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Diversification Benefits of European REIT, Equities and Bonds

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ABSTRACT

This study aims to demonstrate the benefits related to the inclusion of European REIT in a portfolio of stocks and bonds traded on European markets. Major studies of the portfolio's diversification those considered REIT was carried out on the American real estate market. Therefore, this research project aims to extend the work to the European scale by forming a mixed pan-European REIT portfolio. The database is composed of monthly dividend-adjusted closing prices, over the past 11 years, from different stock indexes collected during eleven years of different European market indexes. Four hypothetic portfolios were constructed to test our hypothesis. Descriptive statistics and correlations were presented. Therefore, the results have shown that European REIT has reduced the risk of a mixed portfolio even if the risk reduction is very limited. The same is true for the portfolio's return, which was slightly improved. The study showed that European REIT remains a factor of diversification that should not be overlooked in building an asset portfolio. These findings contribute to the existing portfolio theory arguing that using REITs in portfolio diversification helps investors dilute their risk and improve their returns. Our results also have practical implications. They can be useful to investors and financial analysts in their investment decisions by shedding light on this type of asset.

Keywords*: REITs, Investment Decisions, Strategic Asset Allocation, Stock Market, Developed Market*

Introduction

REIT arose in the United States in the 1960s. In Europe, they emerged in France in 2003 under the name of SIIC (*Sociétésd'investissementimmobiliercotées*). They are publicly listed real estate investment companies. According to the National Association of Real Estate Investment Trusts (NAREIT, 2020), the market value of real estate investment trusts in 2018 was approximately $1,047 billion, an increase of approximately 15% in the past five years. However, between 2017 and 2018, the market capitalization declined by 7.5%. In contrast, in France, the IEIF SIIC index

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capitalized €74.86 billion in 2019, representing an increase of around 17% from 2018 to 2019 (IEIF, 2019). This leads us to the following question: What are the diversification opportunities provided by a portfolio comprised of REIT, equities and bonds listed in the European market? Historically, REITs have performed well on average, as long as they are not volatile. This makes them an appropriate risk hedging tool. Taking the case of SIIC, we see that from 2014 to 2016, real estate securities performed better than the CAC 40 (IEIF, 2019). REIT also benefit from a low correlation to bonds, offering an opportunity for diversification in a portfolio of equities and bonds. Many studies have therefore shown that real estate securities have a higher return on investment than traditional assets (Kuhle, 1987; Georgiev et al., 2003; Gullett & Redman, 2005; Block, 2011; Bond & Glascock, 2006; Hung et al., 2008; Fugazza et al., 2009; Lee, 2010; Śmietana, 2014).

The listed real estate companies' main activity comprise the investment and management of real estate assets. Indeed, they, therefore, rent out their assets in order to generate value (rents collected) and subsequently acquire new ones and so on. In France, for example, significant investments have been planned by SIICs over the period 2017-2021 in order to make companies even more competitive. REITs are distributed by sector and by geographical place. Indeed, shops and shopping centres represent 54% of the portfolio in France, followed by offices representing 27% of the portfolio. 46% of SIIC activity, for example, was present in Greater Paris in Europe in 2016 (IEIF, 2019). In many articles dealing with diversification opportunities offered by REITs in a portfolio, the data used are national REITs (France, USA, etc.) which are added to a portfolio of traditional assets (national indices).

However, the difference in this article will be in the data presented. For this study, the data used are European REIT indices (FTSE EPRA/NAREIT REIT Europe and Euronext IEIF REIT Europe), European equity indices (EuroStoxx50 and Euronext 100), and European bond indices (FTSE MTS Highest rated Eurozone Government Bond 5-7Y and FTSE European Government Bond IG 5-7Y). The objective of the study will therefore be to examine the performance of a portfolio made up of exclusively European equity, bond and REIT indices by determining their correlation, Sharpe ratio and the risk-return ratio in order to define diversification benefits of European REIT.

This research is organized into three parts. First, the literature review and developed hypotheses. Second, we present the methodology adopted. Finally, we show the results and conclusion.

Theoretical Background and Hypotheses

A. REIT Diversification in general

Kuhle (1987) studies the effects of diversification on the risk of a portfolio. The analysis of the risk reduction and performance of REITs argue that the portfolios of REITs compared to those of traditional securities perform better. It was done using the Markowitz model. Because of their low correlation with the rest of the market, owning REITs is an effective way to diversify one's portfolio (Kuhle, 1987). By creating a portfolio made up of traditional assets and REITs, a good

diversification can be observed, thus making REITs an instrument for reducing portfolio risk. His results also show that portfolios made up of mortgage REITs are riskier than those made up of equity REIT. Hung et al. (2008) confirmed the same results found by Kuhle(1987) and suggested that adding mortgages and hybrid REITs helps diversify the portfolio. However, equity REITs offer little scope for diversification. Considering market conditions, REITs are not sensitive to benchmarks. Ultimately, Hung et al. (2008) believe that if the logic of risk reduction is followed, REITs prove to be the least effective.

Unlike the method used by James Kuhle to determine the diversification opportunities of REITs, Boudry et al. (2020) used a utility-based approach. This choice is explained because they consider that the Markowitz approach does not take into account the constraints that investors face. Thus, they concluded that REITs, whether ordinary or participatory, allow a portfolio to be diversified. Investors with low-risk aversion are therefore more inclined to build a portfolio with ordinary REITs. Whereas REITs that do not grant voting rights end up in investor portfolios with a strong aversion to risk. In addition, portfolios made up of ordinary REITs provide higher returns compared to other REIT portfolios with lower risk. Moreover, they have shown that the opportunities for diversifying a risky asset depend on the risk aversion of the investor.

Glascocket al. (2000) use a cointegration model instead of a simple correlation analysis. Indeed, they argue that the simple correlation analysis does not consider long-term economic effects. However, the existing economic links between REITs and other long-term financial instruments were considered in their analysis of cointegration. The study suggests that REITs would behave like fixed income securities in the years leading up to 1992. So, there is a causal phenomenon between equity REITs and mortgage REITs in addition to bilateral feedback. Also, REITs integrate an inflation factor into their prices. After 1992, they found that REITs behave more like a stock rather than a bond. This time, inflation is not included in the prices (Glascocket al., 2000). Chaudhry et al. (2010) used the same cointegration model to allow managers to optimize their investment portfolios and implement hedging strategies. The cointegration model concluded that many assets with a low correlation to REITs, except energy class assets, can be used as diversification tools.

Based on a sharp market decline on October 27, 1997, Glascock et al. (2004) attempted to determine that the REITsbehavior was used to determine whether REITs behave more like stocks or real estate. The authors, therefore, calculated the returns on the assets in a sample as well as the standard deviation as a measure of risk. They concluded from their study that the prices of REITs, as well as traditional stocks, suffered a decline. The blunt fact was that the REIT represents half of the decline seen in equities. In fact, real estate investment trust funds fell by -2.87 compared to -5.10 for equities. Also, it should be noted that REITs offered more constant returns than utilities or public service securities during this period. Knowing that utilities are known as defensive assets by nature. On top of that, REIT yields, as well as the bid-ask spread, saw little variation during this period. Moreover, the authors also found that the standard deviation may not be a valid risk measure for explaining the risk of REITs.

Lee (2017) determines the diversification opportunities of REITs by adopting another measure called the "return gap". This measurement indicates the difference between the two assets considering the standard deviation. The data used for this study come from ten sectors of the real estate world. According to the author, correlation is not an effective measure for determining the diversification of a portfolio made up of REITs classified according to their industry. In other words, the study shows that sectoral REITs have a strong correlation. At first glance, it decreases the possibility of lowering the risk of a portfolio consisting only of REITs. In addition, the standard deviation is found to be high. As a result, the author deduced that considering the standard deviation combined with the correlation shows that there is a potential diversification advantage. Therefore, the study suggests that investors use the "return gap" to build their portfolios. This study goes some way to addressing the concern of Allen et al. (1997) about the validity of standard deviation as the sole measure of portfolio risk.

Moreover, Stephen and Simon (2005) have shown the advantages of keeping REITs in your portfolio for a long or short period. In order to solve this problem, the allocation of REITs in a mixed portfolio is evaluated over different holding periods. Indeed, the period chosen by the author ranges from 5 to 10 years. Since the inclusion of REIT in the mixed portfolio, the impact on risk and return has been investigated. Then, he finally compared the risk of the portfolio consisting of REITs and that of a portfolio without REITs on the efficient frontier for the same level of return. He undertakes the same operations with the same level of risk. The results of this study suggest that REITs offer higher returns and opportunities for diversification. Although this can change over time, it is generally constant over the different time periods analyzed. In addition, the results show that REITs obtain better results in portfolios with a low risk-return ratio. By taking the higher risk-return on the efficient frontier, these results are less attractive. At the bottom of the efficient frontier, good performance seems to be dictated by returns on real estate assets. Conversely, at the top of the efficient frontier, it is the reduction of sector risk that impacts the performance of the portfolio. As a result, the holding period is an important factor in reducing the risk of a portfolio. The longer the period, the lower the risk.

Rees and Selcuk-Kestel (2014) examined the cointegration relationship between different types of REITs in the US market. Assuming there is no structural disruption, the authors first performed a portfolio diversification analysis between long-term and short-term assets. Then, they did the same analysis under the influence of the 2008 financial crisis after performing structural failure tests. This analysis, therefore, allows the authors to test the sensitivity of portfolio diversification to random shocks. It also attempts to show the impact of these cointegrations on portfolio indicators. The study shows that there is indeed no relationship between listed REITs. However, there is a cointegrating relationship between residential real estate investment trust funds. Therefore, the benefits of the asset mix depend on the length of time the investment is held and the risk aversion of the investor. The greater the risk aversion, over the long term, investors are more likely to form portfolios with cointegrated fiduciary assets.

B. Diversification of REITs by type of property and geographical location

Gyourkoand Nelling (1996) used stock market data to examine the systematic risks and diversification attributes of publicly traded real estate investment trusts or "Equity REITs". By combining company performance data with information on property type and geographic location, they created a unique data sample. Depending on the different types of real estate they invest in, the systematic risk of equity REITs also varies. For example, companies that specialize in the commercial sector have a systematic risk that is more than half that of companies specializing in industrial goods. Also, their studies, using a simple regression model, gave no evidence on diversification using property types or geographical location. Indeed, the coefficient of determination R^2 used to measure the effects of diversification has not been conclusive. Gyourkoand Nelling (1996) argue that the data is not yet sufficient to say that location has no impact on diversification.

Andrew and Glenn (2003) confirm that the type of ownership reduces the risk of a portfolio. Indeed, the authors analyzed a mixed portfolio made up of REITs from the private and public real estate sector. They, therefore, used the Markowitz efficient frontier theory with an average variance without constraints. They found that public and private real estate income have a very weak quarterly correlation. Also, the efficient frontier created by the incorporation of public as well as private real estate assets into a mixed-asset portfolio is more effective than the inclusion of just one of the two types of real estate assets, one or the other, or neither of the two. In other words, it is a portfolio that produces a much better efficient frontier and therefore offers a better opportunity for diversification.

Anderson et al. (2015) study the impact of real estate diversification on REITs from 1995 to 2006. There is a strong positive correlation between the diversification of property types, return on assets, return on equity and the "Tobin's Q". According to the authors, the diversification of the portfolio depends heavily on the possibility of selecting, depending on the type of property, assets that have high or low performance reliant on the state of the market. In addition, the study attempts to determine the source of the diversification in which REITs diversify by property type. A first possible source of diversification may be the isolation of real estate risks caused by the dilution of the asset base. Another possible source of diversified income may be the ability of a diversified real estate investment trust to purchase the best performing real estate at any time from a wider range of opportunities comprised of several property types; this second source is called "cherry-picking". There is evidence that moving from fully specialized diversification to some degree of diversification of property type will provide broader investment opportunities and reduce variations in cash flows, which will bring real benefits. For example, Painter (2010) suggests that investors with moderate risk aversion seek to improve their investment portfolio by investing in the agricultural community (F-REIT). In fact, the importance of F-REITs lies in their low level of risk, their low correlation with other asset classes and their relatively higher yields than bonds (see table 1).

Table 1. Correlation matrix of multiple assets from 1972 to 2008 (Marvin, 2010)

	T-b	LB	F-EIT	REIT	Can	Aus	US	Japan	Europe	World	HK
T-bills	1.0	.84	.18	.11	-.34	-.31	.03	.15	-.21	-.25	.10
L Bonds		1.0	.03	.16	-.08	-.03	.18	.13	.06	.15	.03
F-REIT			1.0	-.11	-.05	-.09	-.14	-.16	-.22	-.22	-.01
REITs				1.0	.45	.50	.55	.17	.38	.49	.42
Can					1.0	.74	.64	.46	.60	.71	.57
Aus						1.0	.58	.47	.68	.75	.63
US							1.0	.34	.74	.85	.51
Japan								1.0	.46	.65	.58
Europe									1.0	.86	.50
World										1.0	.61
HK											1.0

Hartzell et al. (2009) determined the relationship between diversification and the value of a sample of REITs from 1995 to 2003. They consider that the property type diversification has little statistical significance with the value of the company. On the other hand, a relationship exists between the location and the value of REITs. Also, they found that REITs that invest in multiple geographic regions are often less valuable than REITs with limited geographic strategies. In fact, the risks inherent in the business and the market risks are higher. For REITs with a high shareholder ratio made up of institutional investors, the degree of investment is high. Variables related to the structural organization of a company also have a significant impact on diversification opportunities.

On the other hand, Adams et al. (2015) have shown that the geographic location of a property is important in the diversification of a portfolio. To back up their remarks, they used the sensitivity of the VaR according to the market situation. This approach consists of quantifying the size of the impact based on the financial situation of the company (value of REITs in a calm, normal or volatile market). In the event of financial difficulties, REITs located in the same geographic area shows little opportunity for diversification. Indeed, the authors estimated the risk to be 33% higher on average than similar REITs at a greater distance. Consequently, geographic diversification, therefore, depends on the distance between the various assets that make up the portfolio. As geographic distance increases, the impact of risk decreases rapidly. For all properties over 400 km, the risk remains low. Empirical results on distance effects indicate that the efficiency of geographic diversification may be lower than previously thought. Individually, REITs appear to be geographically diverse, but in general, they can be highly exposed to other REITs in the same region. More importantly, the usual sample correlation does not detect this interdependence between returns.

The ideas put forward by Adams et al. (2015) converge with the findings of Chua (1999). The latter tries to demonstrate how the incorporation of real estate assets selected on an international basis effectively improves the diversification of a portfolio made up of stocks, bonds, cash and commodities as gold. The study also considers the increase in taxes, transaction costs and asset management fees incurred in the real estate investment process compared to other asset classes, as well as the smoothed valuation of real estate returns. The mean variance was used to optimize

the portfolio. The results also showed that the decrease in portfolio risk is highly dependent on the risk and return desired by the investor.

But international diversification has limits, according to Lu et al. (2013). They study the daily cross-market performance interactions and downside risks between the performance index of a US REIT and the performance indices of 12 international markets. These relationships are established during the normal period of the REIT market and during the rise and fall of REIT prices. Indeed, what is found is that when the market experiences a recession, the returns of the "US REIT" is correlated with the returns of international REITs. In addition, under normal market conditions, the emerging REIT market has a relatively high value at risk. However, the more developed REIT market had the greatest contribution of VaR during the period of the financial crisis. Thus, there is little scope for diversification. This is shown by the "value at risk" study that was carried out. The value at risk of a small market capitalization market is higher in a normal market. The same goes for a market with a large market capitalization when the market is in a recession. When we consider all the changes between markets and each country's VaR level to measure diversified returns, we find that these returns gradually declined during the period of housing bubble formation and price collapse. However, during the period of the financial crisis, the international diversification of REITs caused a greater loss.

C. Performance and diversification of REITby country

Newell and Marzuki (2018a) studied the emergence, the risk as a function of performance and diversification opportunities offered by REITs in Germany between 2007 and 2015. In this same study, a post-crisis analysis after the financial crises of 2008 was carried out in order to assess the behaviour of real estate titles. According to the authors, the REIT market has not yet reached its potential in Germany but still represents the 5th market in Europe with a 1.6% market share. From 2007 to 2015, analysis of performance shows that REITs underperformed the market in general. Also, the risk of real estate securities was high compared to the market. In terms of diversification, REITs are highly correlated with stocks and are not correlated with bonds. As a result, REITs during the crisis are more inclined to be diversified into a portfolio of bonds than stocks. Conversely, the post-crisis analysis shows that the returns of REITs were the highest in the market, with a risk that is always higher but decreased by 10% compared to the period of the crisis. Also, the diversification opportunities remain the same as the correlation between REIT and equities is high and the correlation between REIT and bonds is low.

Marzukiand Newell (2019) also tried to show the structural transformation of REITs and their performance, before and after the 2008 crisis, in Belgium. As the article points out, Belgian REITs are among the oldest in Europe. They have undergone many changes, which make them a reliable listed investment today. Indeed, the regulatory framework had a lot to do with it. Before the crisis, REITs had a higher return on investment than stocks, to the extent that the risk of real estate securities was lower than that of stocks even though stocks outperformed. The negative correlation between REITs and bonds, as well as an existing weak correlation between stocks and REITs, provide an opportunity for diversification. After the crisis, the results are quite different. In terms of performance, REITs provide more absolute returns with lower risk than

stocks but higher than bonds. As a result, REITs also achieved a higher return on investment than the market during this time. Empirical studies have shown that Belgian REITs improve diversification opportunities in a portfolio made up of stocks and bonds.

Newell et al. (2013) explore the REITs of the French real estate market, also known as SIICs (listed real estate investment companies). The analysis of performance and diversification opportunities before and after the financial crisis was also applied to this article. This analysis shows that SIICs have recorded a higher return on investment than the equity market, with a risk that is also higher than the market. The correlation between equities and SIIC is stronger, indicating a low diversification opportunity, unlike bonds where diversification opportunities are stronger. After the crisis, SIICS obtained a higher return on investment than equities. But they performed better after the crisis. Portfolio diversification also remains low, as the correlation between SIICS and the market has remained roughly the same. In both periods, we see that the efficient frontier was strongly impacted by SIICs, given the allocation that these securities have in the diversified portfolio.

Newell and Marzuki (2018b) also studied the emergence of listed real estate in Spain. According to the authors, "Spanish REIT", also known as SOCIMI, constitutes the third-largest European market. The aim of their research was to determine the importance of risk-return performance and diversification opportunities of "Spanish REITs" over a period of approximately four years, namely from August 2014 to February 2018. Their research shows that compared to equities, listed real estate assets have a higher risk-return ratio, but portfolio risk is rarely reduced. On the contrary, compared to bonds, they found SOCIMIs offer a good risk-return ratio and also opportunities for diversification.

In 2016, the same authors also attempted to conduct the same research on UK Real Estate Investment Trusts (REITs). They believe that "UK REITs" represent the fourth largest real estate market in the world. Research shows that compared to UK equities from 2007 to 2014, the risk-adjusted returns generated by these assets did not perform well. However, since the global financial crisis, UK REITs have provided better risk-reward ratios. It should be added that the diversification effects of the latter with the British equity portfolio are still limited. More studies in different countries also found similar results as the study in Turkey (Coşkun et al., 2017), Germany (Schweizer et al., 2013) and the UK (Newell & Muhammad Jufri, 2016).

Research Methodology

To carry out this study, we are going to look at a quantitative approach. Indeed, the data used was extracted from the Bloomberg database. We take the monthly closing prices from the equity, bond and REIT indices. Then, an analysis of the performance of the various portfolios will be done in order to confirm or refute the assumptions made above. Three study hypotheses are presented below:

- H1: Do the returns follow a normal distribution?
- H2: Is the risk-reward ratio of a portfolio made up of REITs and Bonds higher than that of a portfolio made up only of Shares and REITs?

- H3: Does the portfolio of stocks and bonds offer a better Sharpe ratio than the portfolio of stocks, bonds and REITs

To test the hypotheses, we compare the performance of the different portfolios established.

A. Sampling

To do this, the monthly dividend-adjusted closing prices over the past 11 years of different stock indexes are collected. The reason for choosing stock indices is that they are an ideal measure of the performance of the market.

1. Index choice

a. Equity Compartment

Regarding the equity compartment, two indices were used. We took the monthly data from the EuroStoxx 50 index. This index is composed of 50 stocks from the 50 best-performing companies spread mainly in 11 European countries. In addition to the geographic distribution, this index is broken down by sector. In fact, there are 18 different economic sectors. The creation of EuroStoxx 50 aims to allow Anglo-Saxon investors to invest based on the overall economic health of all European countries. The sample for this study is also composed of the Euronext 100 index, which currently represents one of the main financial operators in Europe. It is, therefore, a benchmark index that offers a global perspective on the development of the Nyse Euronext index. The securities which compose it are those which are the most financed and the most liquid. It brings together different markets on a European scale.

b. REITCompartment

As we can see in Figure 1, the REIT compartment has three indices, namely the FTSE EPRA Nareit Europe, the FTSEurofirst Eurozone Real Estate and the REIT Europe index. The FTSE EPRA Nareit Europe Index is a subset of the FTSE EPRA Nareit Developed Index designed to track the performance of listed real estate companies. The index is therefore made up of 101 listed European real estate companies that are the most representative of the real estate market. Its market capitalization, therefore, stands at 198 million euros.

The REIT Europe index has 44 listed real estate companies selected based on their market value and liquidity. Therefore, the pan-European REIT Europe Index helps to monitor the industry of real estate companies that have chosen a REIT scheme and provide fund managers and issuers with a method to assess their performance and compare it with other companies in the same field. The index has a market capitalization of around 110 billion euros.

c. Bond Compartment

The bond compartment is composed of FTSE MTS Highest rated Eurozone Government Bond IG 5-7Y index as well as the FTSE MTS Eurozone Government Bond IG 5-7Y index. The FTSE MTS Index is a bond index used to measure the performance of the euro area government bond market. The FTSE MTS indices are the benchmark in the sovereign bond market. The independent total return index measures the performance of the largest and most traded securities in the euro bond market. The basic data for the FTSE MTS Index is taken from real-time prices.

2. Portfolio composition and allocation

Four portfolios A, B, C and D will be created from these monthly data (see table 2).

- Portfolio A made up of equities and bonds
- Portfolio B made up of REITs and bonds
- Portfolio C made up of REITs and equities
- Portfolio D made up of equities, bonds and REITs

Table 2. Asset allocation for each portfolio

	Portfolio A	Portfolio B	Portfolio C	Portfolio D
REIT sub-fund	-	30%	30%	10%
Equity sub-fund	65%	-	70%	55%
Bond sub-fund	35%	70%	-	35%

In addition, each compartment has a specific weight in each portfolio, as shown in Table 2. The choice of the allocation of REITs in the portfolio is based on a study by Booth and Broussard (2002), which states that the weight of a REIT in a mixed portfolio should be between 10-30%.

3. Formulas used

In order to analyze the data, we calculated monthly returns, as well as descriptive statistics for each asset class as well as for each portfolio. First, we calculate the average of the monthly returns and risks for each asset, and then we annualize them. The return on each portfolio is then calculated while respecting the weight assigned to each sub-fund. The following relationship will be used in order to calculate the monthly returns:

$$E(R_i) = \ln \frac{P_t}{P_{t-1}}$$

$$t : period\ (months)\ ;\ i: asset$$

The portfolio return is calculated by the following relationship:

$$E(R_{portfolio}) = x_{equity}R_{equity} + x_{REITs}R_{REITs} + x_{Bonds}R_{Bonds}$$

$$with\ x: weight\ of\ the\ asset$$

To calculate the risk, we use the standard deviation:

$$\sigma_{portfolio} = \sqrt{\sum_{1}^{i}\sum_{1}^{j} x_i x_j \sigma_{ij}}$$

Then, we will calculate the risk-return ratio of each asset as well as the Sharpe ratio. These are performance indicators of a portfolio (see Table 1). The Sharpe ratio is calculated by the following relation:

$$Sharpe\ Ratio = \frac{E(R_p) - R_f}{\sigma_p}$$

$$E(R_p) = Portfolio\ return;\ R_f = Risk\ free\ rate;\ \sigma_p = portfolio\ risk$$

B. Data collection

Data collection was done using Bloomberg software. All the monthly prices incorporating the dividends were extracted from Bloomberg. These data were used to calculate the performance of portfolios through descriptive statistics as well as the correlation of different asset classes.

Results and Discussion

A. Analysis of descriptive parameters of the return's distribution

Table 3 shows the descriptive statistics of these six indexes. The average of the returns, the standard deviation, the asymmetry coefficient, the kurtosis as well as the Jarque-Bera statistic are presented in Table 3.

Table 3. Monthly Descriptive Statistics of indices from January 2009 to December 2019

	MEAN	STAN DEV	SKEWNESS Coef	KURTOSIS Coef	Jarque-Bera Statistic	Do returns follow a normal distribution?
EuroStoxx50	0,6196%	4,8254%	-0,412565611	0,558953775	-9,681125796	yes
Euronext 100	0,8249%	4,1447%	-0,270860058	0,12644687	-14,19050845	yes
FTSE EPRA/NAREIT EU	0,9958%	4,4681%	0,499671125	1,563036153	-2,410534023	yes
REIT Europe	0,7533%	4,8851%	0,158453824	0,608896929	-12,59869937	yes
FTSE EU Government Bond	0,3248%	1,0402%	-0,309877173	1,357006123	-6,923941355	yes
FTSE EU Higheste Rated bond	0,2878%	0,9420%	0,204876302	-0,0075139	-15,61789187	yes

Table 3 shows that the monthly returns of the FTSE EPRA / NAREIT REIT Europe index have the highest performance compared to the REIT Europe index, which, together with it, makes up the REIT compartment, as suggested by Block (2006) and Bond and Glascock (2006). In addition, it has the best performance compared to the indices that make up the equity and bond compartment. In terms of monthly returns, the FTSE EPRA/NAREIT index with a return of 0.99% is followed by the Euronext 100 index, which has a monthly return of 0.82%. Finally, the EuroStoxx 50 index has the lowest return on investment (0.61%) compared to the assets of the equity and REIT compartments. We can also see that the REIT sub-fund is the one with the highest monthly return ("average" column table 3), followed by the equity sub-fund. There is an average of 0.87% in terms of return for the REIT compartment and 0.72% for the equity compartment. On an annual basis (Table 4), the FTSE EPRA Nareit index has a return of 11.94% compared to 9.89% for the Euronext 100 index.

Table 4. Annual return and risk of indices from 2009 to 2019

Indices	**Returns**	**Risk**	**Indices**	**Returns**	**Risk**
EuroStoxx50	7,4348%	16,72%	REIT Europe	9,0399%	16,92%
Euronext 100	9,8992%	14,36%	EuroMTS GLOBAL	3,8972%	3,60%
FTSE EPRA/NAREIT EU	11,9495%	15,48%	FTSE EU Gov Bond	3,4538%	3,26%

Related to the portfolio risk analysis, the standard deviation (see table 3) is used as an indicator of risk in the financial world. The REIT Europe index is the riskiest, and therefore the most volatile among the indices. The risk of this index is 4.88%, closely followed by the EuroStoxx50 index with a risk of 4.82%. However, the risks of bond indices remain the lowest. In Figure3, we see that the REIT compartment is the riskiest with a 4.67% standard deviation, followed by the equity compartment with 4.48% and finally the bond compartment with 0.99%. For most indices except for the indices of the REIT compartment, there is a negative asymmetry between Skewness and Kurtosis. We can easily deduce that the distribution is relatively spread to the left of the mean. In addition, the distribution of index returns has a narrow distribution or leptokurtic distribution. However, the only exception is the FTSE EPRA Nareit REIT Europe index, which has a relatively normal distribution. Indeed, the kurtosis is substantially equal to 0 (table 3). To check whether the returns follow a normal distribution, we have chosen to apply a Jacque-Bera test. The parameters that were considered to calculate the Jarque-Bera statistic are the number of observations, the asymmetry coefficient and the kurtosis of the sample. The assumptions for the test Jarque-Beraare threshold 5%; degrees of freedom 2; and critical value 5,991464547. As the Jarque-Bera statistic is lower than the critical value set at 5.991464547, this means that the returns follow a normal distribution. Such an assertion will allow us to set up statistical analyzes.

B. Correlation analysis

The correlation between equities and REITs also remains high and is in the order of 0.76, as shown in Table 5. Such a correlation shows the non-diversifiable character of REITs when they are incorporated into a portfolio consisting only of REITs and actions as the two asset classes have an almost perfect positive relationship. They tend to increase or decrease together, as indicated by the direction of the line in Figure 1, which is sharply tilted upwards. Note that the monthly returns of the two variables are concentrated around the trend line.

Table 5. Correlation between the Equity, Bonds and REIT compartment

	Equities	*REIT*	*Bonds*
Equities	1		
REIT	0,76079803	1	
Bonds	-0,05503404	0,1241053	1

	EQUITIES		*REIT*		*BONDS*	
	EuroStoxx50	**Euronext 100**	**FTSE EPRA/NAREIT EU**	**REIT Europe**	**FTSE EU**	**FTSE MTS EU**
EuroStoxx50	1	0,9678	0,7271	0,7245	-0,0185	-0,2820
Euronext 100	0,9678	1	0,7597	0,7416	-0,0392	-0,2707
FTSE EPRA/NAREIT EU	0,7271	0,7597	1	0,9685	0,1005	-0,0678
REIT Europe	0,7245	0,7416	0,9685	1	0,0895	-0,0953
FTSE EU	-0,0185	-0,0392	0,1005	0,0895	1	0,7586
FTSE MTS EU	-0,2820	-0,2707	-0,0678	-0,0953	0,7586	1

Note: FTSE EU and FTSE MTS EU are Government Bond

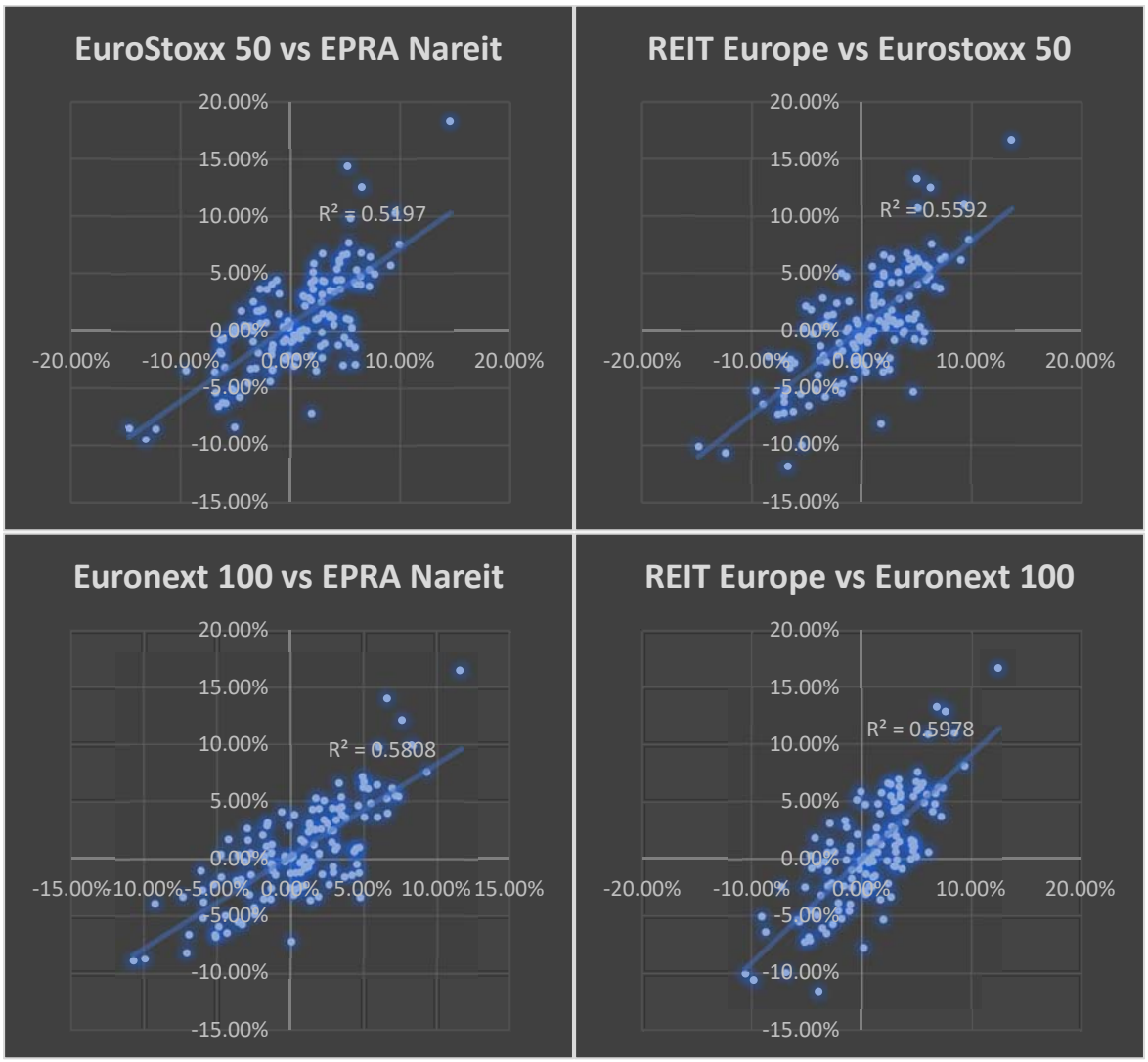

Figure 1. *Correlation between REITs and actions from January 2008 to December 2019*

Conversely, the correlation between REIT and bond indices is low and increase the diversification opportunities. The correlation is therefore estimated at 0.20. The latter remains weak, but the existing relationship between stocks and bonds is much weaker. Indeed, the correlation is 0.06 and implies diversification opportunities. The risk reduction is, therefore, greater when adding REITs to a portfolio as they are not strongly correlated with bonds. There is almost no relationship between the bond index and the rest of the asset classes, namely REITs and equities. The bond index is therefore independent of changes in REITs and equities, as shown in Figure 2 and Table 4.

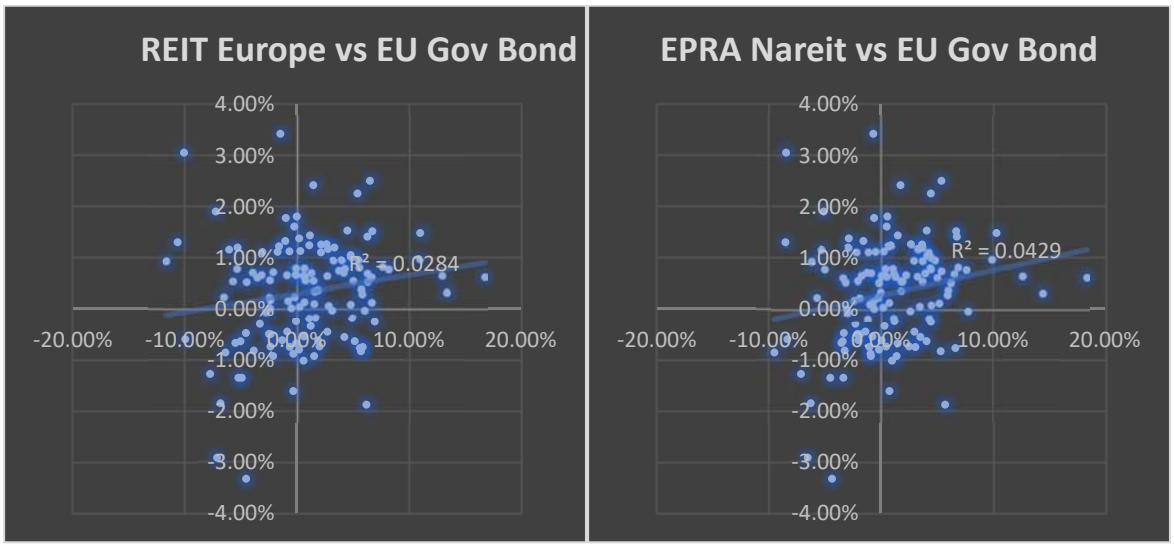

Figure 2. *Correlation between REIT and Bonds from January 2008 to December 2019*

C. Performance analysis

Table 6 and Table 7 show the performance of four portfolios, A, B, C, D. The results show that portfolio B, which is made up of the REIT and bond sub-fund indices, has the lowest risk compared to other portfolios. Indeed, there is a risk of 3.20% for portfolio B against 5.78% for portfolio A, 8.54% for portfolio C and 5.65% for portfolio D. The combination of REIT and Bonds can greatly reduce the risk of a portfolio. In fact, the bond index combined with the equity index does not, therefore, make it possible to reduce the risk like portfolio B (see Figures 3 and 4). This is explained on the one hand by the allocation of 30%, which was attributed to the REIT in portfolio B. On the other hand, as the correlation analysis reminds us, REITs have a low correlation with bonds (see table 9). In addition, portfolio B performs much better if we compare their risk-return ratio. Indeed, REITs combined with bonds have a ratio of 29.76% versus 19.93% for a portfolio of stocks and bonds. This shows once again that the mix of assets observed in Portfolio B is performing better than the other portfolios.

Table 6. Portfolios 'performance

	Portfolio A	*Portfolio B*	*Portfolio C*	*Portfolio D*
Composition	*Equities, Bonds*	*REITs, Bonds*	*REITs, Equities*	*Equities, Bonds, REITs*
Mean	1,1533%	0,9535%	1,5359%	1,1838%
Standard deviation	5,7859%	3,2038%	8,5400%	5,6521%
Ratio return/risk	19,93%	29,76%	17,98%	20,94%
Sharpe Ratio	0,17514	0,25393	0,16345	0,18467

Table 7. Annual risk and returns of portfolios from 2009 to 2019

	Portfolio A		*Portfolio B*		*Portfolio C*		*Portfolio D*	
Date	Returns	Risk	Returns	Risk	Returns	Risk	Returns	Risk
2009	3,70%	12,83%	1,73%	5,27%	4,93%	17,99%	3,57%	12,26%
2010	-0,03%	9,25%	0,46%	4,18%	0,37%	12,84%	0,12%	8,87%
2011	-2,26%	9,69%	-0,55%	3,54%	-3,36%	13,56%	-2,16%	8,96%
2012	2,70%	7,50%	2,46%	2,44%	3,19%	9,09%	2,74%	6,76%
2013	2,73%	6,58%	0,62%	3,93%	3,10%	8,43%	2,44%	6,34%
2014	1,24%	5,04%	2,56%	1,88%	1,41%	6,24%	1,49%	4,54%
2015	0,90%	12,21%	0,85%	5,19%	1,48%	15,29%	0,99%	11,42%
2016	0,35%	6,28%	-0,17%	3,64%	-0,40%	9,71%	0,14%	6,20%
2017	1,23%	5,09%	0,45%	2,55%	1,62%	6,10%	1,16%	4,63%
2018	-2,19%	6,62%	-0,71%	2,05%	-3,25%	8,57%	-2,12%	6,00%
2019	3,85%	6,25%	1,94%	2,51%	4,93%	7,97%	3,71%	5,61%

Portfolio D, which includes all asset classes, is the second-best performing portfolio after portfolio B. It will serve as a basis for evaluating diversification opportunities as it includes all asset classes. The portfolio has a risk of approximately 5.65%. If we compare it with portfolio A, we observe that the risk decreases slightly. In fact, there is a slight decrease of 0.13% compared to the portfolio made up of stocks and bonds. This decrease is estimated at 0.5% on an annual basis (see Table 8), which remains relatively low. REITs, therefore, represent a diversification factor that is much less effective when combined in a mixed portfolio of stocks and bonds. But conversely, they are much more effective if you combine them only with bonds. This is also shown by the calculation of the Sharpe ratio; the best performing investment remains portfolio B, followed by portfolio D, which have ratios of 0.176 and 0.148, respectively. The incorporation of European REITs in a mixed portfolio reduces the risk of this portfolio. REITs, therefore, make it possible to diversify a portfolio as well as increase its return.

Table 8. Annual portfolio risk and return

	Mean	Standard deviation		Mean	Standard deviation
Portfolio A	13,8399%	20,0429%	Portfolio C	18,4306%	29,5834%
Portfolio B	11,4425%	11,0982%	Portfolio D	14,2055%	19,5794%

Table 09. Correlation between the Equity, Bonds and REIT compartment

	Equities	*REIT*	*Bonds*
Equities	1		
REIT	0,76079803	1	
Bonds	-0,05503404	0,1241053	1

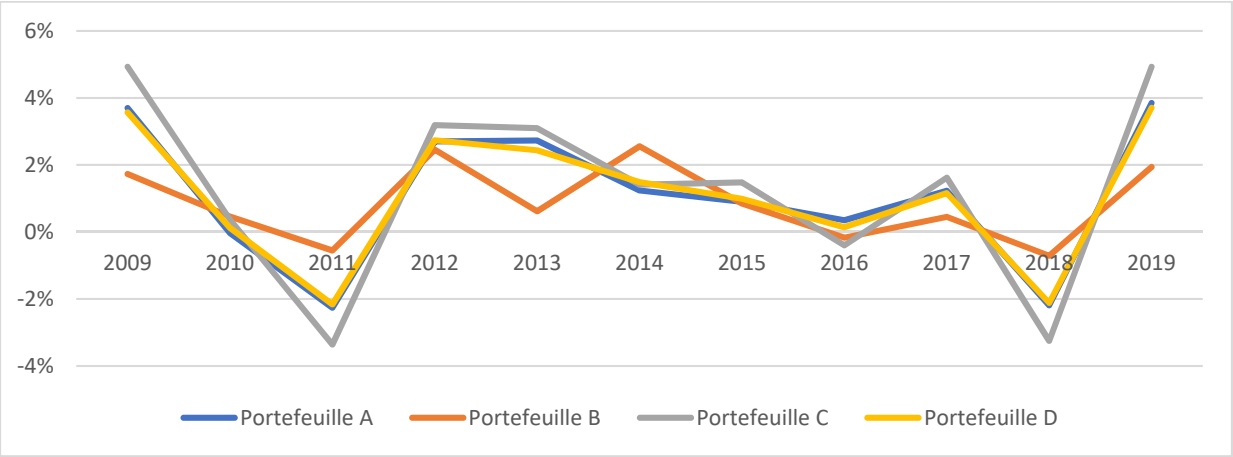

Figure 3. Evolution of portfolio returns from 2009 à 2019

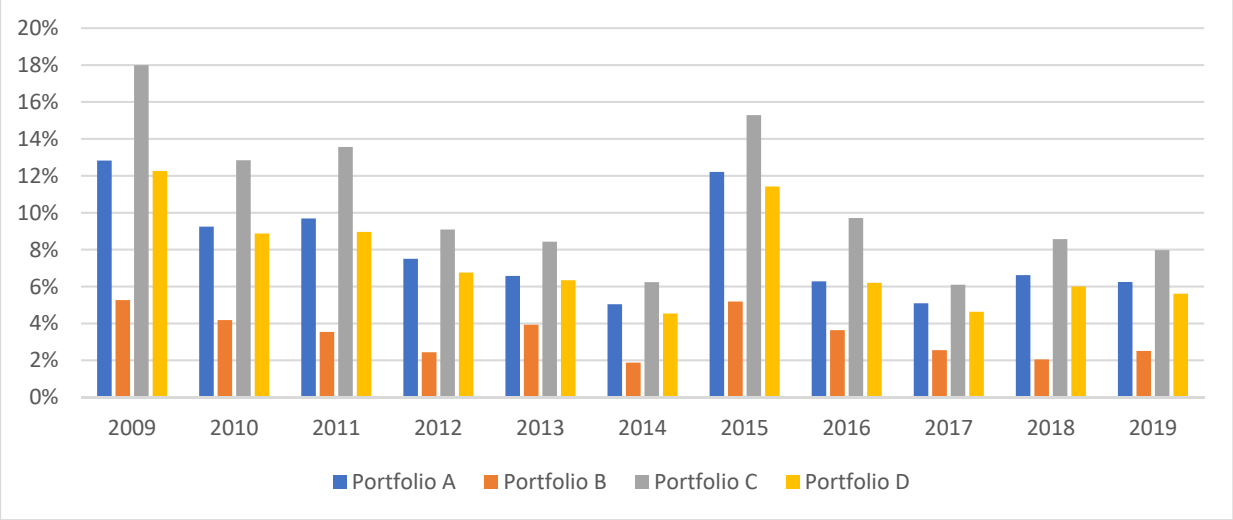

Figure 4. Histogram of portfolio's risk

Analysis of the results also enabled us to respond to the assumptions made at the start of the study. Indeed, JarqueBera's statistics allowed us to confirm the normality of the data used for the study. Also, the results allowed us to demonstrate that the risk-return ratio (29.76%) of portfolio B, which is made up of REITs and bonds, is higher than that of portfolio A (19.93%), which is made up of stocks and bonds. This means that bonds perform better in the presence of REITs. In addition, the Sharpe ratio of portfolio A allows us to judge the impact of REITs in a mixed portfolio. In fact, we note, for portfolio D, a Sharpe ratio of 0.18, which is slightly higher than that of portfolio B.

Conclusion

The objective of this research is to study the diversification opportunities offered by REITs located in Europe. In order to carry out this study, as a first step, the literature review allowed us to have an important view on what has been advanced by several authors on the reduction of risk

in a portfolio made up of stocks, bonds and by REIT. The monthly returns of the EuroStoxx 50, Euronext 100, FTSE EPRA Nareit REIT Europe, Euronext IEIF REIT Europe, FTSE MTS Highest Rated Government Bond index and the FTSE European Government Bond index were therefore collected over a period of 11 years. These indices group together securities traded on European stock exchanges. They have therefore been organized in the form of compartments, namely equity, a REIT and a bond compartment. Finally, an analysis of descriptive statistics, an analysis of the correlation and an analysis of the performance of the various portfolios were carried out.

The results show that the REIT sub-fund has the highest average monthly return at 0.59%. Also, in terms of risk, it is the REIT compartment that has the largest standard deviation. We note the risk of this sub-fund at 4.62% compared to 4.23% for the Equities sub-fund. In addition, correlation analysis has shown that the indices that make up the REIT compartment are weakly correlated with bonds. The same goes for the correlation between stocks and bonds. At the same time, the study found that eurozone equity indices are much less correlated with bonds than REITs. Finally, we note that European REITs offer diversification opportunities to a mixed portfolio, as suggested by Conover et al. (2002). In fact, in portfolio B, made up of REITs and bonds, the risk is lower than in portfolio A made up of stocks and bonds. This means that REITs combined with bonds can significantly reduce the risk of a portfolio. REITs incorporated into a portfolio mix nevertheless produce a low diversification opportunity and therefore reduce the risk of this portfolio by 0.5% per year. However, it also increases the return of the mixed portfolio by 0.36%, which is still an advantage even if this increase remains small.

This study has therefore shown the advantages of holding REITs as well as stocks and bonds traded in European markets. As practical implications, we can point out the use of REITs in investment portfolios bring alternatives to risk diversification for investors. The theoretical contribution of this study is in accord with the modern portfolio theory; this study showed how risk-averse investors could construct portfolios using REITs to maximize return based on a given level of market risk.

It would be interesting for other studies to come to compare the performance of European REITs with, for example, that of American REITs, Asian, and African REITs in a mixed portfolio. Another interesting point could be studied until, with the level, the increase of REITs in the portfolio continues to reduce the risk, as suggested by Glascock et al. (2018).

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