *t*, HML_t is the difference between the returns on diversified portfolios of high and low B/M stocks at time *t*.

3.3.3. CARHART FOUR-FACTOR MODEL

In 1997, M. Carhart introduced an alternative to the Fama-French three-factor model by adding another explanatory factor in order to account for the momentum effect.

In his paper, he wanted to determine a mutual fund's ability to generate superior returns when following a 1-year momentum strategy. He demonstrated strong performances while excluding both management fees and transactions costs (Carhart, 1997).

In his paper, he computed the Carhart four-factor model as follows:

$$R_{i,t} - Rf_t = \alpha_i + \beta_i(Rm_t - Rf_t) + \beta_{SMB,t}(SMB_t) + \beta_{HML,t}(HML_t) + \beta_{MOM,t}(MOM_t) - \epsilon_{i,t}$$

Where MOM_t is the difference between the returns on a diversified portfolio with high and low past returns at time *t*.

One should note that data related to the Fama-French and Carhart models was collected from the Fama website[22].

3.3.4. DETERMINANTS OF THE ALPHA

In order to analyse the impact fund's expense ratio, turnover ratio and size on the fund's alpha, I use a four-factor model. Like Carhart, I first compute the E. Fama and J. McBeth (1973) monthly cross-sectional regression. Then, I average these factors across the whole sample period in order to assess the influence of REMF factors on their performances.

It is computed as follows:

$$\alpha_i = \beta_0 + \beta_1(Expense\ Ratio_{i,t}) + \beta_2(Turnover_{i,t}) + \beta_3(Size_{i,t}) + \epsilon_{i,t}$$

Where α_i is the monthly abnormal performance for each REMF obtained from the four-factor model estimated over a 36 month rolling window at time *t*, $Expense\ Ratio_{i,t}$ is the annual fee that all funds charge to their shareholders at time *t* (including 12b-1 fees, management fees, administrative fees, operating costs, and all other asset-based costs incurred by the fund), $Turnover_{i,t}$ measures the fund's trading activity by taking the lesser purchases or sales and dividing by average monthly net assets at time *t* and $Size_{i,t}$ is the logarithm of total net assets at time *t*.

[22] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

3.4. DATABASE

3.4.1. MORNINGSTAR® DIRECT

The different pieces of information used in this paper were collected from the Morningstar® Direct database. These include monthly return, fund NAV, expense ratio, turnover, just to name a few.

I used the following approach to design my sample of funds. Firstly, I requested all "open-end funds" investing globally within the broad category "real estate sector equity". Then, I input the timeframe (i.e. from 2003 to 2015) and, in order to have a sufficient quantity of data, I excluded all REMFs with less than 36 months of monthly returns available. Finally, in order to avoid survivorship bias, I did not only include the surviving investments.

Several authors analysed the impact of survivorship bias on the performance of a sample of mutual funds. They indicated the two key reasons for the demise of a fund, which were either because it experienced recurring poor performance over a period or because its market value became so low that the management team decided to close it. Therefore, they found that, if a sample only included surviving funds, it overestimated the measuring performance, as it did not account for the worst results (Elton, Gruber & Blake, 1996).

Finally, my sample is composed of 1253 securities, grouped according to their fund identifier. On 01/01/2003, my sample contained 29 observations; this grew to 226 on 12/31/2015. Overall, I collected information about 381 different REMFs over the whole period.

3.4.2. SAMPLING

Based on the above-mentioned information, I divided my whole sample into three separate groups, representing respectively the pre-crisis (i.e. from 01/01/2003 to 12/31/2006), the crisis (i.e. from 01/01/2007 to 12/31/2009) and the post-crisis (i.e. from 01/01/2010 to 12/31/2015) periods.

Each set only includes REMFs with at least 36 months of returns available in order to avoid misleading results due to lack of information.

3.4.3. PORTFOLIO

Since the objective of this paper is to measure the performance on both individual and collective levels, I created an artificial equally weighted portfolio to reflect its monthly average performance. It allocated the same weight to each fund, regardless of its market capitalization or its economic size. Therefore, the portfolio was rebalanced on a monthly basis according to the entry or exit of REMFs.

The monthly returns of the equally weighted portfolio ($R_{p,t}$) were calculated as follows:

$$R_{p,t} = \frac{1}{N_t} \sum_{i=1}^{N} R_{i,t}$$

Where N_t is the number of REMFs at time t and $R_{i,t}$ is the return of the i[th] REMF at time t.

3.4.4. BENCHMARK – MARKET PROXY

As highlighted by the literature, it is critical to select the right benchmark when evaluating the relative performance of mutual funds (Roll, 1978; Damodaran & Liu, 1993).

I used the GPR Global Index as market proxy for my analysis. Established in 1983, it aims at describing the trends in the global real estate market and it is published on a monthly basis. It is currently composed of 643 global companies, whose market capitalization varies from 19 million USD to 65,382 million USD. Consequently, it takes into account small-, mid- and large-cap stocks.

As shown in Appendix I, GPR Global Index is mainly composed of American (45%), European (23%) and Eastern (30%) companies while African firms are less represented (2%). With respect to its sector breakdown, 90% of this benchmark is composed of retail, diversified, office, residential and industrial-oriented companies. Just for your information, the remainder consists of healthcare and hotels. It should be noted that it is mainly constituted of REITs.

One should note its high correlation with the FTSE/EPRA NAREIT (99,23%), which originated in 2005. The latter tracks the performance of both listed real estate companies and REIT at a global level and as such it is considered a good indicator of financial movements in real estate equities worldwide.

CHAPTER IV

RESULTS AND DISCUSSION

4.1. FOREWORD

I divide the presentation of the empirical results into four parts.

I will start by analysing the performance of the global REMF industry through single and multi-factor models. To this end, I first present the results of my equally weighted portfolio and of my sample of funds for each of the period under consideration (i.e. 2003-2006, 2007-2009 and 2010-2015). Afterwards, I review the explanatory power of the different models through the concept of r-squared.

In the second part, I will review the results provided by the performance metrics (i.e. the Treynor, Sharpe, Information and Sortino ratios) and then make a link with the regression testing.

In the next section, I will investigate the cross-sectional determinants of alphas in order to find the existing relationships between fund performances and, respectively, the TER, the turnover and the size.

Finally, I will analyse the empirical relationship between the real estate industry and the broad stock market at the global level.

4.2. PERFORMANCE ANALYSIS

4.2.1. 2003-2006

Table A					
Portfolio: 2003-2006					
CAPM - Single-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	0.0002345	0.0010611	0.221	0.826	
GPR	1.0048479	0.029594	33.954	2E-16	***
Funds	35				
Fama-French - Three-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	0.0009877	0.0011844	0.834	0.4088	
GPR	1.0282829	0.0302047	34.044	2E-16	***
SMB	-0.132584	0.0577303	-2.297	0.0265	*
HML	-0.0804207	0.0983519	-0.818	0.4179	
Funds	35				
Carhart - Four-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	0.000956	0.0012	0.797	0.43	
GPR	1.027205	0.030651	33.513	2E-16	***
SMB	-0.126036	0.061032	-2.065	0.045	*
HML	-0.070904	0.102735	-0.69	0.494	
MOM	-0.013961	0.038443	-0.363	0.718	
Funds	35				

I begin with an analysis of the performance of my portfolio from 2003 to 2006. When using the General GPR as benchmark, table A shows that the asset-weighted average portfolio alpha is statistically insignificant, which means it did not produce abnormal performance over this period. Whatever the model used (i.e. single- or multi-factor model), they all provide the same result as above-mentioned.

Table B								
35 REMFs: 2003-2006								
Model	Funds		Positive	Negative	Significant	Insignificant	Positive and Significant	Negative and Significant
CAPM	35	*Abs.*	18	17	7	28	4	3
		Rel.	51.43%	48.57%	20.00%	80.00%	11.43%	8.57%
Fama - French	35	*Abs.*	21	14	4	31	2	2
		Rel.	60.00%	40.00%	11.43%	88.57%	5.71%	5.71%
Carhart	35	*Abs.*	21	14	4	31	2	2
		Rel.	60.00%	40.00%	11.43%	88.57%	5.71%	5.71%

A perusal of table B will demonstrate the number of REMFs that produced positive, negative, significant and insignificant alphas during the 2003-2006 period. It expresses the results in both absolute and relative terms in order to provide a clear overview of the findings.

Under the CAPM single-factor model, I find quite balanced results. In fact, 18 REMFs experience a positive alpha, with 2 significant at the 10 % level, 1 significant at the 5 % level and 1 significant at the 1 % level, while 17 produce a negative alpha, with 1 significant at least at the 10 % level, 5 % level and 1 % level. These results are in line with the portfolio analysis, as it does not provide any strong evidence of underperformance or outperformance during the period.

Fama-French three-factor model and Carhart four-factor model further confirm these findings. Although the number of significant and positive/negative alphas decrease (i.e. respectively from 4 to 2 and from 3 to 2), results are still well balanced. Therefore, it does not clearly indicate any underperformance or outperformance in this industry.

Table C		
35 REMFs: 2003-2006		
Model	R-squared	Adj. R-squared
CAPM	0.9616315	0. 9607974
Fama-French	0.9659916	0. 9636729
Carhart	0.9660956	0. 9629417

When looking at the results provided by table C, I notice the significant and positive impact of the Global GPR Index on the performance of my equally weighted portfolio. This suggests performance is clearly explained by this benchmark. To check the validity of this assertion, one should pay attention to the r-squared analysis, provided in table C. I find that the single-factor CAPM model explains approximately 96.16% of the results, while the Fama-French three-factor model and Carhart four-factor model have a very low additional explanatory power, respectively 96.60 % (+0.34%) and 96.61% (+0.35%). As a matter of fact, the General GPR index is sufficient to explain the performance of my portfolio over the 2003-2006 period.

This is in line with the literature related to the REMF industry. Indeed, when using a real estate index as benchmark to analyse the performance of REMFs, E. O'Neal and D. Page (2000) and C Lin and K. Yung (2004) indicated its huge power

in explaining the results of the model, while other factors such as SML, HML and MOM had a relatively low incremental impact.

Table D		
35 REMFs: 2003-2006		
Model	Average R-squared	Average Adj. R-squared
CAPM	0.720985434	0.714742466
Fama-French	0.734179369	0.71548938
Carhart	0.739536791	0.714555051

The individual r-squared analysis provides similar results to those obtained previously. Indeed, both Fama-French three-factor and Carhart four-factor models provide a very low incremental explanatory power with respect to the CAPM single-factor model. Once again, this confirms the strong impact of the General GPR index.

4.2.2. 2007-2009

Table E					
Portfolio: 2007-2009					
CAPM - Single-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.003056	0.002257	-1.354	0.185	
GPR	1.111479	0.029741	37.372	2E-16	***
Funds	124				
Fama-French - Three-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.002984	0.002156	-1.384	0.1759	
GPR	1.073917	0.032832	32.709	2E-16	***
SMB	0.188722	0.13445	1.404	0.17	
HML	0.26219	0.123591	2.121	0.0417	*
Funds	124				
Carhart - Four-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.003461	0.002166	-1.598	0.12	
GPR	1.049813	0.03747	28.017	2E-16	***
SMB	0.172769	0.133638	1.293	0.206	
HML	0.197367	0.13221	1.493	0.146	
MOM	-0.068389	0.052938	-1.292	0.206	
Funds	124				

When analysing the results provided by table E, I do not find any strong evidence of portfolio ability to outperform or underperform the market during the

2007-2009 crisis. This assertion holds whatever the model under consideration. In fact, both single-factor and multi-factor models generated negative but non-significant alphas.

As previously discussed, the adjustment mechanism of supply and demand in this specific industry is far slower than in fluid markets. Therefore, I expect to find evidence of the strong and negative consequences of the 2007-2009 crisis in the post-crisis period. This will be analysed in the following section (i.e. 2010-2015).

Table F								
124 REMFs: 2007-2009								
Model	Funds		Positive	Negative	Significant	Insignificant	Positive and significant	Negative and significant
CAPM	124	*Abs.*	26	98	13	111	0	13
		Rel.	20.97%	79.03%	10.48%	89.52%	0.00%	10.48%
Fama-French	124	*Abs.*	28	96	14	110	0	14
		Rel.	22.58%	77.42%	11.29%	88.71%	0.00%	11.29%
Carhart	124	*Abs.*	16	108	15	109	0	15
		Rel.	12.90%	87.10%	12.10%	87.90%	0.00%	12.10%

The results provided in table G suggest some underperformance in my sample of REMFs. Indeed, I find a great majority of negative alphas, regardless of the model implemented. On top of this, I do not find any positive and significant alphas during the 2007-2009 downturn, while 13 out of 124 REMFs experienced negative and significant performances under the CAPM model.

Taken together, these results suggest REMFs suffered a lot during this period. This is not surprising as the housing bubble crisis poisoned all the sectors of the economy. However, the REMF industry seems to be hurt to a lower extent than "more fluid" markets. Both the equally weighted portfolio and the sample of funds demonstrate poor performances. Indeed, while the equally weighted portfolio produces negative and non-significant alphas, 13 REMFs experienced negative and significant alphas under the CAPM single-factor model, which account for approximately 11 % of my sample of funds.

As previously discussed, I expect to find stronger underperformances in the post-crisis period (i.e. between 2010 and 2015) due to the low adjustment mechanism of supply and demand in the specific real estate industry. Therefore, I suggest the consequences of the crisis were even more severe during the following years.

Table G			Table H		
Portfolio: 2007-2009			**124 REMFs: 2007-2009**		
Model	R-squared	Adj. R-squared	**Model**	Average R-squared	Average Adj. R-squared
CAPM	0.9762352	0.9755363	*CAPM*	0.897270566	0.89424911
Fama - French	0.9795825	0.9776684	*Fama - French*	0.910893015	0.902539234
Carhart	0.9806256	0.9781257	*Carhart*	0.914897173	0.903916158

As evidenced in the previous part (2003-2006), table G demonstrates the strong power of the General GPR index in explaining the results of the model. Indeed, when adding additional factors to the global real estate benchmark, the r-squared only increases marginally. As illustrated in the table, it changes from 0.9762352 to 0.9795825 when adding SML and HML to the index and from 0.9795825 to 0.9806256 when accounting for the MOM factor. This holds when I analyse the average r-squared of my sample of REMFs, as illustrated in table H.

4.2.3. 2010-2015

Table I					
Portfolio: 2010-2015					
CAPM - Single-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.0017215	0.0008605	-2	0.0493	*
GPR	1.0405375	0.0207945	50.04	2E-16	***
Funds	249				
Fama-French - Three-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.0015531	0.0008683	-1.789	0.0781	.
GPR	1.0374826	0.0210666	49.248	2E-16	***
SMB	0.0239252	0.0600556	0.398	0.6916	
HML	0.0811965	0.0555695	1.461	0.1486	
Funds	249				
Carhart - Four-factor model					
Variables	Estimate	Std. Error	T-Value	Pr (>|t|)	
Alpha	-0.0019105	0.0009156	-2.087	0.0407	*
GPR	1.0385034	0.0210171	49.412	2E-16	***
SMB	0.0219937	0.0598869	0.367	0.7146	
HML	0.1008348	0.0577713	1.745	0.0855	.
MOM	0.0466115	0.0389355	1.197	0.2355	
Funds	249				

I end up this first part by analysing the performance of REMFs over the post-crisis period, from 2010 to 2015.

As illustrated in table I, both single-factor and multi-factor models demonstrate negative and significant asset-weighted average portfolio alphas. While the 2007-2009 downturn showed some evidence of underperformance in the industry, the crisis appears to have had worse consequences in the following years.

Table J								
249 REMFs: 2010-2015								
Model	Funds		Positive	Negative	Significant	Insignificant	Positive and significant	Negative and significant
CAPM	249	*Abs.*	57	192	44	205	0	44
		Rel.	22.89%	77.11%	17.67%	82.33%	0.00%	17.67%
Fama-French	249	*Abs.*	51	198	44	205	0	44
		Rel.	20.48%	79.52%	17.67%	82.33%	0.00%	17.67%
Carhart	249	*Abs.*	38	211	52	197	0	52
		Rel.	15.26%	84.74%	20.88%	79.12%	0.00%	20.88%

As illustrated in table J, the analysis of my sample of funds confirms this assertion. Indeed, I find a great number of negative and significant alphas, respectively 44 when using the CAPM single-factor model and Fama-French three-factor model (17.67% of the sample) and 52 under the Carhart four-factor model (20.88% of the sample).

Therefore, when comparing the results from the crisis and post-crisis period, I give clear evidence of a sharp increase in the percentage of REMFs that experience significant underperformances. This confirms my predictions, especially concerning the existence of a "lagged effect" in this industry.

Table K			Table L		
Portfolio: 2010-2015			**249 REMFs: 2010-2015**		
Model	R-squared	Adj. R-squared	**Model**	Average R-squared	Average Adj. R-squared
CAPM	0.972804	0.9724155	*CAPM*	0.825684861	0.822694529
Fama - French	0.9736753	0.9725139	*Fama - French*	0.835690889	0.826940482
Carhart	0.9742266	0.9726879	*Carhart*	0.841000663	0.82948149

Finally, as I already demonstrated, both tables K and L manifest the strong explanatory power of the General GPR index in describing the performances of REMFs. Indeed, when comparing the r-squared provided with additional factors, I notice insignificant increases, therefore suggesting their low incremental impacts.

4.3. PERFORMANCE METRICS

In this section, I review the results provided by the performance metrics. As it would be complicated to review the outcomes of each individual REMF, I decided to summarize the data in tabular form. These contain information for each of the three periods under consideration. I also divided up my analysis in order to illustrate metrics that express the excess-return with respect to the risk-free rates (i.e. Treynor, Sharpe and Sortino (rf) ratios) and measure it against the General GPR index (Information and Sortino (GPR) ratios).

Before getting into the subject matter of the case, I want to highlight the strong increase in the number of global REMFs during the three periods presented. Indeed, it grew from 35 to 124 between 2003-2006 and 2007-2009 and, from 124 to 249 between 2007-2009 and 2010-2015. In their papers, C Lin and K.Yung (2004), J. Hartzell, T. Mulhoffer and S. Titman (2010) and A. Kaushik and A. Pennathur (2012) found evidence of the same phenomenon, as they noticed a rapid growth in this industry since the mid-1990s.

4.3.1. 2003-2006

Table M

	Treynor ratio	Sharpe ratio	Information ratio	Sortino ratio (rf)	Sortino ratio (GPR)
N	35	35	35	35	35
Minimum	0.007792346	0.215965566	-0.688272461	0.320568058	-0.603352541
Maximum	0.038892673	0.84783854	0.56988162	2.207050565	1.490163323
Positive	35	35	24	35	24
Negative	0	0	11	0	11
Mean	0.02074429	0.580285221	0.035787585	1.171297462	0.140748197
Quartile 1	0.018918418	0.514140229	-0.028231903	0.898673408	-0.037340596
Median	0.019783847	0.618792002	0.143583561	1.141625471	0.236722227
Quartile 3	0.024461154	0.669327964	0.191011819	1.455203695	0.303914358

As illustrated in table M, the analysis of the performance metrics tends to confirm the results from my regression models.

Firstly, the review of Treynor, Sharpe and Sortino (rf) ratios demonstrates that all REMFs experienced positive excess-returns over the risk-free rate per unit of risk, respectively represented by the beta, the standard deviation and the downside deviation. Therefore, it suggests that, on average, my sample produced positive monthly returns during this period.

Secondly, when evaluating the excess-return over the index per unit of risk, table M shows that some REMFs (11) were not able to outperform the General GPR over this period. Indeed, 24 funds out of 35 produced, on average, greater monthly returns than the General GPR index.

However, both Information and Sortino (GPR) ratios provided evidence of low reward per unit of risk, respectively the tracking error and the downside deviation. This in turn suggests that, when generating excess-returns, fund managers were not able to produce significant outperformance. It confirms the findings from my regression analysis, as they do not suggest significant evidence of underperformance or outperformances during the 2003-2006 period.

4.3.2. 2007-2009

Table N

	Treynor ratio	Sharpe ratio	Information ratio	Sortino ratio (rf)	Sortino ratio (GPR)
N	124	124	124	124	124
Minimum	-0.092439995	-0.631991254	-0.405893687	-0.553980812	-0.422617685
Maximum	0.004786817	0.051470764	0.233522796	0.075339778	0.44475862
Positive	1	1	10	1	10
Negative	123	123	114	123	114
Mean	-0.009891598	-0.118299872	-0.12975055	-0.145321544	-0.160350159
Quartile 1	-0.010778698	-0.133962105	-0.209031606	-0.165984003	-0.26251105
Median	-0.008750387	-0.109723487	-0.136858013	-0.139306097	-0.182782914
Quartile 3	-0.007048344	-0.088163327	-0.047664517	-0.113242119	-0.064291026

When analysing the results provided by table N, I find strong evidence of underperformance in the industry.

First of all, only one REMF experienced a positive Treynor, Sharpe and Sortino (rf) ratio during this period. This in turn means that the vast majority of my sample of funds produced negative excess-returns over the risk-free rate per unit of risk. It is thus hardly surprising to face such a situation as the housing bubble crisis had severe consequences on the whole global economy and, especially the real estate market. On the one hand, REMFs experienced a large majority of negative monthly returns over this period and, on the other hand, after reaching a peak in August 2007 (0,43%), risk-free interest rates plummeted to 2010 (0,00%).

Secondly, when comparing the above results with those provided by the Information and Sortino (GPR) ratio, I find that 10 REMFs experienced positive excess return over the benchmark index per unit of risk. While this represents a

relatively limited part of my sample (approximately 10%), it demonstrates that several funds were able to produce, on average, better monthly returns during this period.

Therefore, it supports the results provided by the regression analysis, which suggests underperformance during the housing bubble crisis, as approximately 11% of my sample of REMFs produced negative and significant alphas. However, it nevertheless provides no clear evidence of "lagged effect", as shown in table O below.

4.3.3. 2010-2015

Table O					
	Treynor ratio	**Sharpe ratio**	**Information ratio**	**Sortino ratio (rf)**	**Sortino ratio (GPR)**
N	249	249	249	249	249
Minimum	-0.017077413	-0.193729199	-0.611441835	-0.228971913	-0.564203382
Maximum	0.014249162	0.276333609	0.173354288	0.445036048	0.332635187
Positive	235	235	75	235	75
Negative	14	14	174	14	174
Mean	0.006053607	0.13674495	-0.07336019	0.21125396	-0.082729027
Quartile 1	0.004993723	0.115124149	-0.127242231	0.171943284	-0.165671899
Median	0.006749214	0.153198339	-0.061369694	0.231743343	-0.083610458
Quartile 3	0.007853533	0.180561711	0.015244356	0.282114094	0.021294529

I end up this section with a review of the results in table O. Compared with the 2007-2009 period, REMFs experienced a great majority of positive excess-returns over the risk-free rate per unit of risk, as highlighted by the Treynor, Sharpe and Sortino (rf) ratios. Indeed, 235 out of 249 REMFs produced, on average, greater monthly returns than the risk-free rate over this period (against 1 during the housing bubble crisis). This suggests REMFs were usually able to generate greater returns than risk-free rates, which was not true in the previous period.

On top of this, I give evidence of a large majority of negative Information and Sortino (GPR) ratios over those years, respectively 174 negatives and 75 positives. This is consistent with the results from my regression analysis, demonstrating significant underperformance over this period.

Compared with the previous period, some contrasting results can be seen. While REMFs still appear to underperform the Global GPR index, this effect is less pronounced than that from 2007 to 2009. Therefore, it does not show the "lagged effect" which is specific to the real estate industry. This can be explained by the length of the post-crisis period (i.e. 6 years). Although REMFs suffered a lot just after the 2007-2009 housing bubble crisis, they seem to have recovered in the last years of

the period and, therefore, several were able to produce above average returns. This has more than likely influenced my analysis.

To conclude, although the analysis of performance metrics paves the way for some questions, especially the "lagged effect" that is specific to the real estate industry, it confirms the great majority of the results from the regression models. Especially, it does not provide evidence of neither underperformance nor outperformance during the pre-crisis years. On top of this, it demonstrates that fund managers significantly underperform the General GPR index during both the 2007-2009 and 2010-2015 periods.

4.4. CROSS-SECTIONAL DETERMINANTS OF REMF ALPHA

Table P						
Summary table						
Year		**Alpha**	**Expense ratio**	**Turnover**	**Size (NAV)**	**Funds**
From	**To**					
2003	2005	0.004117311	1.672666667	57.08%	1.606059001	4
2004	2006	0.000773132	1.650583333	56.33%	1.803591698	6
2005	2007	-0.000599414	1.538263889	58.33%	1.758761332	17
2006	2008	-0.002541245	1.430138889	40.93%	2.20719253	43
2007	2009	-0.001097651	1.318769841	67.50%	2.794811169	71
2008	2010	0.000673553	1.40875	71.13%	2.650544992	93
2009	2011	-0.001216302	1.542083333	51.19%	2.765494764	94
2010	2012	-0.005024748	1.207202381	61.26%	2.821327316	81
2011	2013	-0.001726459	1.6640625	81.36%	2.035134476	71
2012	2014	-0.000279695	1.686956019	81.47%	2.007259483	64
2013	2015	-0.002134267	1.213020833	86.45%	2.735715303	53
Average		-0.000823253	1.484772517	64.82%	2.489185316	54

Table Q					
Cross-Sectional analysis					
Variable	Estimate	Std. Error	T-Stat	Pr (>|t|)	
Alpha	-8.75E-06	4.01E-06	-2.181	0.0296	*
Yearly Total Expense Ratio	-6.10E-04	1.92E-04	-3.171	0.0016	**
Yearly Turnover Ratio	-3.87E-06	1.47E-06	-2.626	0.00886	**
Size (Log NAV)	4.56E-05	1.23E-04	0.372	0.70998	
R-Squared	***0.02846***				
N	***1449***				

In this section, I begin with an analysis of the determinants of the alphas, respectively the TER, turnover ratio and the size. Then, I attempt to explain the coefficient of determination of the model.

Table P provides a summary of the average alphas, total expense ratio, turnover ratio, net asset value, as well as the number of REMFs included in the analysis. The sample only includes REMFs that provide information about the above-mentioned factors for three successive years.

As illustrated in table Q, I measure the E. Fama and J. McBeth (1973) monthly cross-sectional regression and, afterwards, make the average of these coefficient estimates over the whole period from 2003 to 2015 in order to gauge the impact of the total expense ratio, the turnover ratio and the size on REMF alphas. To this end, I use a 36-month rolling window of returns to find the beta loadings of the Carhart four-

factor model and then compute the alphas for each period (Carhart, 1997; Brown, Harlow & Starks, 1996). This approach offers great flexibility, as beta can vary over time and time-varying alphas include this effect.

As previously mentioned, I hypothesized that a negative relationship between REMF's alpha and the total expense ratio and the turnover ratio would be found. Additionally, I expected the alpha to be positively related to fund size, as expressed by the net asset value.

Firstly, I notice a negative relationship between the TER and REMF's alpha that is statistically significant at the 5% level. This is in line with the literature related to both the broad mutual fund market and the specific REMF industry. Indeed, studies realized by E. O'Neal and D. Page (2000), A. Kaushik and A. Pennathur (2012), B. Malkiel (1995) and D. Indro, C. Jiang, M. Hu and W. Lee (1999) demonstrated similar results.

Secondly, table N shows a negative and statistically significant (at the 5% level) relationship between the alpha and the yearly turnover ratio. While the literature related to the broad mutual fund market demonstrates similar results (Indro, Jiang, Hu & Lee, 1999), researches realized on the REMF industry illustrated a positive relationship (Kallberg, Liu & Trzcinka, 2000; O'Neal & Page, 2000; Kaushik & Pennathur, 2012).

However, as I have already explained, there is some evidence that the specific REMF industry was extremely inefficient during the 1990s and the early 2000s. Managers were able to make use of these shortcomings to make the best investment decisions and therefore to outperform the market consistently. Consequently, it can be assumed that they made a lot of transactions in order to take advantage of these imperfections and to produce good performances, which in turn led to a positive relationship between REMF's alpha and turnover ratio. In my view, as the industry has gradually become increasingly efficient since the early 2000s, I find it reasonable to assume a negative relationship, which is in line with the broad mutual fund market.

Finally, I do not find any significant relationship between the alpha and the size of the REMF.

To conclude this part, I want to give some information about the very low r-squared coefficient. Indeed, it is equal to only 0.0286, which indicates the model does not fit the data well. I have therefore come to the conclusion that it is related to the geographical coverage of my thesis. While major studies on the REMF industry

concentrate on the US industry, I have focused on the global market. Given that my sample is quite diversified in terms of location, they have quite varied features. As illustrated in Appendix II, I take into account 35 different countries of domiciliation in my sample, where the most represented are Luxembourg, Ireland, United Kingdom and United States with respectively 38 %, 13%, 9% and 8%. On top of this, as REMFs invest at global level, each of them are exposed to different areas worldwide. This in turn can explain the poor coefficient of determination of the model.

4.5. CORRELATION BETWEEN THE BROAD STOCK MARKET AND THE REAL ESTATE INDUSTRY AT A GLOBAL LEVEL

Table R			
Correlation 2000-2002		**Correlation 2003-2006**	
	MXWO		**MXWO**
MXWO0RE	57.102821%	MXWO0RE	66.890592%
GPR	50.699869%	GPR	65.751018%
Russel 3000	97.563429%	Russel 3000	94.671410%
Correlation 2007-2009		**Correlation 2010-2015**	
	MXWO		**MXWO**
MXWO0RE	93.997827%	MXWO0RE	82.311198%
GPR	93.464412%	GPR	83.886367%
Russel 3000	97.642285%	Russel 3000	96.319839%

N.B.: Correlation coefficients greater or equal to 80% are written in green, otherwise they are in red.

Finally, I analyse the existing relationship between the broad stock market and the real estate industry at the global level. To this end, I have selected several benchmarks in order to represent their respective performances from 2000 to 2015.

On top of the General GPR index, I use MSCI World Real Estate index (i.e. MXWO0RE) to replicate the performance of the real estate industry. As illustrated in Appendix III, the latter includes both mid and large-cap real estate stocks (107 constituents) coming from 23 developed markets worldwide. As such, United States (57%), Japan (12%), Hong-Kong (9%), Australia (7%) and France (4%) are its major constituents. With regards to its sub-industry distribution, it mainly represents the retail REITs (24%), the specialized REIT (18%) and the diversified real estate (16%) sectors. It is rebalanced on a quarterly basis. Because General GPR index is somewhat different from MSCI WRE index, especially with regard to its sector and continent breakdown (i.e. it is less exposed to the US market), I find it interesting to include it in my analysis.

I choose the MSCI World index (i.e. MXWO) in order to reflect the performance of the global stock market. It consists of both mid and large-cap securities originating from 23 developed markets worldwide. Thanks to its large number of constituents, it includes approximately 80-90 % of free float-adjusted market capitalization in each of the participating countries. Once again, it is mainly exposed to the US (60%) market. Other important actors include Japan (9%), the

United Kingdom (7%), Canada (4%) and France (4%). With regards to its sector breakdown, financial (19%), IT (14%) and health care (13%) are the main industries represented in the index (please refer to Appendix IV for additional information).

As clearly evidenced throughout, United States is the most represented country within each of the above-mentioned indexes. Therefore, I also select the Russell 3000 index (Appendix V) in order to highlight the performance of the entire US stock market, as it includes the 3,000 largest securities of the US industry.

Once the indexes were selected, I measured their monthly returns over the 2000-2015 period and computed their adjusted prices (i.e. from 100 USD). Then, I plotted them on a graph in order to have a general overview of the trends on these markets. Consequently, this allows for a quick overview of the existing relationships among them.

Then, I calculated the correlation coefficients between the MSCI World index and respectively, the MSCI World Real Estate index, the General GPR index and the Russell 3000 index. I reproduced it for the 2000-2002, 2003-2006, 2007-2009 and 2010-2015 periods.

When analysing the graph in Appendix VI, the first thing I want to highlight is the close relationship between the MSCI World index (i.e. MXWO) and the Russell 3000 index. Indeed, both curves tend to shift exactly in the same way throughout the years. Table R confirms this assertion as it demonstrates high and constant correlation coefficients during the whole period and each of the sub-periods under consideration. This is not surprising as they are both heavily exposed to the US market.

When comparing the global performance of the real estate industry, which is measured by the MSCI World Real Estate index (i.e. MXWO0RE) and the General GPR index (i.e. GPR), and the broad stock market, as represented by MSCI World index, I expected to find evidence of a significant and positive relationship over the period. Indeed, D. Quan and S. Titman (1999) analysed the global performance of these markets over a relatively long period of time. While country-specific researches did not show any powerful relationships, they demonstrated a significant link between the global stock returns and the global real estate values.

The analysis of the graph (Appendix VI) suggests contrasting results. While it indicates a strong correlation between 2007 and 2015, it demonstrates some de-correlation from 2000 to 2006.

The analysis of table R supports this assertion, as it demonstrates high correlation coefficients during both 2007-2009 (94%) and 2010-2015 (83%) periods and relatively low correlation coefficients over 2000-2002 (50% and 57%) and 2003-2006 (66%).

More research was required to understand this de-correlation. Consequently, I first analysed the economic environment between 2000 and 2002, as it demonstrated the lowest correlation coefficient. Then, I reviewed the features of the subsequent period from 2003 to 2006.

In his paper, D. Baker (2008) illustrated the consequences of the US stock bubble, which originated in the early 1990s, on the US economy. Because investors made significant gains thanks to the sharp increases in the US stock market, they invested heavily in the real estate industry. Consequently, this fuelled the quick development of the housing bubble that emerged in the mid-1990s. They both grew together until the collapse of the US stock bubble, in 2000. The author gave evidence of the collapse's contrasted impact on the US economy. While the US stock market plummeted between 2000 and 2002, investors, who had lost confidence in the stock market, strongly invested in the real estate industry. Indeed, they considered it a good investment alternative. This in turn further fuelled the housing bubble during the 2000-2002 period.

While both indexes reflect the global performance of these industries, they are heavily exposed to the US industry. Although the 2000-2002 downturn mainly affected the US market, it also had consequences on the world economy. Therefore, it is not surprising to find evidence of very low correlation coefficients over this 2-year period (i.e. 51% and 57%, for the GPR and MXWO0RE respectively).

With respect to the next period from 2003 to 2006, D. Baker (2008) and K. Kim and B. Renaud (2009) pointed out the huge growth of the housing bubble and the poisonous effect of the expansion of complex financial instruments, especially MBS and CDO, on the world economy. All this resulted in record growth rate in the real estate industry. In the meantime, the stock market progressively recovered from the 2000-2002 crisis and demonstrated, on average, positive returns (i.e. relatively small with respect to the real estate industry). It is therefore not surprising to discover stronger correlation coefficients.

While these industries experienced different performances from 2000 to 2002, they shifted in the same direction, but not with the same intensity, during the

subsequent period. Consequently, correlation coefficient remained relatively low (i.e. 66%) between 2003 and 2006.

During the following periods, table R demonstrates strong correlations, as previously mentioned. As the housing bubble crisis affected the whole global economy, it is obvious that both real estate industry and stock market suffered a lot and plummeted between 2007 and 2009. This in turns explains why I find a strong relationship (i.e. 93%).

Again, I demonstrate a high, but lower (i.e. with respect to the 2007-2009 period), correlation coefficient during the post-crisis period (i.e. 84%). When analysing the graph, the broad stock market tended to recover more slowly than the real estate industry, which therefore explains my findings.

To conclude, if excluding the housing bubble period (between 2000 and 2006) from my analysis, I suggest a significant and positive relationship between the stock market and real estate industry at the global level. In fact, I find evidence of a strong correlation among them, which suggests the relatively low portfolio diversification benefits of the global real estate market, when associated with the world stock market.

CHAPTER V

CONCLUSION

5.1. THEORETICAL IMPLICATIONS OF THE STUDY

Since the late 1990s, the real estate industry has seen its popularity escalate in the economic and financial world. In some ways, it developed along with the US housing bubble, which led to a record rate of growth until the second half of 2007. When it finally burst, the world economy faced a severe slowdown, starting in the United States of America and spreading across the planet. As we are still dealing with its consequences, it is of great interest to study its impact on the real estate market at global level. In addition, as the US real estate industry showed signs of inefficiencies during the 1990s, managers were able to consistently produce above average returns over the market index. It is of interest to see whether this trend is continuing into the 2000s.

For these reasons, this paper was aimed at:

a) illustrating research findings related to the REMF industry and the housing bubble environment.
b) providing to financial agents, interested in this specific industry, information about the performance of the global REMF industry and its relationship with the broad stock market.
c) broadening the current REMF literature, as it is not a very well-known topic.

When reviewing the results of my research, the data is generally in line with my expectations, as reflected in the introduction.

First of all, while REMF literature demonstrated that there were some signs inefficiency during the 1990s, my regression analyses do not support this hypothesis for the period 2003-2015. Indeed, REMFs demonstrate neither under-, nor out-performance from 2003 to 2006. In addition to this, they significantly underperform the General GPR index during subsequent periods (i.e. 2007-2009 and 2010-2015).

These findings are in line with the broad mutual fund literature, which state that mutual funds are unable to beat their respective benchmarks. My study also suggests the existence of a "lagged effect" in this industry, as REMFs experienced the worst performance during the post-crisis period. It is also interesting to note the strong explanatory power of the General GPR index to describe the results of my regression analyses, as illustrated by my r-squared analyses.

Secondly, the cross-sectional analysis of the determinants of alphas shows a negative relationship between fund's performance and both the total expense ratio and the turnover ratio. However, the relatively low r-squared suggests the model does not fit the data well and therefore, does not allow for general conclusions to be drawn.

Finally, when excluding the 2000-2006 period, I find evidence for a strong relationship between the stock market and the real estate mutual fund industry at the global level. As illustrated, the housing bubble period had opposing effects on both sectors, as one was recovering from the US stock market crash and the other one was experiencing record growth rates. This in turn explains their low respective correlations over that period.

All of the results have a number of economical implications and lead me to come up with several recommendations for REMF investors.

5.2. MANAGERIAL IMPLICATIONS OF THE STUDY AND FINANCIAL IMPLICATIONS

In contrast to previous years (i.e. during the 1990s), REMF industry now appears to be more efficient. Consequently, managers were no longer able to take advantage of imperfections to produce abnormal performances systematically during the period under review. This in turn suggests standardization within the industry, as it demonstrates similar results to those obtained by mutual fund literature. Therefore, I would not recommend that investors, who may be seeking inefficiencies to consistently produce abnormal returns, should invest in this industry.

A negative relationship between fund's alpha and respectively the TER and turnover ratio is demonstrated. Consequently, I would advise investment in REMFs with the lowest TERs and turnover ratios, as they tend to produce better performance. However, the relatively low r-squared coefficient does not allow relevant conclusions to be drawn from the cross-sectional analysis of determinants.

Finally, investors exposed to the world stock market should not consider global REMFs as a good diversification tool within their portfolio. However, this does not apply to the 2000-2006 period, as representative indexes experienced different performances (i.e. recovery versus strong expansion) due to the particular worldwide economic environment.

5.3. LIMITATION AND SUGGESTION FOR FUTURE RESEARCH

While the great majority of the REMF research focuses on the performance of the US industry in the late 1990s and early 2000s, this paper definitely aims at providing a significant contribution to the current literature, as it takes a different approach.

For that reason, I want to highlight the need for further research and data in the global REMF industry. These, in turn, could be compared to my study in order to challenge and check its conformity.

Moreover, this paper only provides a limited analysis of the existing relationship between the broad stock market and real estate industry at the global level. Therefore, I strongly recommend some extensive research on this topic in an effort to get a better idea of the diversification benefits.

Finally, the correlation coefficient analysis demonstrates that the General Property index (GPR) strongly outperformed the MSCI World index (MXWO) and the MSCI World Real Estate index (MXWO0RE) over the period (especially from 2010 to 2015). As my Master's thesis only aims at analysing the correlation between industries, I did not go through that topic. Therefore, I would recommend that future research should review this phenomenon.

APPENDICES

I. APPENDIX I: GENERAL GPR INDEX FACTSHEET

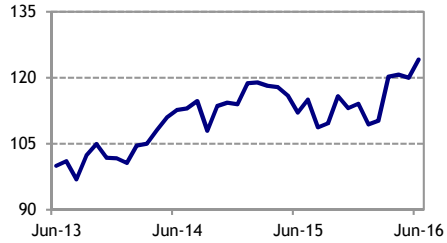
GPR General Index

The GPR General Index consists of all the listed property stocks that comply to our consistently applied rules. The GPR General Index is the longest running index, with an inception date of 31 December 1983.

Index characteristics

Number of companies	650
Full Market Cap (USD m)	1,897,391
Average	2,919
Largest	67,111
Smallest	49
Median	1,207
% Weight Largest Company	3.54%
Top 10 Holdings (% Index Weight)	16.67%

3-year index performance in USD



Index characteristics

Returns	3 month	3.29%
	6 month	8.82%
	Y-T-D	8.82%
	1 year	10.76%
	annualized 3 year	7.48%

Dividend yield

	1 year	3.80%

Volatility

Annualized	1 year	0.13
risk	3 year	0.11

Index Information

Base date
31 December 1983

Base value
100

Calculation frequency
Monthly

Currencies
EUR, LOC and USD

Geographies
World, continents, regions, zones and countries

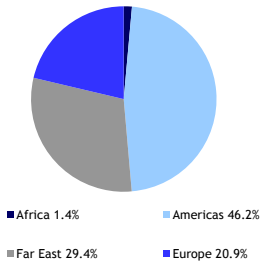
Sectors
Diversified, healthcare, hotel, industrial, office, other, residential and retail

Fund types
Open end bank funds & closed-end

Top 10 by Full Market Cap

	Company	Full Market Cap	Weight
1	Simon Property Group Inc.	$ 67,111	3.54%
2	Public Storage Inc.	$ 44,315	2.34%
3	Welltower Inc	$ 27,192	1.43%
4	General Growth Properties Inc	$ 26,337	1.39%
5	Prologis Inc	$ 25,750	1.36%
6	Unibail-Rodamco SE	$ 25,740	1.36%
7	Mitsubishi Estate Co. Ltd.	$ 25,385	1.34%
8	Equity Residential	$ 25,176	1.33%
9	AvalonBay Communities Inc.	$ 24,743	1.30%
10	Ventas Inc.	$ 24,623	1.30%

Continent Breakdown



Rules for company inclusion

Size
>50 USD million Full Market Cap

Real estate activity
>75% operational turnover

Rental income
>25% operational turnover

Sector allocation
>60% operational turnover from one specific sector, else Diversified

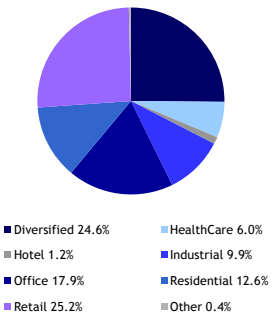
Country allocation
>75% operational turnover from one country (not crossing continental borders), else country of listing

Customization possibilities

Besides the plain vanilla indices like the GPR 250 Index, GPR 250 REIT Index, GPR General Index and the GPR General Quoted Index, Global Property Research offers a vast amount of customization possibilities.

- Any group of continents, countries or constituents can be capped or fixed to reduce or increase its weight;
- Concentration constraint imposed by the UCITS Directive can be implemented;
- All indices can be hedged partially or fully to any currency to reduce the possible currency risk;
- Dividends can be reduced using client specific Withholding Tax percentages;
- Indices can be developed not based on market capitalization, but on Fundamental Indexation factors.

Sector Breakdown



GPR Indices on Data Systems

Bloomberg
Datastream
DeltaOne Solutions
EIKON
FactSet
Financial Express
Fininfo
Investment Metrics
Macrobond Financial
Morningstar, Inc.
Rimes
StatPro
Thomson Reuters
Vestek
Wilshire

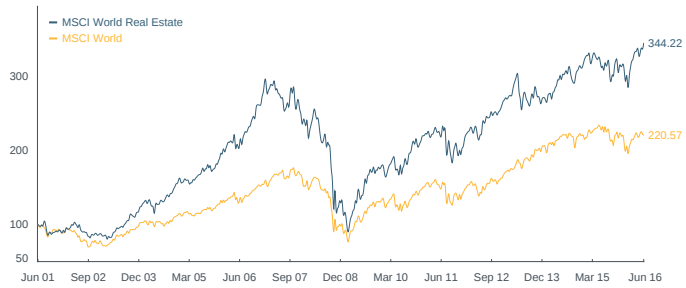
II. APPENDIX II: GENERAL GPR INDEX CONSTITUENTS (GEOGRAPHICAL BREAKDOWN)

Number	Country	Number	Percent
1	Austria	9	0.7183%
2	Belgium	10	0.7981%
3	Bermuda	3	0.2394%
4	British Virgin Islands	10	0.7981%
5	Cayman Islands	3	0.2394%
6	Denmark	2	0.1596%
7	Finland	6	0.4789%
8	France	3	0.2394%
9	Germany	8	0.6385%
10	Gibraltar	1	0.0798%
11	Greece	1	0.0798%
12	Guernsey	8	0.6385%
13	Hong Kong	1	0.0798%
14	Ireland	166	13.2482%
15	Italy	3	0.2394%
16	Japan	100	7.9808%
17	Jersey	3	0.2394%
18	Liechtenstein	11	0.8779%
19	Luxembourg	482	38.4677%
20	Malaysia	4	0.3192%
21	Malta	6	0.4789%
22	Mauritius	1	0.0798%
23	Netherlands	16	1.2769%
24	Norway	17	1.3567%
25	Poland	1	0.0798%
26	Saudi Arabia	3	0.2394%
27	Singapore	9	0.7183%
28	South Africa	18	1.4366%
29	South Korea	58	4.6289%
30	Spain	24	1.9154%
31	Sweden	6	0.4789%
32	Switzerland	27	2.1548%
33	Taiwan	20	1.5962%
34	United Kingdom	119	9.4972%
35	United States	94	7.5020%
	Total	**1253**	**100.0000%**

III. APPENDIX III: MSCI WORLD REAL ESTATE INDEX FACTSHEET

The MSCI World Real Estate Index is a free float-adjusted market capitalization index that consists of large and mid-cap equity across 23 Developed Markets (DM) countries*. All securities in the index are classified in the Real Estate industry group (within the Financials sector) according to the Global Industry Classification Standard (GICS®).

CUMULATIVE INDEX PERFORMANCE - GROSS RETURNS (USD) (JUN 2001 – JUN 2016)



ANNUAL PERFORMANCE (%)

Year	MSCI World Real Estate	MSCI World
2015	1.05	-0.32
2014	15.05	5.50
2013	3.55	27.37
2012	29.69	16.54
2011	-6.40	-5.02
2010	21.24	12.34
2009	33.94	30.79
2008	-47.59	-40.33
2007	-4.96	9.57
2006	40.90	20.65
2005	15.91	10.02
2004	36.99	15.25
2003	37.68	33.76
2002	-5.65	-19.54

INDEX PERFORMANCE — GROSS RETURNS (%) (JUN 30, 2016)

	1 Mo	3 Mo	1 Yr	YTD	ANNUALIZED 3 Yr	5 Yr	10 Yr	Since Dec 30, 1994
MSCI World Real Estate	3.79	3.86	12.40	9.13	8.96	8.71	4.93	7.07
MSCI World	-1.07	1.21	-2.19	1.02	7.54	7.23	5.02	7.05

FUNDAMENTALS (JUN 30, 2016)

	Div Yld (%)	P/E	P/E Fwd	P/BV
MSCI World Real Estate	3.31	22.10	24.09	1.66
MSCI World	2.66	20.13	15.73	2.08

INDEX RISK AND RETURN CHARACTERISTICS (JUN 30, 2016)

	Turnover (%) [1]	ANNUALIZED STD DEV (%) [2] 3 Yr	5 Yr	10 Yr	SHARPE RATIO [2, 3] 3 Yr	5 Yr	10 Yr	Since Dec 30, 1994	MAXIMUM DRAWDOWN (%)	Period YYYY-MM-DD
MSCI World Real Estate	3.14	12.36	15.27	21.14	0.74	0.61	0.28	0.30	71.10	2007-02-22—2009-03-09
MSCI World	2.51	11.71	13.17	16.51	0.66	0.58	0.30	0.34	57.46	2007-10-31—2009-03-09

[1] Last 12 months [2] Based on monthly gross returns data [3] Based on BBA LIBOR 1M

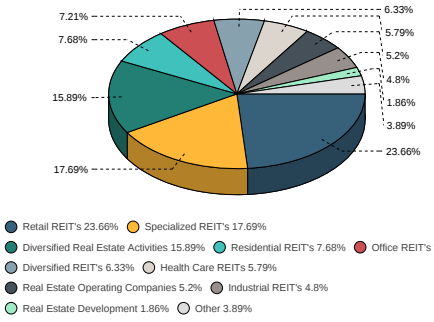
INDEX CHARACTERISTICS

	MSCI World Real Estate
Number of Constituents	107
	Mkt Cap (USD Millions)
Index	1,174,434.21
Largest	67,112.78
Smallest	1,226.14
Average	10,976.02
Median	7,965.63

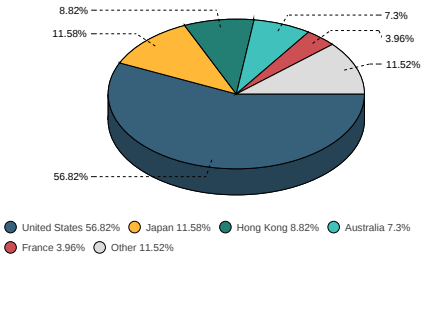
TOP 10 CONSTITUENTS

	Country	Mkt Cap (USD Billions)	Index Wt. (%)	Sector Wt. (%)
SIMON PROPERTY GROUP	US	67.11	5.71	5.7
AMERICAN TOWER CORP	US	48.16	4.10	4.1
PUBLIC STORAGE	US	37.64	3.21	3.2
CROWN CASTLE INTL CORP	US	33.85	2.88	2.9
BROOKFIELD ASSET MAN A	CA	29.26	2.49	2.5
WELLTOWER INC	US	27.05	2.30	2.3
EQUINIX	US	26.76	2.28	2.3
PROLOGIS	US	25.73	2.19	2.2
UNIBAIL-RODAMCO	FR	25.60	2.18	2.2
EQUITY RESIDENTIAL	US	25.15	2.14	2.1
Total		346.33	29.49	

SUB-INDUSTRY WEIGHTS



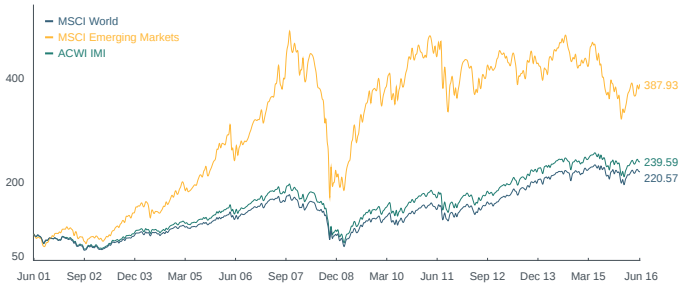
COUNTRY WEIGHTS



IV. APPENDIX IV: MSCI WORLD INDEX FACTSHEET

The MSCI World Index captures large and mid cap representation across 23 Developed Markets (DM) countries*. With 1,645 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

CUMULATIVE INDEX PERFORMANCE - GROSS RETURNS (USD) (JUN 2001 – JUN 2016)



ANNUAL PERFORMANCE (%)

Year	MSCI World	MSCI Emerging Markets	ACWI IMI
2015	-0.32	-14.60	-1.68
2014	5.50	-1.82	4.36
2013	27.37	-2.27	24.17
2012	16.54	18.63	17.04
2011	-5.02	-18.17	-7.43
2010	12.34	19.20	14.87
2009	30.79	79.02	37.18
2008	-40.33	-53.18	-42.01
2007	9.57	39.82	11.66
2006	20.65	32.55	21.49
2005	10.02	34.54	12.06
2004	15.25	25.95	16.93
2003	33.76	56.28	36.18
2002	-19.54	-6.00	-17.26

INDEX PERFORMANCE — GROSS RETURNS (%) (JUN 30, 2016)

	1 Mo	3 Mo	1 Yr	YTD	ANNUALIZED 3 Yr	5 Yr	10 Yr	Since May 31, 1994
MSCI World	-1.07	1.21	-2.19	1.02	7.54	7.23	5.02	6.92
MSCI Emerging Markets	4.10	0.80	-11.71	6.60	-1.21	-3.44	3.88	5.00
ACWI IMI	-0.67	1.25	-3.33	1.69	6.68	5.99	5.02	6.70

FUNDAMENTALS (JUN 30, 2016)

	Div Yld (%)	P/E	P/E Fwd	P/BV
MSCI World	2.66	20.13	15.73	2.08
MSCI Emerging Markets	2.76	13.80	11.90	1.45
ACWI IMI	2.60	20.02	15.47	1.94

INDEX RISK AND RETURN CHARACTERISTICS (JUN 30, 2016)

	Turnover (%) [1]	ANNUALIZED STD DEV (%) [2] 3 Yr	5 Yr	10 Yr	SHARPE RATIO [2, 3] 3 Yr	5 Yr	10 Yr	Since May 31, 1994	MAXIMUM DRAWDOWN (%)	Period YYYY-MM-DD
MSCI World	2.51	11.71	13.17	16.51	0.66	0.58	0.30	0.31	57.46	2007-10-31—2009-03-09
MSCI Emerging Markets	9.95	16.51	18.83	23.52	-0.01	-0.10	0.23	0.40	65.14	2007-10-29—2008-10-27
ACWI IMI	3.17	11.82	13.64	17.20	0.59	0.48	0.30	0.31	58.28	2007-10-31—2009-03-09

[1] Last 12 months [2] Based on monthly gross returns data [3] Based on BBA LIBOR 1M

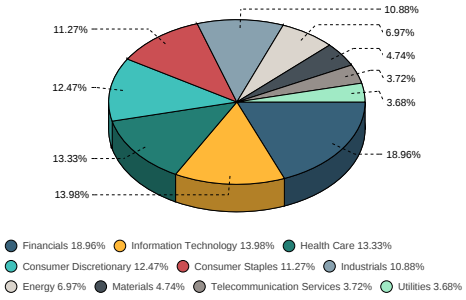
INDEX CHARACTERISTICS

	MSCI World
Number of Constituents	1,645
	Mkt Cap (USD Millions)
Index	31,971,972.47
Largest	530,062.13
Smallest	962.67
Average	19,435.85
Median	8,377.83

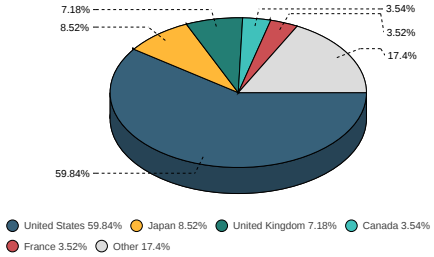
TOP 10 CONSTITUENTS

	Country	Mkt Cap (USD Billions)	Index Wt. (%)	Sector	Sector Wt. (%)
APPLE	US	530.06	1.66	Info Tech	11.9
EXXON MOBIL CORP	US	389.28	1.22	Energy	17.5
MICROSOFT CORP	US	384.48	1.20	Info Tech	8.6
JOHNSON & JOHNSON	US	334.71	1.05	Health Care	7.9
GENERAL ELECTRIC CO	US	293.73	0.92	Industrials	8.4
AMAZON.COM	US	286.40	0.90	Cons Discr	7.2
AT&T	US	265.79	0.83	Telecom Srvcs	22.3
FACEBOOK A	US	262.27	0.82	Info Tech	5.9
NESTLE	CH	245.95	0.77	Cons Staples	6.8
PROCTER & GAMBLE CO	US	229.00	0.72	Cons Staples	6.4
Total		3,221.67	10.08		

SECTOR WEIGHTS



COUNTRY WEIGHTS

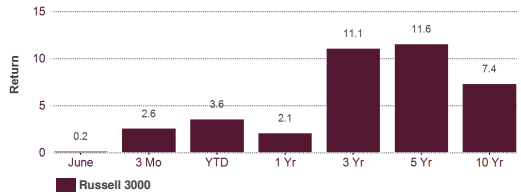


V. APPENDIX V: RUSSELL 3000 FACTSHEET

Statistics	
Capitalization statistics (in billions)	
Average Market Cap ($-WTD)	114.600
Median Market Cap	1.397
Largest Stock by Market Cap	523.642
Fundamental characteristics	
Price/Book	2.75
Dividend Yield	2.02
P/E Ex-Neg Earnings	20.60
EPS Growth - 5 Years	6.56
Number of Holdings	3,007

Top 10 performers	1 month return %	Ticker
HeartWare International Inc	96.4	HTWR
Exact Sciences Corp	84.5	EXAS
Tesaro Inc	81.5	TSRO
LDR HOLDING CORPORATION	75.7	LDRH
Demandware Inc	56.1	DWRE
Elizabeth Arden Inc	49.9	RDEN
EXCO Resources Inc	44.1	XCO
FAIRMOUNT SANTROL HLDGS	43.3	FMSA
Coeur d'Alene Mines Corp	41.6	CDE
MEETME INC	41.0	MEET

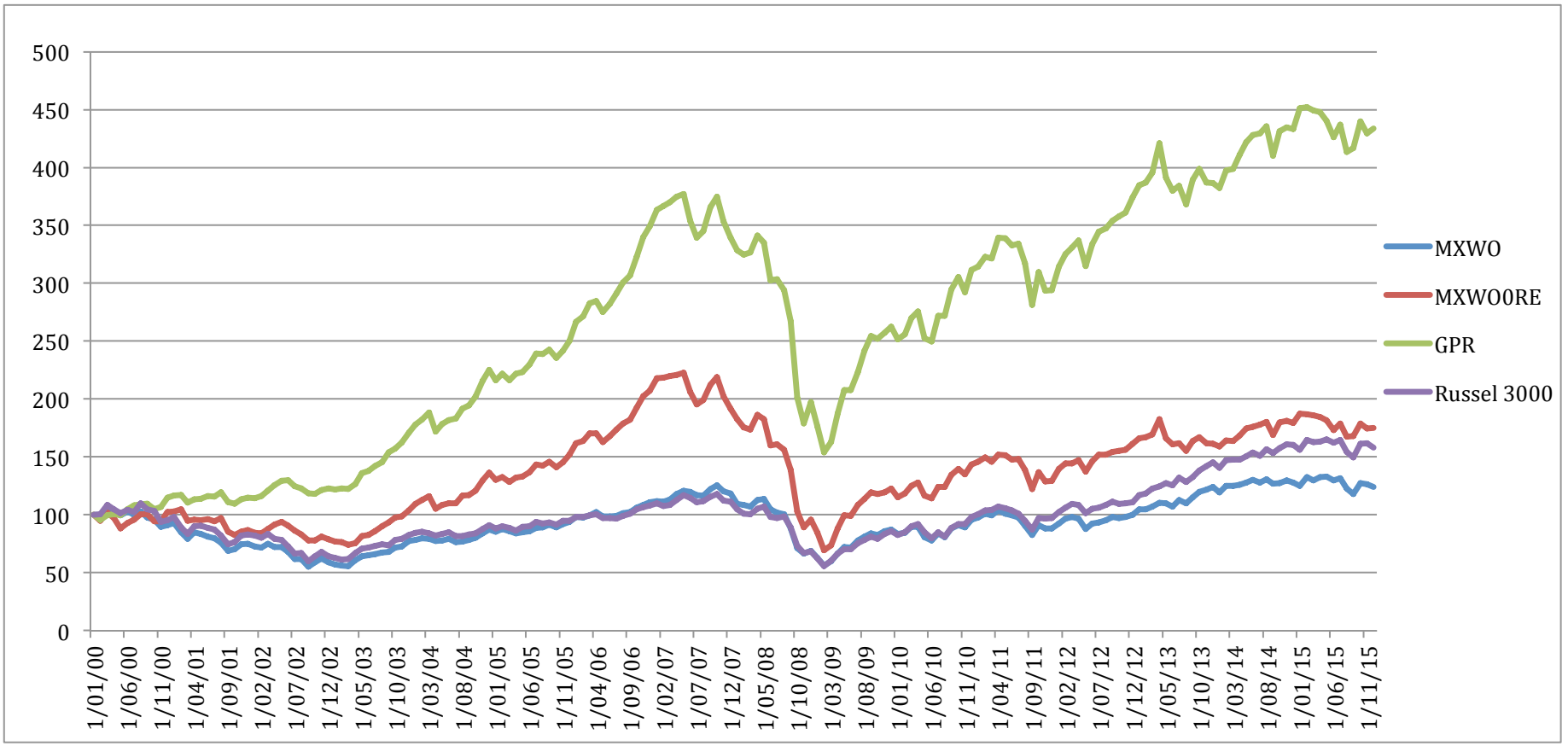
Total returns



Top 10 holdings
Apple Inc
Exxon Mobil Corp
Microsoft Corp
Johnson & Johnson
General Electric Co
Amazon.com Inc
Berkshire Hathaway Inc
AT&T Inc
Facebook Inc
Verizon Communications Inc

Top 5 RGS sectors
Financial Services
Technology
Consumer Discretionary
Health Care
Producer Durables

I. APPENDIX VI: GRAPH WITH ADJUSTED PRICES FOR ALL SELECTED BENCHMARKS FROM 2000 TO 2015



BIBLIOGRAPHY

- Baker, D. (2008). The Housing Bubble and the Financial Crisis. *Real-World Economics Review*, *46(20)*, 73-81. Retrieved from mercury.ethz.ch

- Barry, C. B. & Brown, S. J. (1984). Differential Information and the Small Firm Effect. *Journal of Financial Economics, 13(2)*, 283-294. doi: 10.1016/0304-405X(84)90026-6

- Basu, S. (1977). Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis. *The Journal of Finance*, *32(3)*, 663-682. doi: 10.1111/j.1540-6261.1977.tb01979.x

- Beechey, M., Gruen, D. W., & Vickery, J. (2000). *The efficient market hypothesis: a survey*. Reserve Bank of Australia, Economic Research Department. Retrieved from http://www-ho.rba.gov.au/publications/rdp/2000/pdf/rdp2000-01.pdf

- Bernardo, A. & Ledoit, O. (2000). Gain, Loss and Asset Pricing. *Journal of Political Economy*, *108(1)*, 144-172. doi:10.1086/262114

- Bhandari, L. C. (1988). Debt/Equity Ratio and Expected Common Stock Returns : Empirical Evidence. *The Journal of Finance*, *43(2)*, 507-528. doi: 10.1111/j.1540-6261.1988.tb03952.x

- Black, F. (1973). The Pricing of Options and Corporate Liabilities. *The Journal of Political Economy, 81(3), 637-654. Retrieved from http://www.jstor.org/stable/1831029*

- Brown, F. E. & Vickers, D. (1963). Mutual Fund Portfolio Activity, Performance, and Market Impact. *The Journal of Finance*, *18(2)*, 377-391. doi: 10.1111/j.1540-6261.1963.tb00730.x

- Carhart, M. M. (1997). On persistence in Mutual Fund Performance. *The Journal of Finance*, *52(1)*, 57-82. doi: 10.1111/j.1540-6261.1997.tb03808.x

- Chang, E. C. & Lewellen, W. G. (1984). Market Timing and Mutual Fund Investment Performance. *The Journal of Business*, *57(1)*, 57-72. Retrieved from http://www.jstor.org/stable/2352888

- Chaudhry, A. and Johnson, H. L. (2008). The Efficacy of the Sortino Ratio and Other Benchmarked Performance Measures Under Skewed Return Distributions. *Australian Journal of Management*, *32(3)*, 485-502. doi: 10.1177/031289620803200306

- Cogneau, P., & Hubner, G. (2009). The 101 ways to measure portfolio performance. *Available at SSRN 1326076*. doi: http://dx.doi.org/10.2139/ssrn.1326076

- Damodaran, A. & Liu, C. H. (1993). Insider Trading as a Signal of Private Information. *Review of Financial Studies*, *6(1)*, 79-110. doi: 10.1093/rfs/6.1.79

- Elton, E. J., Gruber, M. J. & Blake, C. R. (1996). Survivorship Bias and Mutual Fund Performance. *Review of Financial Studies*, *9(4)*, 1097-1120. *doi: 10.1093/rfs/9.4.1097*

- Fama, E. F. & French, K. R. (1996). Multifactor Explanations of Asset Pricing Anomalies. *The Journal of Finance*, *51(1)*, 55-84. doi: 10.1111/j.1540-6261.1996.tb05202.x

- Fama, E. F. & McBeth, J. D. (1973). Risk, Return and Equilibrium : Empirical Tests. *Journal of Political Exonomy*, *81(3)*, 607-636. Retrieved from http://www.jstor.org/stable/1831028

- Fame, E. F. & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, *47(2)*, 427-465. doi: 10.1111/j.1540-6261.1992.tb04398.x

- French, K. R. (2016). *Kenneth French – Data Library*. Retrieved from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

- Gallo, J. G., Lockwood, L. J. & Rutherford, R. C. (2000). Asset Allocation and the Performance of Real Estate Mutual Funds. *Real Estate Economics*, 28(1), 165-185. doi: 10.1111/1540-6229.00797

- Global Property Research (n.d.). *Global Property Research – Solutions for customized property indices*. Retrieved from https://www.globalpropertyresearch.com

- Goodwin, T. H. (1998). The Information Ratio. *Financial Analysts Journal*, *54(1)*, 4, 34-43. doi: http://dx.doi.org/10.2469/faj.v54.n4.2196

- Gremillion, L. (Ed.). (2005). *Mutual Fund Industry Handbook: A Comprehensive Guide for Investment Professionals*. Boston, MA : John Wiley & Sons.

- Grinblatt, M. & Titman, S. (1989). Mutual Fund Performance : An Analysis of Quarterly Portfolio Holdings. *The Journal of Business*, *62(3)*, 393-416. Retrieved from http://www.jstor.org/stable/2353353

- Grinblatt, M. & Titman, S. (1993). Performance Measurement without Benchmarks : An examination of Mutual Fund Returns. *The Journal of Business*, *66(1)*, 47-68. Retrieved from http://www.jstor.org/stable/2353341

- Grinold, R. C. (1989). The Fundamental Law of Active Management. Journal of Portfolio Management, *15(3)*, 30-37. doi: 10.3905/jpm.1989.409211

- Gruber, M. J. (1996). Another Puzzle : The Growth in Actively Managed Mutual Funds. *The Journal of Finance*, *51(3)*, 783-810. doi: 10.1111/j.1540-6261.1996.tb02707.x

- Hartzell, J. C., Mühlhofer, T. & Titman, S. (2010). Alternative Benchmarks for Evaluating Mutual Fund Performance. *Real Estate Economics*, 38(1), 121-154. doi: 10.1111/j.1540-6229.2009.00253.x

- Hubner, G. (2003). The generalized Treynor ratio: a note. *University of Liege, Management Working Paper*. doi : http://dx.doi.org/10.2139/ssrn.375061

- Indro, D., Jian, C., Hu, M. & Lee, W. (1999). Mutual Fund Performance: Does Size Matter?. *Financial Analysts Journal*, *55(3)*, 74-87. doi: http://dx.doi.org/10.2469/faj.v55.n3.2274

- Israelsen, C. L. (2005). A Refinement to the Sharpe Ratio and Information Ratio. *Journal of Asset Management*, *5(6)*, 423-427. doi: http://dx.doi.org/10.1057/palgrave.jam.2240158

- Jensen, M. C. (1968). The Performance of Mutual Funds in the Period 1945-1964. *The Journal of Finance*, *23(2)*, 389-416. doi: 10.1111/j.1540-6261.1968.tb00815.x

- Kallberg, J. G., Liu, C. H. & Trzcinka, C. (2000). The Value Added from Investment Managers : An Examination of Funds of REITs. *Journal of Financial and Quantitative Analysis*, *35(3)*, 387-408. doi: http://dx.doi.org/10.2307/2676210

- Kaushik, A. & Pennathur, A. K. (2012). An Empirical Examination of the Performance of Real Estate Mutual Funds 1990-2008. *Financial Services Review, 21(4)*, 343-358. Retrieved from http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=623eea12-8235-48f1-8aeb-01900934b73c%40sessionmgr102&vid=2&hid=124

- Kidd, D. (2011). Measures of Risk-Adjusted Return: Let's Not Forget Treynor and Jensen. *Investment Risk and Performance*, *2011(1)*, 1-3. Retrieved from http://www.cfapubs.org/doi/full/10.2469/ipmn.v2011.n1.12

- Kyung-Hwan, K. & Bertrand, R. (2009). The Global House Price Boom and its Unwinding : An Analysis and a Commentary. *Housing Studies*, *24(1)*, 7-24. doi: 10.1080/02673030802550128

- Lehmann, B. N. & Modest, D. M. (1987). Mutual Fund Performance Evaluation : A comparison of Benchmarks and Benchmark Comparisons. *The Journal of Finance*, *42(2)*, 233-265. doi: 10.1111/j.1540-6261.1987.tb02566.x

- Lin, C. Y. & Yung K. (2004). Real Estate Mutual Funds : Performance and Persistence. *Journal of Real Estate Research, 26(1)*, 69-93. Retrieved from http://aresjournals.org/doi/abs/10.5555/rees.26.1.r248714m2503q416

- Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, *47(1),* 13-37. doi : 10.2307/1924119

- Malkiel, B. G. (1995). Returns from Investing in Equity Mutual Funds: 1971-1991. *The Journal of Finance*, *50(2)*, 549-572. doi: 10.1111/j.1540-6261.1995.tb04795.x

- Markowitz, H. M. (1968). Portfolio selection: efficient diversification of investments (Vol. 16). *Yale university press*.

- McDonald, J. G. (1974). Objectives and Performance of Mutual Funds, 1960-1969. *Journal of Financial and Quantitave Analysis*, *9(3)*, 311-333. doi: http://dx.doi.org/10.2307/2329866

- Merton, R. C. (1973). Theory of Rational Option Pricing. *The Bell Journal of Economics and Management Science*, *4(1)*, 141-183. doi: 10.2307/3003143

- Nawrocki, D. (1999). A Brief History of Downside Risk Measures. *The Journal of Investing*, *8(3)*, 9-25. doi: 10.3905/joi.1999.319365

- O'Neal, E. S. & Page, D. E. (2000). Real Estate Mutual Funds : Abnormal Performance and Fund Characteristics. *Journal of Real Estate Portfolio Management*, *6(3)*, 239-247. Retrieved from http://aresjournals.org/doi/abs/10.5555/repm.6.3.r708656604t73651

- Quan, D. C. & Titman, S. (1999). Do Real Estate Prices and Stock Prices Move Together ? An International Analysis. *Real Estate Economics*, *27(2)*, 183-207. doi: 10.1111/1540-6229.00771

- Roll, R. (1978). Ambiguity when Performance is measured by the Security Market Line. *The Journal of Finance*, *33(4)*, 1051-1069. doi: 10.1111/j.1540-6261.1978.tb02047.x

- Rosenberg, B., Reid, K. & Lanstein, R. (1985). Persuasive Evidence of Market Inefficiency. *Journal of Portfolio Management*, *11(3)*, 9-16. doi: 10.3905/jpm.1985.409007

- Sharpe, W. (1964). Capital Asset Prices : A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*, *19(3)*, 425-442. doi: 10.1111/j.1540-6261.1964.tb02865.x

- Sharpe, W. (1966). Mutual Fund Performance. *The Journal of Business*, *39(1)*, 119-138. Retrieved from http://www.jstor.org/stable/2351741

- Sharpe, W. (1994). The Sharpe Ratio. *The Journal of Portfolio Management*, *21(1)*, 49-58. doi: 10.3905/jpm.1994.409501

- Sortino, F. A. & Price, L. N. (1994). Performance Measurement in a Downside Risk Framework. Journal of Investing, *3(3)*, 59-64. doi: 10.3905/joi.3.3.59

- Stattman, D. (1980). Book values and stock returns. *The Chicago MBA: A journal of selected papers*, *4(1),* 25-45.

- Treynor, J. L. (1965). How to Rate Management of Invested Funds. Harvard Business Review, *43(1),* 63-75. Retrieved from http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=4fc72658-3b55-4830-b370-c41e5ae1edd9%40sessionmgr120&vid=2&hid=124

- Treynor, J. L. & Mazuy, K. K. (1966). Can Mutual Funds Outguess the Market?. *Harvard Business Review*, *44(4)*, 131-136. Retrieved from http://users.business.uconn.edu/jgolec/Treynor-Mazuy.pdf

- Treynor, J. L. and Black, F. (1973). How to Use Security Analysis to Improve Portfolio Selection. *Journal of Business*, *46(1)*, 61-86. Retrieved from http://www.jstor.org/stable/2351280

- Wermers, R. (2000). Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses. *The Journal of Finance*, *55(4)*, 1655-1695. doi: 10.1111/0022-1082.00263

EXECUTIVE SUMMARY

Thanks to the real estate industry's strong growth since the early 2000s, financial investors have shown increased interest in it. This has paved the way for the quick development of specialized investment vehicles and especially Real Estate Mutual Funds. This is precisely what led to the writing of this paper.

As a first step, it aims at describing the economic environment that surrounds this specific industry between 2003 and 2015. It provides information and details about the main drivers of the expansion of the US housing bubble. It further illustrates the disastrous consequences of the bubble's rupture on the global economy and the way financial markets recovered over the next years.

In a second step, it analyses the past performances of global REMF during the pre-crisis (i.e. 2003-2006), crisis (i.e. 2007-2009) and post-crisis (2010-2015) periods. While REMF market showed strong signs of inefficiencies throughout the 1990s, the paper demonstrated standardization in the industry, as the results were fairly similar to those obtained by the broad mutual fund industry. In fact, managers were no longer able to consistently outperform the real estate benchmark over the period.

Following that, the paper used regression models to highlight the factors (i.e. total expense ratio, turnover ratio) impacting the REMF alphas. It found that REMF with the lowest TER and turnover ratio tend to produce better performances. However, the relatively low r-squared suggested that no general conclusions could be drawn from this analysis,

Finally, it provides a cursory analysis of the existing relationship between the stock market and the real estate mutual fund industry at the global level. With the exception of the 2000-2006 period, which featured contrasting trends in the economy (i.e. the quick expansion of the housing bubble and the recovery of the stock market), it found a strong correlation between them. This in turn suggested the low diversification benefits from the real estate industry, when added to a world stock portfolio.

Keywords: Real estate, Real estate mutual funds, Regression analysis, Cross-sectional determinants, Performance metrics, Housing bubble crisis, Correlation coefficients, Diversification, Global performance.