

https://dspace.org/

Diversification benefits of SA REITs in a mixed asset portfolio: one decade and a pandemic later

Mphaho, Masilo

2023

https://hdl.handle.net/10539/44326

Mphaho, Masilo. (2023). Diversification benefits of SA REITs in a mixed asset portfolio: one decade and a pandemic later [Master's dissertation, University of the Witwatersrand, Johannesburg].WireDSpace.https://hdl.handle.net/10539/44326

Downloaded from a DSpace repository. https://dspace.org/

Diversification benefits of SA REITs in a mixed asset portfolio: one decade and a pandemic later





A Thesis/Dissertation

presented to

Faculty of Commerce, Law, and Management

Wits Business School

University Of the Witwatersrand

In partial fulfilment for

the requirements for the Degree of

Master of Management in Finance and Investments

By

Masilo Mphaho

2023

Supervisor: Assoc. Prof. Odongo Kodongo

PLAGIARISM DECLARATION

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.
2. I have used the American Psychological Association (APA) (6th Edition) convention for citation and referencing. Each contribution to, and quotation in, this study from the work (s) of other people has been attributed and has been cited and referenced.
3. This study on the Diversification benefits of SA REITs in a mixed asset portfolio: one decade and a pandemic later in South Africa is my own work.
4. I have not allowed and will not allow anyone to copy my work with the intention of passing it off as his or her own work.
5. I acknowledge that copying someone else's assignment or essay, or part of it, is wrong, and declare that this is my own work.

MMphaho

Masilo Mphaho

ACKNOWLEDGEMENTS

I would like to take this opportunity to first thank God for giving me the strength to persist with this paper. My family and my partner for love, support, and always cheering me on, especially when I feel like giving up. A special word of gratitude to my Supervisor, Prof. Kodongo, a great leader who is always so patient when providing guidance, and Vukile Property Fund for funding my studies. I wish to further extend appreciation to the staff of WBS for all the assistance that got me this far.

ABSTRACT

Volatility spillover between financial markets causes inefficiency of diversification. Therefore, other investment alternatives are required to build an optimal portfolio, one of them being Real Estate Investment Trusts (REITs). The low correlation between REITs and stocks implies an advantage of diversification in an investment portfolio containing both assets. An important implication of this finding is that if stocks and REITs are incorporated into an investment portfolio, the investor will have better diversification benefits. This paper looks at the diversification benefits of having REITs in a mixed asset portfolio by conducting an empirical study from when the REIT regime came into effect in South Africa 10 years ago, particularly focusing on the period between 2013 and 2023. The econometric tools used in this regard include cointegration and, time series models (VAR and VECM) for forecasting. The paper also considers how the COVID-19 pandemic has affected this relationship by conducting a mean-variance spanning test to see if the inclusion of REITs in an existing portfolio dominates it. Other measures such as Sharpe ratios and Efficient Frontiers are included for analysing portfolio performance. Therefore, providing a mature analysis of REITs continuing from current literature and assisting Fund Managers in understanding the impact of including the asset class in a portfolio with a long-term investment horizon. This study affirms the low correlation between REITs and other stocks and further shows that they are not affected by shocks in the bond and stock markets respectively while also having the potential to improve the risk-adjusted returns of a Portfolio. Therefore, Fund Managers can consider REITs for their portfolio diversification strategies.

TABLE OF CONTENTS

PLAGIARISM DECLARATION 1
ACKNOWLEDGEMENTS 2
ABSTRACT 3
LIST OF TABLES 6
LIST OF FIGURES 7
LIST OF ABBREVIATIONS 8
1. CHAPTER ONE - INTRODUCTION 9
1.1 BACKGROUND 9
1.2 CONTEXT OF THE STUDY 11
1.3 PROBLEM STATEMENT 14
1.4 RESEARCH OBJECTIVES / RESEARCH QUESTIONS 15
1.5 BENEFIT OF THE STUDY (I.E., POLICY, INVESTORS ETC.) 16
2. CHAPTER TWO - LITERATURE REVIEW 17
2.1 WHAT IS A REAL ESTATE INVESTMENT TRUST? 17
2.2 DEBT COVENANTS 18
2.2.1 Theoretical Literature 18
2.2.2 Empirical Literature 19
2.3 DIVERSIFICATION BENEFITS 19
2.3.1 Theoretical Literature 19
2.3.2 Empirical Literature 20
2.4 PORTFOLIO OPTIMIZATION 22
2.4.1 Theoretical Literature 22
2.4.2 Empirical Literature 22
2.5 DIVIDENDS 23
2.5.1 Theoretical Literature 23
2.5.2 Empirical Literature 25
2.6 COINTEGRATION 26
2.6.1 Theoretical Literature 26
2.6.2 Empirical Literature 26
2.7 CONTRIBUTION TO THE LITERATURE 27
3 CHAPTER THREE - METHODOLOGY 28
3.1 INTRODUCTION 28
3.2 DESCRIPTIVE STATISTICS 28

3.3 MEAN-VARIANCE SPANNING TEST 29
3.4 COINTEGRATION 31
3.4.1 Unit Root Test 31
3.4.2 Testing for Co-integration 31
3.4.3 Explanation of Results 32
3.4.4 Error correction model (ECM) 32
3.4.5 Forecasting and Analysis 32
3.5 DATA AND DATA SOURCES 32
3.6 PERIOD OF STUDY 33
4 CHAPTER FOUR - DATA ANALYSIS 34
4.1 DATA 34
4.2 DESCRIPTIVE STATISTICS 34
4.3 CORRELATIONS 36
4.4 PORTFOLIO OPTIMIZATION 38
4.5 MEAN-VARIANCE SPANNING TEST 40
4.5.1 Mean-variance Spanning Tests under normality. 40
4.5.2 Mean-variance spanning tests under conditional heteroskedasticity. 41
4.5.3 Sub-sample analysis 41
4.6 COINTEGRATION 42
4.6.1 Unit Root Test 42
4.6.2 Lag Length Selection 44
4.6.3 Testing for Co-integration 46
4.6.4 Vector Autoregression 46
5 CHAPTER FIVE - CONCLUSION 51
5.1 INTRODUCTION 51
5.2 SUMMARY OF FINDINGS 51
5.3 CONCLUSION 52
5.4 IMPLICATIONS ON STAKEHOLDERS 52
5.5 RECOMMENDATIONS FOR FURTHER RESEARCH 52

LIST OF TABLES

Table 1 Index Correlation 12
Table 2 REIT Payout Ratios 25
Table 3 Outline of data used. 34
Table 4 Descriptive Statistics for March 2013 to March 2023 35
Table 5 Descriptive Statistics during national state of disaster between the 27th of March 2020 to the 8th of April 2022. 35
Table 6 Correlation Matrix between March 2013 to March 2023 37
Table 7 Correlation Matrix during national state of disaster between 27th of March 2021 to the 8th of April 2022 37
Table 8 Correlation matrix for indexes from 2014 to 2023 38
Table 9 Correlation matrix for indexes during national state of disaster 38
Table 10 Sharpe ratios of the different portfolios during COVID and the full sample period 38
Table 11 Normality tests for Portfolio 1 and 2 41
Table 12 GMM of Portfolio 1 and 3 during full sample period 41
Table 13 GMM of Portfolio 1 and Portfolio 2 during Covid19 period 42
Table 14 All Share Index Unit Root Test 43
Table 15 REIT Index Unit Root Test 43
Table 16 Government Bond Index Unit Root Test 44
Table 17 Lag Length Selection 44
Table 18 Trend and Intercept Test 45
Table 19 Augmented Dickey Fuller test for Error Term 45
Table 20 Autoregressive Distributed Lag Model 46
Table 21 Vector Autoregression Lag Order Selection 47
Table 22 VAR Residual Serial Correlation LM Tests 47
Table 23 Roots of Characteristic Polynomial 47
Table 24 Vector Autoregression Estimates 47
Table 25 VAR Granger Causality 48
Table 26 Forecast error variance decompositions 49

LIST OF FIGURES

Figure 1 Cumulative Asset Class Return *14*
Figure 2 Correlation of REITs with Direct Investments *23*
Figure 3 Portfolio 1 Opportunity Set *43*
Figure 4 Portfolio 1 Opportunity Set during Covid-19 ..... *39*
Figure 5 Portfolio 2 Opportunity Set *44*
Figure 6 Portfolio 2 Opportunity Set during Covid-19 ..... *39*
Figure 7 All Share Index Graph *42*
Figure 8 REIT Index Graph *43*
Figure 9 Bond Index Graph *44*
Figure 10 Impulse Response Functions *50*

LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
ALBI	All-Bond Index
ARDL	Autoregressive distributed lag
CAL	Capital allocation line
CAPM	Capital asset pricing model
CPI	Consumer Price Index
DDM	Dividend Discount Model
ECM	Error Correction Model
EREIT	Equity Real Estate Investment Trust
ETF	Exchange Traded Fund
FCF	Free Cash Flows
FPE	Final Prediction Error Criterion
FVA	Fair Value Adjustment
GDP	Gross Domestic Product
GMMs	Generalised Method of Moments
HQ	Hannan-Quinn Criterion
ICR	Interest Coverage Ratio
JB	Jarque–Bera test
JSE	Johannesburg Stock Exchange
JSEALSH	Johannesburg Stock Exchange All Share
LM	Lagrange multiplier
LTV	Loan to Value
MPT	Modern Portfolio Theory
MREIT	Mortgage Real Estate Investment Trust
NAV	Net Asset Value
NPV	Net Present Value
OLS	Ordinary Least Squares
PLS	Property Loan Stocks
PUT	Property Unit Trust
REIT	Real Estate Investment Trusts
SARB	South African Reserve Bank
SARS	South African Revenue Service
SC	Schwarz Criterion
STATSA	Statistics South Africa
VAR	Vector Autoregression
VECM	Vector Error Correction Model

1. CHAPTER ONE - INTRODUCTION

1.1 BACKGROUND

The willingness to participate in the Real Estate market is a result of many different factors, from those who want to improve South Africans' social quality of living to others who recognize the potential of this asset class in adding value to their investment portfolio. While access to the property market has improved over time, with more previously marginalized groups having better access to credit in the form of a mortgage loan/bond since participating in the economy, the possibility of entry to larger investment properties is unfortunately limited (Massyn, 2015). Only those with an existing financial capital base of reason or access to intermediaries who are comfortable lending such large sums of financial capital can participate in the commercial property industry. With the average maximum Loan to Value ratio of 80%, the monetary value of the equity portion is not readily available to much of the less fortunate population (Chatterjee et al., 2022). For this research, we use 'Real Estate' and 'Property' interchangeably.

Such interest in the asset class, combined with a lack of affordability, has seen many property holders utilize the opportunity to go public and provide this offering to a wider group through the financial markets and other platforms such as crowdfunding (Montgomery,2018). The expected growth in emerging markets has opened an opportunity for domestic and, more especially, foreign investors. Furthermore, the potential diversification benefit is a widespread notion that has led many researchers to investigate if this is truly an add-on or if it could just be an assumption as to why many institutional investors intend to have the vehicle within their mixed asset portfolio to reap the possible diversification benefits attributed to property investment (Feng, 2009).

To understand Real Estate performance, you can distinguish between the asset classes split into four major sub-classes: office, industrial, retail, and residential, or consider the sector holistically. The short-term movements of these sub-classes are driven by their respective drivers, which include *inter alia*, population, employment, and real income per capita, some of which overlap between the sub-classes.

South Africa's introduction of the Real Estate Investment Structure (REIT) in 2013, according to Ntuli et al. (2017), had the intention of encouraging more local and international investment. With the conversion from property companies to REITs, many entities started showing qualities of listed equity and property-backed assets. With the former introducing more market volatility, this raises the question of whether REIT performance should continue to be classified in the same category as other property companies and how large a gap could be realized. This would affect the way investors value these assets, whether putting more weight on the underlying asset through property appraisal prices or capital market information. The first method which is more linked to the economic theory of hedonic prices (Lisi, 2022) introduces what is known as the property appraisal evaluation risk, whilst the latter introduces the risk of investor sentiment that is priced in asset prices, which could lead to mispricing.

The background of REITs in South Africa, as explained by Klerk (2019), originates from back in 2006 when the local listed property sector was facing specific tax challenges and the various sector representatives began engaging with the South African National Treasury to promote the concept of a REIT, which was a fast-growing trend over the rest of the world. For South Africa to keep up, they had to implement a similar vehicle tailored to the local investment culture (Ntuli, 2020). Treasury formally published the REIT tax legislation for South Africa on the 25th of October 2012 in the 2012 Taxation Laws Amendment Bill. This took the form of a new section (section 25BB) in the Income Tax Act, which Klerk (2019) refers to bringing South Africa's publicly traded property sector in line with international standards, with the JSE publishing new listing requirements on 28th March 2013 facilitating the SA REIT.

The following was set as the guide on what structure these entities should retain: minimum share capital of R300 million, total loan-to-value ratio of 60 percent with the source of income being 75 percent from the rental and direct/indirect income from property owned, and a minimum distribution of 75 percent of distributable income to Shareholders (De Klerk, 2013).

The various attributes of a REIT that aim to, in summary, simplify and maximize real estate investment and returns might have resultant effects on the performance of these instruments with different economic cycles. Newell, et al. (2013), Newell et al. (2015); Newell et al. (2016) being one of the few that distinguish the asset class, find that, in established REIT markets, the risk-adjusted performance of REITs tends to be greater than that of stocks and listed property and that in these markets, the risk-adjusted performance of REITs tends to be greater than that of stocks and listed property.

Since property companies expose themselves to more criticism when converting to REITS, there ought to be a great enough opportunity cost for them to pursue that conversion. According to Wang (2022), the decision may depend on each country's regulatory restrictiveness, market sentiment, the actions of peers, and company-specific factors. This includes taxation and how listed property in each country is affected by taxation. Gyourko et al. (1999) investigated this and they found that tax savings played a significant role in this regard. Furthermore, REIT regimes are different in each country; where some countries are lenient on capital gains tax some REIT regimes require taxation of unrealized capital gains in the property portfolio, and this could demotivate property companies showing interest in acquiring REIT status.

That said, there is a distinction to be acknowledged between this and other asset classes from a performance and portfolio formation point of view. For diversification benefits, this is primarily because REITs provide a 'real asset' hedge to systematic risk. Unlike most shares on the stock market, REITs, like commodity and other infrastructure companies, are assumed a balance sheet, which is reinforced by their ability to hold decent value during periods of economic slowdown however this notion, according to Chyi (2012), is inaccurate. Chang (2017) suggests that this asset class can contain a hedge against inflation, which allows investors to protect their portfolios from the harsh impacts of inflation on earnings and capital growth.

Another factor to consider is the accretive nature of dividends provided by REITS. Since REITs are required to distribute 75% of their distributable income, most of these funds compete to achieve a lot more than this requirement such that investors (usually income-focused) weigh their dividend-earning capabilities of the pool of entities. Most REITs on the Johannesburg Stock Exchange (JSE) make it a point to issue more than 90% of their earnings to investors with further consistent growth guidance in dividends per share. The race to pay dividends, a peculiar quality across asset classes, allows REITs to stand out.

1.2 CONTEXT OF THE STUDY

Recently, there have been peculiar movements across the financial markets globally and domestically. According to a report by Anchor Stockbrokers, a local brokerage firm, on indexes cumulative asset class returns to May 2023, the property sector has somewhat gone against the recovery trend apparent in common equity and bonds, showing a slowdown for most of the

period. This comes as landlords are faced with rising interest rates and increased operating costs due to load shedding and municipal expenses (Kelly, 2018). Coupled with business plight as consumers are struggling to keep up with the higher costs of living, this results in a 'double whammy' on landlords who are often approached with rent freezes and, in some cases, negative rental reversions. This is particularly worse for portfolios containing rental office properties that currently face all-time low occupancy rates, resulting in less income and lower valuations from fair value adjustments.

As a result, the relationship between the performance of REITs has shown a negative correlation, as shown in Table 1 below, supporting what has been described above. This is based on a pre-study of this research using data from Yahoo Finance based on weekly return data, collected over ten years.

Table 1 Index Correlation of REITS vs All Share and Government Bonds

	vs	
J805TR INDEX	JALSH INDEX	-0,312
J805TR INDEX	IGOV TR INDEX	-0,370

Where the J805TR index is the JSE REIT index, the JSEALSH index is the JSE all share index, and IGOV TR INDEX is government bonds, the REIT index has exhibited low negative correlation when paired with the All share and the Government bond indexes, respectively.

The following are factors affecting the performance of the Real Estate sector recently: Electricity load shedding worsened in 2019, resulting in disrupted trade for tenants in the retail and industrial subclasses, followed by corporate companies adopting the remote working practice for their employees practiced by many corporates in 2020, which led to many landlords experiencing significant numbers of vacant offices and subsequent loss of income. Coupled with municipal expenses containing double CPI increases, according to Kelly, (2018), the 2021 social unrest in the KZN region resulted in many commercial property owners either losing their properties or having to at least increase their guarding expenses with no foreseeable return but as a defensive measure (Elumalai,2022). Furthermore, the Russia/Ukraine war affecting global food security and prices resulted in reduced consumer discretionary spend, followed by the 2022 severe floods and landslides in KZN, Eastern Cape, and recently (2023 Q3) Western Cape, which caused damage to properties and government infrastructure like roads and sewer

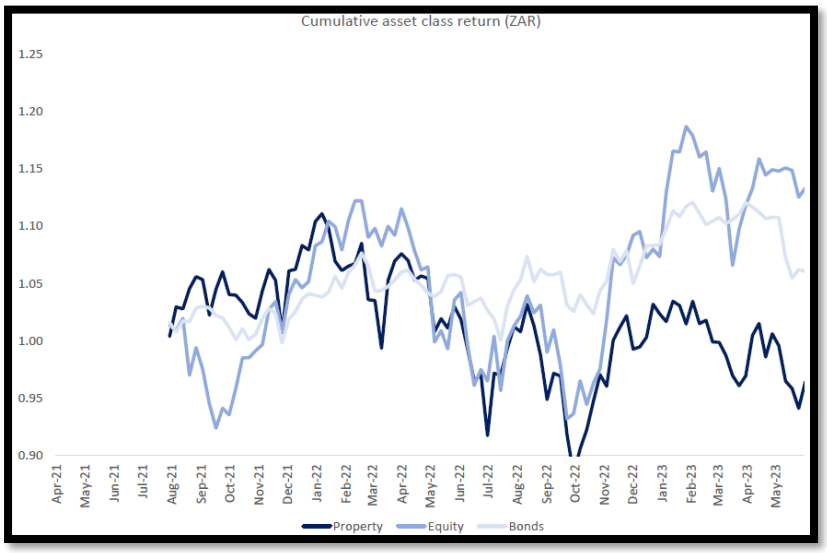
networks at the same time when most REITs face interest rate increases affecting cost of finance.

All the events mentioned above have an impact on most REIT portfolios of different nature and size. The interest rate spikes, municipal expenses, and electricity load shedding (spending on backup solutions and indirectly through tenant trade downtime) directly reflect on the financials. In their most recent results, the two largest retailers stress how generator running costs (diesel and maintenance) have impacted their financials, with one reporting the first-ever loss since listing (Child,2023). The resultant effect is that tenants are becoming stricter on rentals to reduce the total cost of occupation. The remainder of the issues also eventually affect performance and maybe more severely, like the disruption caused by RIOTs placing R7 billion worth of property at risk in eThekwini and floods removing R25 billion from the economy (South African Institute of Valuers,2022).

Other financial risks of a systematic nature, like interest rate hikes, which increased from 3.75% in 2021 to 8.25% in 2023 (from levels of 6.25% before the Covid-19 pandemic), appear to show a greater impact on Real Estate, which accord with Anderson (2022) on the effect of interest rates on REITs valuation and future return. This is mainly due to the industry levels of leverage (loan-to-value ratios) and the magnitude (size of capital) thereof. The sector relies greatly on external capital, which mostly comes from credit providers such as banks (Feng, 2007), and where such facilities have not been hedged using swap agreements, the interest rate risks and movements that take place during monetary policy tightening reduce the amount of cash available to satisfy lender repayments. This and other issues like financial covenants affect confidence in the sector, which increases the cost of capital in this alternative market and impedes growth even further by so doing (Borgonovo, 2013). The graph that follows shows the slow recovery compared with other asset classes on a cumulative return basis:

What is apparent is that in May 2023, listed property lagged far from a cumulative asset class return perspective compared to common stock and bonds. The three financial instruments have had periods where they move collectively; however, from November 2022, listed properties (which mostly consist of REITs) have started bucking that trend. To better understand this, sub-samples need to be extracted for these cycles and matched with the respective business cycle or major economic activities.

Figure 1 Cumulative Asset Class Return of Property, Equity and Bonds over the period of August 2021 to May 2023



Source: Anchor Stockbrokers

In measuring the relevance of REITs in current mixed-asset portfolios, this paper investigates their performance using different asset types as a reference and further taking into consideration other factors which are prudent when analyzing the performance of the REITs by assessing the impact of the various REIT rules imposed on these companies. To this effect, we also consider how the distribution requirements affect the performance in tight economic conditions and how investors perceive this as a value add by looking into the movements in the stock price during times when investors failed to deliver on this requirement, i.e., during Covid-19 when cash flow was tight and the preceding period interest rate hikes.

1.3 PROBLEM STATEMENT

The COVID-19 pandemic, coupled with the technical recession experienced by many countries globally before the closure of economies, has exacerbated challenges for companies across the board. For REITs, who have certain obligations to meet to retain their listing status and reap the benefits of having this status, this has been further challenging as their clients (mostly retailers) could not trade unless they provided essential services (Akinsomi, 2020).

The matter becomes if REITs still hold a diversification benefit for investors and how they bode in a defensive portfolio, especially through major economic headwinds. What risk does

the latter bear on shareholders who had considered REITs as part of their investment strategy? Should these parties revisit the guidelines, and strategies given that it has been 10 ten years since they were implemented, and now there is a long enough period to test the relevance of the initial REIT structure and or/ business case and observe how it competes with pre-existing and newer financial instruments.

Key literature like Carstens (2019), shows the adverse effects of this legislation on a REITs internal and external capital availability due to the lessened retention rate and increased distribution rate. (Akinsomi, 2020)'s early investigation into the impact of COVID-19 shows the importance of understanding REIT performance on an asset class level, as distinct events have different results on each.

Share structures have also become a focal point with Fortress (REIT), now formally known as Fortress 'Real Estate Investments' Investments', having lost its REIT status due to its inability to issue dividend payouts to its shareholders emerging out of the pandemic in 2022 when interest rates were starting to normalize. The company has since described this as an unfortunate event. However, they claim that they are now able to reduce their LTV and redirect the capital to income-enhancing developments and capital expenditure. Others like Hyprop, Attacq, and Texton also failed to issue dividends in the 2020 to 2022 period with the latter's cash generation in 2020 being below 75% of its distributable income which is the required distribution to retain REIT status. Could the REIT diversification benefit have been a fallacy and is the risk of other listed companies with REIT status is a broader problem that this paper seeks to solve adding COVID-19 as a test. Although other Authors have completed earlier studies on South African REITs during COVID-19 this paper also offers a 10-year examination which is currently found in a global context therefore intending to assist local investors.

1.4 RESEARCH OBJECTIVES / RESEARCH QUESTIONS

The overall objective of this study is to examine REIT investment performance when included in a mixed portfolio of fixed-income instruments (bonds) and common stock, continuing from previous studies that consider the benefits of having a REIT in a mixed asset portfolio for diversification purposes.

Specifically, the study seeks to:

1) Study REIT diversification benefits for the ten years since introduction and,

2) Further to the above, due to the sensitivity of financial markets to economic cycles, this paper will perform tests on how the REIT performance was affected by the COVID-19 pandemic as GDP growth was under strain. This study examines the safe haven characteristics of this asset class as their ability to hedge against prevalent economic downturns, placing additional focus on the COVID-19 pandemic.

1.5 BENEFIT OF THE STUDY (I.E., POLICY, INVESTORS ETC.)

This paper will firstly assist investors in understanding more of the impact/strength of South African REITs and if they would be a value add to their portfolios, as well as policymakers in ensuring that the structure remains relevant and beneficial to these investors in the fast-changing environment. As the worst of the pandemic now seems to be over, this paper aims to continue where previous researchers left off and draw attention to how REITs behave during times of uncertainty and extremely weak economic headwinds.

2. CHAPTER TWO - LITERATURE REVIEW

2.1 WHAT IS A REAL ESTATE INVESTMENT TRUST?

The property sector is well known for its long-term growth and reliable returns reinforced by the underlying brick-and-mortar and land value, which tends to appreciate over time (Omokhomion, 2018). Introducing this asset class to the financial markets has sparked much interest from institutional investors, *inter alia*: life insurance companies, pension funds, and mutual, hedge, and superannuation funds (Andonov et al., 2015).

An investment vehicle that later became known as a Real Estate Investment Trust (REIT) was established to expand the offering and make the properties more attractive to investors. This asset trades as an alternative investment on the stock exchange, like ETFs and other non-conventional asset classes, which the market perceives. (Robinson, 2018) describes a REIT as an entity that owns income-generating assets that offer investors an opportunity to gain access to the capital-intensive world of property.

The introduction of this asset to the capital markets has resulted in supernatural growth of the sector and, consequently, its contribution to economic growth; as statistics have it, the sector has grown to make up a substantial portion of global gross domestic product with assets of about $2 trillion (Brown, 2019). This begs the question of how much we understand of this asset class - from the underlying asset to other corporate finance matters like capital funding strategies and, on the other end, the potential risk it poses to the world economy as seen in the housing market-induced global economic crisis of 07/08 (Bhuyan, 2015).

This evolution of REITs has undergone various changes, progressively arriving at the most efficient structure. Some studies, such as Nareit (2010), deal with when the first REIT Act was passed by Mr. Eisenhower, former president of the United States, which was contained in the Cigar Excise Tax Extension of 1960. There are also different types of REITs (Equity REITs, Mortgage REITs, and Hybrid REITs), and each can be further broken down into subcategories (S&P Dow Jones Indices, 2023).

A REIT, however, is simply a property asset structure that allows the Founders/Managers growth by allowing them to pass on the tax obligation to the investor provided that certain requirements set by the REIT legislature are met. These rules include a minimum distribution of, i.e., at least 70% and 75% in Nigeria and SA, respectively, while in the UK, at least 90%

(as region-specific requirements) of its distributable earnings to shareholders. REITs are pushed to disperse profits from their commercial real estate portfolios to take advantage of tax breaks for shareholders, which earn relatively small net income margins (Omokhomion, 2018). According to Friday (1999), REITs are closed-end investment companies providing investors a passive channel to invest in income-producing real estate. A REIT's investing goal is to produce dividend income for investors, typically through rental revenue and gearing from capital gains on real estate assets.

Haslama (2015) says there is a significant amount of value at stake if predictions about future values turn out to be overly optimistic because Fair Value Adjustments (FVA) modify asset values in the present based on future financial expectations about earnings that have not yet been realized. If asset values are reduced, these changes must be covered by shareholder funds, which might or might not be enough to reduce financial instability and avert insolvency. Haslama (2015) further, finds that because of the favorable development potential and financial returns that FVA and legal changes combined to offer to real estate investors in 2007, represented a fresh chance for the REIT business model. However, in 2008, during the financial crisis, when the value of commercial property fell by nearly 50%, the climate in which this business model operated was badly damaged. The stock market value of this group of companies fell in line with the decrease in real estate values in 2007-2008.

2.2 DEBT COVENANTS

2.2.1 Theoretical Literature

Earlier research has also recommended debt covenants to curb Agency Problems (Jensen et al., 1976) Smith et al., 1979). One of the common attributes of REITs is the covenants placed by debt financiers when providing a facility to a REIT for a property. These create an accountability tool for managers when undertaking projects and protect debtholders from value-reducing projects. These financial covenants normally include limits on leverage, prescribed fixed charges, and minimum interest coverage ratios, also known as ICRs, and are mostly more prevalent in investment-grade REITs (Tsang, 2016)

It should be noted that the distribution requirements, which limit ploughing back, also prohibit management’s expropriation and require the agent to make an effective investment decision that provides long-term benefits to shareholders. Omokhomion1, (2018), Berle et al. (1932),

and Hartzell et al. (2003) indicate that having a large family/founder concentration limits this Agency problem with inside ownership positively correlated with the REITs TobinQ.

2.2.2 Empirical Literature

Tsang (2016) demonstrates that covenants only reduce the cost of debt for investment-grade REITs that have a higher potential for agency conflicts and liquidity risk and even though the covenant requirements are probably non-binding, investment-grade REITs can gain from using covenant clauses as a sign of the quality of their debt when they offer loans. Their results demonstrate that investment-grade REITs may still have agency conflicts between shareholders and debt holders. However, they may be lessened by covenant provisions, which would lower the cost of debt. This is also supported by Riddiough (2020), who found agency conflicts by documenting how they help manage the conflict between managers and shareholders over spare debt capacity.

2.3 DIVERSIFICATION BENEFITS

2.3.1 Theoretical Literature

Diversification is an important concept in portfolio formation as it involves spreading investments across different asset classes, sectors, geographies, and securities to reduce risk and potentially enhance returns (Biswas, 2015). The idea behind diversification is that different investments behave differently under different market conditions. By diversifying a portfolio, investors can reduce the impact of negative events affecting any one particular investment, asset class, or sector on their overall portfolio. This means that if one investment performs poorly, it may be offset by the positive performance of another investment in the portfolio. Diversification also helps manage risk by ensuring that the portfolio is not overly exposed to any security or asset class (Koumou, 2020). This can help investors avoid the risks associated with concentrated positions, such as any risk of a company-specific event that negatively impacts the stock price.

Real estate is an investment that shows a specific risk/return characteristic and low co-movements with investments in the domestic bond and stock markets (Maurer et al., 2002). This implies that including real estate in a portfolio of stocks and bonds presumably enhances the risk/return profile from the perspective of a domestic investor (Maurer et al., 2002). On the other hand, according to Chandrashekaran (1999), REITs do appear to offer substantial diversification benefits, at least during certain periods, and therefore, dynamic asset allocation

strategies that invest in REITs are likely to achieve superior risk and return profiles. Since the overall goal of asset allocation is to realize the best possible level of return at the lowest level of risk, real estate asset allocation, thus, aims to achieve diversification among different classes of property assets combined in an investment portfolio (Darst et al., 2008) and (Bhuyan, 2015).

2.3.2 Empirical Literature

Glascock (2018) looks at the difference between REITs and Listed Property companies by using diversification properties (or benefits) of holding both in one portfolio, which is more aligned with what this paper intends to explore. This allows mixed Fund Managers to weigh their opportunities of investing more in real estate and spreading their risk even further, as property investment itself is considered to provide diversification. Using various portfolio constructs (six in particular), the authors were able **to** identify the results of including or removing these assets from a portfolio.

Starting by comparing the portfolio performance, which initially shows that REITs and public property companies provide diversification benefits if both play a part in the portfolio formation; however, a mixed asset portfolio that already contains REITs will not achieve an additional benefit by including listed property companies in their portfolio. To reduce the error that the market conditions could induce, Glascock (2018) continues to conduct the test throughout different economic cycles. With different property asset classes expected to perform differently depending on the cyclical environment, this also calls for a proper robustness test. The results were almost close to the initial test conducted. He finds that REITs and listed property companies contain diversification benefits from a mixed asset portfolio perspective but do not yield noteworthy gains when holding both stocks in one portfolio. Whilst listed property companies do provide more opportunities; the poor substitutability qualities of these assets should be considered by investors who wish to invest in real estate.

This is similar to Seiler's journal investigation of the possibility of using 'Equity REIT (EREITs) shares to rebalance/ diversify private real estate portfolios' (Seiler, 2001). Seiler used different real estate asset classes (retail, etc.) in all private and public real estate through re-allocating each asset class into a portfolio repeatedly, i.e., comparing a private real estate-only portfolio comprising of apartments, industrial, office, and retail versus one without the private industrial and replacing it with public industrial (EREITs). The percentage allocations in each property type and the efficient frontiers were compared before and after. The more dissimilar the pre- and post-allocations and efficient sets are, the lower the degree of substitutability. This means that the two assets provide less diversification benefits. Seiler

found that in the US, the substitution of public real estate for private real estate in a private real estate-only portfolio varied to a considerable extent and would not result in in-efficient portfolio formations. However, efficient frontiers were almost the same. They proved that there can be a swap of a public real estate asset for a private one but with a similar efficiency level. The paper also goes on to evaluate the ability of short selling in a public real estate portfolio, but this method was proven to be fruitless in a sense.

When looking at REITs' absorption to various 'conventional and unconventional monetary policy shocks,' Feng et al. (2022) note a level of heterogeneity between the various real estate asset classes (e.g., office, hospitality, etc.). However, the sector tends to respond similarly to these shifts. The paper uses the Inoue (2021) method of identifying monetary policy shocks according to shifts in the entire term structure of government bond yields, looking at unconventional periods such as the COVID-19 pandemic experienced in 2020-2021 and the 07/08 Global Financial Crisis.

Bossman (2022) deals with the impact of the COVID-19 pandemic by examining the physical aspects of lockdown restrictions on performance and the strain induced by the 'heightened financial uncertainty' due to the unstable market sentiment. They found that the pandemic has resulted in a heightened bearish market and suggested a more robust policy oversight to control market sentiment and protect REIT performance. The return from investment however not only controlled by market sentiment but also the response of an investor to the market according to Vallespin et al. (2021) who studied REITs performance pre and during the COVID-19 pandemic.

Hanif (2013) studies the diversification potential of REITs from 2016 to 2022 against the economic downturn of the bearish crude oil market and COVID-19 and tests for haven properties using the regression analysis of REIT returns vs Oil returns. This study found that during the pandemic, the Japanese REIT index amongst 13 other indexes (including the Global REITs index) proved to be the only one with hedging qualities with a beta equal to 0.060 at a level one significance. Fuss (2011), after finding a correlation between REITs and other asset classes, the Johansen co-integration test to assess the potential for diversification by including international REITs in the strategic asset allocation of a mixed-asset portfolio and finds the asset class to offer both active investors and those with long-term investment horizons ample diversification potential through the achievement of continuous cash flows.

BOVA11, which represents the Brazilian variable income market, and the SPDR S&P500, which represents real estate investment, were used by Penabad (2017) to measure and analyze the diversification by investing in REITs and equities for an investor from Brazil. Their findings prove that the introduction of REITs is optimal in a mixed asset portfolio by individual and institutional investors searching for assets with attractive potential for profitability and risk diversification (Penabad, 2017).

2.4 PORTFOLIO OPTIMIZATION

2.4.1 Theoretical Literature

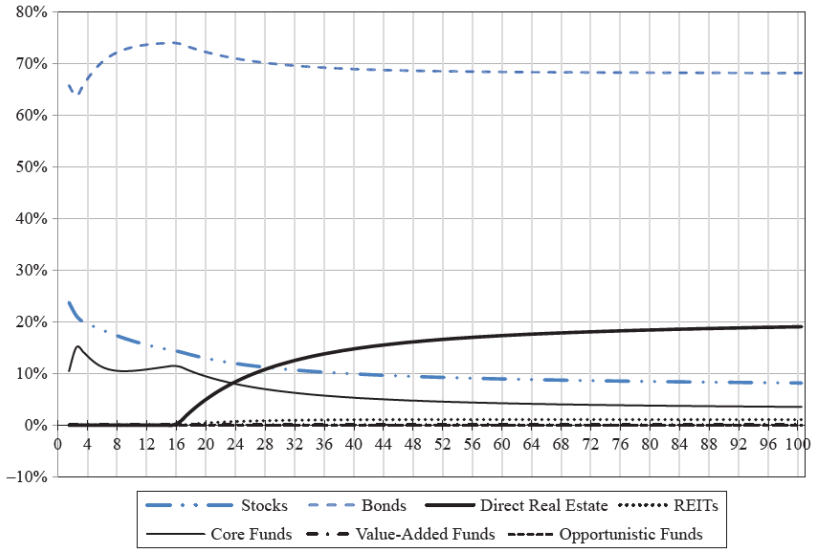
Mean-variance optimization, another name for portfolio optimization, is a quantitative technique used in finance to build investment portfolios to minimize risk for a given level of projected returns or maximize returns for a given level of risk (Markowitz, 1952). Depending on the investor's risk tolerance and investment goals, the main principle underlying portfolio optimization is to arrange assets so that the final portfolio provides the optimum trade-off between risk and return. The Modern Portfolio Theory was created by the famous Harry Markowitz in the 1950s and aims to optimize the trade-off between risk and return in the construction of an investment portfolio. (Markowitz, 1952) It is crucial to remember that portfolio optimization is predicated on assumptions and previous data, and future success is not guaranteed. Moreover, it assumes that market conditions remain constant, which is frequently not the case (Petter et al., 2014).

2.4.2 Empirical Literature

Cheng (2017) extends the classic Morden Portfolio Theory to analyze mixed-asset portfolios and explain the actual portfolio allocation to real estate without resorting to special data manipulations such as smoothing techniques and retaining basic MPT principles of greater returns at the least levels of risk. They found that the holding period T is irrelevant to optimal portfolio choice. Other papers also find the respective significance of French, Singapore and UK REITs in mixed-asset portfolios in the post-global financial crisis (GFC) environment (Newell et al., 2013) (Newell et al., 2014) (Newell et al., 2016).

Another study by Hoesli (2019) finds that due to the significant transaction costs usually associated with the asset class, the allocation to direct real estate in a portfolio that seeks to maximize the Sharpe ratio and contains equities and bonds is zero for investment periods shorter than 2.5 years indicating less value add. However, even over the long term, REITs are proven to have the lowest correlation with direct investments, as shown in the figure below.

Figure 2 Correlation of REITs with Stocks, Bonds, Direct Real Estate, Core Funds, Value Added Funds and Opportunistic Funds



Source: (Hoesli, 2019)

2.5 DIVIDENDS

2.5.1 Theoretical Literature

Dividend policy has been a topic of research, with many trying to establish the relevance and effect of its existence, such as the well-sought Corporate Finance paper of Miller et al. (1961). This indicates that, in efficient markets with fixed investment policies, all feasible capital structures and dividend policies are optimal because they produce the same shareholder wealth. So, the choice among them is irrelevant. A later paper by DeAngelo et al. (2005) titled, 'The irrelevance of the MM dividend irrelevance theorem' strongly differs from the findings of Miller and Modigliani based on the assumptions taken. They argue that this Theory ignores the assorted options that companies have in how much they decide to distribute (MM states that 100% distribution is implemented in one way or the other) and retention or a pay-out of less than the full NPV of Free Cash Flows (FCF) affects a firm's value.

According to DeAngelo et al. (2005), the MM theory, including others that support the phenomenon that the dividend policy of an entity does not affect shareholder value, is quite flawed, and it would be/has been misleading to investors and researchers thereof to rely on this theory. In their words, "Failure to recognize that MM's dividend irrelevance theorem does not apply to pay-out/retention decisions can cause serious mischief." They further criticize the Black (1976) dividend puzzle, which emphasizes the tax implications of issuing dividends by reducing the real income earned by the shareholder, and firms should retain most of their

distributable earnings. This theorem will result in firms showing minimal to no value when using the Dividend Discount Model (DDM), which relies on the present value of all expected future dividends of an entity, consequently affecting a firm that seeks to raise capital. The counter to the Dividend puzzle is that in the normal cause of dividends being taxed, investors can select assets that are favorable to them.

In conclusion, DeAngelo et al. (2005), whilst acknowledging the foundation set by MM in Morden corporate finance theory, proves that a pay-out ratio is most certainly relevant in a world where previous limitations are removed from retention.

One of the characteristics of REITs mentioned above is the pay-out required ratio. Since REITs are required to pay out most of their distributable earnings to shareholders using dividends, the question becomes how elastic investors are to the distribution ratio above this threshold compared to other property companies that do not have a dividend requirement (Roberts et al., 2023).

To understand the impact of the pay-out decisions on shareholder sentiment, we can attempt to study what is known as the ex-dividend share price of the entity. Experts have attributed this to an exact offset for the dividend amount as a qualification for the drop in share price. Considering the tax effects of paying out dividends versus plowing that income into profitable projects and allowing the investors to delay the tax - Capital gains tax arises when you dispose of an asset for more than what you paid for it - then why do companies then prefer to pay-out as much as they can? This is the opening question by Wang (1993) in their paper titled: Dividend policies and dividend announcement effects for real estate investment trusts. Instead of retaining some of the earnings at no cost and channeling those funds into their investments, companies normally issue a maximum pay-out and do a capital raise (which entails a floatation cost that could have been averted).

A general justification for high dividend pay-out ratios is the market signaling potential embedded in dividends and how this helps reduce the chances of agency costs Jensen (1986). This is exacerbated by the advisors used by entities who might have conflicting values. REITs also issue dividends at levels over 100% of their distributable earnings, according to Wang, (1993); this is made possible by accrued revenue and expenses (depending on the accounting methods used), depreciation method, and refinancing of their properties.

Allowing these companies to go beyond the regulatory requirements and concluding that these factors allow firms to set a tone in the market on their performance. This was later confirmed

by Mooradian (2001), who found that listed property companies use more debt and pay less dividends than REIT entities. His study, which was based on hotel REITS vs non-REIT hotels, indicated that the former usually has free cash flow retention levels.

2.5.2 Empirical Literature

REITs in South Africa have become popular for their high dividend practices, well above the 75% requirement leaning much closer to the one ratio to their distributable income before the pandemic. Carstens (2019) finds an increase in sustainable growth and profitability since the introduction of the SA REIT structure in 2013, which has enabled REITs to offer shareholders long-term stable and even increasing returns. Large players in the market have maintained a payout ratio of 95% even through tough economic conditions and elevated Operating Costs. According to Hill (2008), these excess dividends inform the capital markets that Management is aware that they will need more funding and that they are prepared to enhance the value of their shares to gain access to them in the future.

Below is a sample of 4 large SA REITs and their payout ratios:

Table 2 REIT Full Year Distributable Income Payout Ratios during the pandemic period

Entity	**Payout Ratio**
Fairvest Ltd.	100%
Investec Property Fund Ltd.	95%
SA Corporate Real Estate Ltd.	90%
Growth Point Properties Ltd.	82.5%
Redefine Properties Ltd.	80%

Source: 2022 Company Results

As a result, REITs appear to have become more attractive to shareholders, making them more competitive and stimulating future shareholder investment, which in turn may increase future profitability and growth (Roberts et al., 2023). This study also confirms that leverage and profit retention diminished after the introduction of legislation, suggesting that the new legislation may limit capital availability, which is why most REITs regularly go through a period of asset disposals during their tenure. On the one hand, this has allowed this market to get a more reliable understanding of their NAV over and above the desktop valuations conducted and created space for new entrants.

In 2020, at the height of the COVID-19 pandemic, the local body of REITs in South Africa, formally known as SAREIT, requested the South African National Treasury to forego the 75% dividend payment obligation for two years ending 2022 (Akinsomi, 2020). This was because REITs were grappling with low turnovers, resulting in minimal or non-positive distributable earnings.

2.6 COINTEGRATION

2.6.1 Theoretical Literature

Engle (1987) introduced the cointegration method, which employs error correction models instead of correlations to determine the long-horizon equilibrium between a group of non-stationary variables. Cointegration approaches are used in well-known real estate research like Myer (1997) and Hansz (2017) to identify long-term relationships between real estate and alternative asset classes. It is important to study cointegration because it provides an understanding of long-term equilibrium correlations between the price series of two data sets, especially because long-term relationships are particularly important for long-term investors. Additionally, cointegration deals with the significant drawback of conventional current portfolio-based approaches to a certain extent (Glascock, 2018). This is addressed by the robustness of cointegration methods against correlation instability (Glascock, 2018). Crucially, cointegrated assets have similar risk profiles and move in unison, offering little to no benefits for diversification.

2.6.2 Empirical Literature

To build a connection between risk diversification and cointegration theory, Glascock (2018) expands theoretical frameworks by examining the implications of portfolios empirically and assessing the long- and short-horizon inter-relationships between REITs and other listed properties using Granger causality approaches and Johansen cointegrations. In his paper Hansz (2017) finds that in a cointegrative system, EREITs are regarded as the leading asset, MREITs as the subordinate asset, and vice versa, implying that although long-term cointegrated prices of MREITs and REITs are stable in the cointegrated vectors, MREITs are a subordinate asset in the system and EREITs are the leading asset due to the unilateral Granger-causality from EREIT returns making the latter superior in ranking for asset allocation (Hansz, 2017). Glascock (2018); however, it was established that cointegrated real estate assets would be superfluous as diversifiers and can thus be omitted from portfolios.

2.7 CONTRIBUTION TO THE LITERATURE

This research paper considers the effects of recent business cycles on the performance of REITs and how they measure when combined with stocks and fixed-income securities. Employing methods such as co-integration as Hansz (2017) and Glascock (2018) but for a broader understanding of diversification benefits in a mixed asset portfolio instead of a real estate concentrated portfolio.

Since there has been minimal study on REIT performance and diversification potential post-pandemic, this study will add substance to studies like Akinsomi (2020) in understanding the effects of the tough economic conditions and, especially considering that this asset class was particularly affected by delayed dividend distributions as observed in the pandemic because this vehicle is popular for dividend distributions.

In closing, Chapter 2 conceptualizes REIT diversification benefits in a mixed asset portfolio by first discussing the physical nature of the underlying asset which tends to retain value over time compared to other asset classes. When considering different papers produced like Feng et al., (2022) economic shock resistance can be considered together with the low correlation between REITs and others covered by Hoesli (2019) this increases the potential of diversification. In addition to this, the elevated payout nature of REITs studied by DeAngelo et al. (2005) makes them more attractive to investors and has an impact of portfolio growth (Roberts et al., 2023). As alluded to in the Research Problem, this paper will add to existing literature and further close the gap between global studies on REITs in mixed asset portfolios as covered by papers such as Newell, et al. (2016), Darst et al. (2008) and Bhuyan (2015) by considering REITs in South Africa.

3 CHAPTER THREE - METHODOLOGY

3.1 INTRODUCTION

This methodology allows for a structured approach to deal with the research problem. An overview of the data sources, the types of statistical methods, their relevance, period, and interpretation of results is detailed here. The chapter begins with a description of the research approach and strategy before detailing the research design, data collection, and instruments. Thereafter, the data and methodological limitations and assumptions are identified and discussed.

3.2 DESCRIPTIVE STATISTICS

Descriptive statistics are first conducted to assist in summarizing the key characteristics of individual assets within a portfolio, such as their returns and risks (Kulkarni, 2019). This summary allows investors to understand the properties of each asset before considering their inclusion in a diversified portfolio. Co-movements between REITs, common stock, and bonds are also considered to understand if any volatility spillovers exist between the asset classes.

To compare the diversification benefits provided by REITs during the 10-year period and the pandemic respectively, four multi-class portfolios are created as follows:

1. Portfolio (I), consisting of bonds and common stock stocks,
2. Portfolio (II) consisting of bonds, common stock, and REITs,
3. Portfolio (III), consisting of bonds and common stock stocks during the pandemic and
4. Portfolio (II) consisting of bonds, common stock, and REITs during the pandemic.

Excel Solver is then used to derive an optimal portfolio using the combination of portfolios above, where the overall return is maximized at the lowest level of risk. Results from a pre-study exercise show that a portfolio with REITs produces a lower Sharpe ratio than a portfolio without REITs.

Below is the Sharpe ratio formula which adjusts expected returns by risk:

$$SR'i = \left(\frac{ERi}{6}\right) \quad (1)$$

where,

SR_i = *Sharpe Ratio*

ER_i = excess return of portfolio, ($ER_i = u_i - r_f$)

σ_i= standard deviation of the excess portfolio return

3.3 MEAN-VARIANCE SPANNING TEST

To introduce a test for REIT diversification benefits, especially for 2020 to 2021 during the Covid-19 pandemic, we deploy various mean-variance spanning tests by (Huberman (1987), which are normally used to assess the diversification benefits of financial assets. Bélanger (2020) lays out the different types of mean-variance (M-V) spanning tests that will be considered for this paper.

As a financial and statistical test, the Mean-Variance Spanning Test is used to evaluate the effectiveness and diversification of an asset portfolio. It is sometimes referred to as the spanning test or the mean-variance efficiency test. The modern portfolio theory (MPT), which was created by Harry Markowitz, serves as the foundation for the test. The main concept behind MPT is to build a portfolio that either minimizes risk for a given level of expected returns or maximizes expected returns for a given level of risk (volatility). By comparing returns and risk, the Mean-Variance Spanning Test helps establish whether one portfolio may be regarded as efficient in comparison to another.

Mean-variance spanning tests under normality.

If the minimum-variance frontier of the K assets is the same as the minimum-variance frontier of the K assets plus additional N assets, then K risky assets span a wider set of N + K hazardous assets. The benchmark assets are the first set, while the test assets are the second set. Investors who care about the mean and variance of their portfolios will only be interested in the tangency portfolio of the risky assets (i.e., the one that maximizes the Sharpe ratio) if there is a risk-free asset and unlimited lending and borrowing is permitted at the risk-free rate. (Bélanger, 2020) Investors in that situation are solely interested in determining whether the tangency portfolio utilizing K benchmark risky assets is identical to the one formed using all N + K risky assets. This can be summarized as follows:

$$R_{2t} = \alpha + \beta R_{1t} + \epsilon_t \quad (2)$$

R_1 is a T x K matrix of the reference assets' returns, R_2, a T x N matrix of the test

assets' returns, β, a K x N matrix the regression' coefficients, α, a vector of size N and ϵ, a vector of size T of the error terms.

Mean-variance spanning tests under conditional heteroskedasticity.

Returns are assumed normally distributed for the tests described by Kandel (1987). However, in many cases, the return of assets exhibits heteroskedasticity, in which case a different approach needs to be considered.

Step-down mean-variance spanning tests under conditional heteroskedasticity.

The distance between tangent portfolios (i.e., a rise in the slope of the tangent lines) is rather minor, and the difference between global minimum variance portfolios primarily drives the strength of the tests. In other words, even if the economic difference is not significant, a slight decrease in the global minimum variance portfolio's standard deviation may cause the null hypothesis to be rejected (Bélanger, 2020).

On the other hand, even if there is a considerable economic difference between the tangent portfolios, this will not result in the null hypothesis being rejected. Since statistical significance does not necessarily equate to economic significance, it is advised to take a method where each component is dealt with separately.

Therefore, in accordance with Kan et al. (2012), we test the hypothesis H0: $\alpha = 0N$ first and then H0: $\delta = 0N$ if $\alpha = 0N$. If the initial test is not accepted, a conclusion is made that the tangent portfolios differ statistically. The minimum variance portfolios are statistically different if the second test is not accepted.

Sub-sample analysis

- Mahalanobis distance

The Mahalanobis distance has been utilized by Li (2010) to proxy financial instability. Financial volatility is described as periods when asset prices tend to exhibit greater upward and downward price movements when compared to their historical patterns. Both the volatility of individual assets and their correlation are considered by this measurement. Krutzman et al. (2010) define the turbulence index as:

$$d_t = (y_t - \boldsymbol{\mu})\, \Sigma^{-1}\, (y_t - \boldsymbol{\mu})' \qquad (3)$$

where,

- dt = Turbulence during t (a scalar).
- yt = Vector of asset returns for the period t.

- $\boldsymbol{\mu}$=Vector of asset returns means.
- $\boldsymbol{\Sigma}$=Covariance matrix of asset returns.

- Business cycles

Separating the portfolios into sub-samples based on the economic cycle, as called by Statistics South Africa (STATSA) or any other official government agency, further supports the normal investor in understanding the hedging potential of REITs compared to other asset classes.

Further to the portfolio analysis, we introduce cointegration, which identifies long-horizon relationships between the REITS and the different asset classes, which is especially relevant for investors with long investment horizons, as is mostly the case in the property industry. Importantly, assets that are cointegrated share risk profiles and move in tandem, providing low or no diversification benefits (Seiler,2001). Cointegration methods are also robust to correlation instability, addressing a major limitation of traditional modern portfolio-based methods.

3.4 COINTEGRATION

Cointegration is a statistical concept used to assess the long-term relationship between two or more time series variables. In this context of REITs, we use it to determine whether there is a stable long-term relationship between the returns of different REITs or between REIT returns and other financial market indices.

After identifying and collecting the data as laid out above, we analyze for cointegration, we carry out the following:

3.4.1 Unit Root Test

Before performing a cointegration test, it is important to check whether the individual time series is stationary. We can use unit root tests such as the Augmented Dickey-Fuller (ADF) test or the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to evaluate stationarity. If the data are not stationary, we may need to differentiate the series until they become stationary.

3.4.2 Testing for Co-integration

The most common test for co-integration is the Autoregressive distributed lag (ARDL) procedure (Peresan, 2001). In this approach, we shall continue as follows:

Estimate linear regression. Regress one of the time series on the other time series (s). The stationarity of the resulting series of residuals must be tested using unit tests.

i. If the residual is stationary, this indicates cointegration. In this case, we can proceed to the second step of the Engle-Granger procedure compared to Cointegration Testing:
ii. Use a cointegration test, such as the Johansen cointegration test, to formally test for cointegration. The Johansen test is used to determine the number of cointegrating vectors, which represents the number of cointegrating relationships between variables.

3.4.3 Explanation of Results

If the cointegration test confirms that there is a cointegrating relationship between the variables, this implies that they will evolve together in the long run; in this case, this will be REITs with other common stock and fixed-income assets. The coefficients from the regression equation in step a. can provide insight into the nature of this long-run relationship.

3.4.4 Error correction model (ECM)

Once the co-integration process is established, we can build an error correction model. This model allows analysis of short-term dynamics and adjustment towards long-term equilibrium when deviations occur.

3.4.5 Forecasting and Analysis

After confirming co-integration, we use the relationship to make long-term forecasts, perform a VECM to understand the direction of influence, and conduct further analysis and pseudo-testing theory. Additionally, cointegrating relationships can change over time, so this analysis would need to be regularly updated to re-examine cointegrating relationships as needed.

3.5 DATA AND DATA SOURCES

To exclude geo-economic influence that could affect performance or distort risk, this paper will focus on REITS who have a minimum of 50% of their fixed-property and real estate equity investments in South Africa for portfolio construction.

FTSE/JSE Real Estate Investment Trust Index, FTSE/JSE South Africa Listed Property Index, and the Government Bond Index with weekly total returns are analysed from 2014 to 2023 (approximately 10 years). Weekly returns were used to smooth out intraday fluctuations and market noise, which would have tended to be present in daily returns. This allows the analysis to focus on more meaningful long-term trends, which the study is focused on, while retaining most short-term movements which would have otherwise been smoothened with monthly returns. Weekly returns also provide more data points, which increase statistical power analytically, which could be missed in the less frequent quarterly or monthly data, providing more robust results with more substantial relationships between variables.

The asset types we consider are South African government bonds, REITs, and common equity. The total return index for SA REITs is the FTSE/JSE J867. Most companies formerly recognized as Property Unit Trusts (PUTs) and Property Loan Stocks (PLSs) are now listed in the REIT index because they converted to this structure, so separating them is unnecessary. This Index includes non-SA REITs (i.e., companies identified as REITs in foreign markets). The stock series is the FTSE/JSE All Share Index (J203). The bond index used is the All-Bond Index (ALBI), which consists of the top twenty conventionally listed basic bonds; bonds with a term of less than one year are not included.

3.6 PERIOD OF STUDY

This paper will consider a period aligned with what real estate investors consider when investing in property, be it an acquisition or development, and when they dispose of assets. According to Wang (1993) taking, using over 1000 Canadian commercial real estate transactions, the average holding period is about 5–8 years, depending on property the type. Since the average holding period of property is 4 or 5 years, this study will consider two periods of this term for this research which is 10 years. Brown (2020) also finds that the average holding period for these properties is around five years. According to one of the largest REITs in their 2020 interim results presentation, the holding period for the valuation of multi-tenanted properties is four years and single-tenanted properties ten years. REITs have also been around for almost ten years in South Africa, allowing us to get more accurate results. Brown (2020) states that a planned holding period is attained through the various financial models providing a present value and the internal rate of return. By tradition, many such projections are for a holding period of five years (Ziobrowski, 1999).

4 CHAPTER FOUR - DATA ANALYSIS

Version 12 of the E-Views software was used to process the data due to its efficacy in examining time-series data. In interpreting the results, we consider the p-values associated with each coefficient. If a p-value is below a chosen significance level (0.05), the coefficient is statistically significant, and those coefficients that are statistically insignificant may be less reliable. Using MacKinnon (1996) one-sided p-values, the t statistic for a 5% level is 1.96, therefore; if this value is less than 1.96 then the variable lag is insignificant, and the opposite applies for a t statistic greater than 1.96.

4.1 DATA

The data used for graphic and descriptive analysis is presented in Table 3 below.

Table 3 Outline of data used.

Indicator	Description
J805TR INDEX	FTSE/JSE SA REIT Index
JALSH INDEX	JSE All Share Index
IGOV TR INDEX	FTSE/JSE Inflation-Linked Government index
CP507394 Corp	Republic of South Africa International Bond 1
EI879470 Corp	Republic of South Africa International Bond 2
EI595689 Corp	Republic of South Africa International Bond 3
NPN	Naspers Ltd.
FSR	First Rand Ltd.
SBK	Standard Bank Ltd.
AMS	Anglo American Platinum Ltd.
GRT	Growthpoint Properties Ltd.
VKE	Vukile Property Fund Ltd.
RDF	Redefine Properties Ltd.

4.2 DESCRIPTIVE STATISTICS

Tables 4 and 5 present the descriptive statistics of the various assets for the full sample and during the COVID-19 pandemic periods, respectively. For the ten years, average weekly returns for the REIT indexes vary between 0% and 0,001%, whilst bonds all have negative

returns and common stock is all positive, with the highest being 0,005%. The volatility of all indexes during this period was also observed, with bonds being the lowest, followed by common equity and REITs being in a similar range. This is based on the standard deviation of bonds between 0.01% and 0.02% and common equity at 0.02% and 0.07%. In contrast, REITs are between 0.04% and 0.07%, which would imply the impact of having all three in one portfolio, giving a wider mean variance spread. When comparing these measures against REITs, common equity appears to provide better risk-adjusted returns, showing the highest return at a moderate risk level. In contrast, bonds provide more conservative returns at the least level of risk. REITs appear to have greater maximums than the rest, which means there have been periods where it would have been an incremental value to have them in a portfolio.

Table 4 Descriptive Statistics for March 2013 to March 2023

The table shows the descriptive statistics for the weekly return data of a portfolio with a combination of REITS, Common stock, and Government Bonds for the 10-year period
Assets

	AMS	CP507394	E1595689	E1879470	FSR	GRT	RDF	NPN	SBK	VKE
Mean	0,0006	-0,0004	-0,0006	-0,0002	0,0008	-0,0003	0,0008	0,0045	0,0058	0,0011
Median	-0,0001	0,0000	-0,0002	-0,0001	-0,0017	0,0000	0,0000	0,0032	0,0035	0,0000
Maximum	0,1707	0,0684	0,1018	0,0388	0219083	0,3635	0,4828	0,4155	0,3122	0,2036
Minimum	-0,1003	-0,1065	-0,1646	-0,0733	-0,3446	-0,2499	-0,3467	-0,3129	-0,2850	-0,2500
Std.Dev.	0,0298	0,0117	0,0225	0,0102	0,0521	0,0482	0,0731	0,0657	0,0742	0,0355
Skewness	0,3164562446	-1,6313	-0,8374	-1,4130	-0,7085	1,0385	1,4480	0,3474	0,3545	0,3486
Kurtosis	2	21,4040	11,7224	13,9073	9,6845	16,3217	14,9621	7,2702	4,9097	1425940
Jarque-Bera	157,30	7540,16	1702,61	2740,09	>9999	>9999	>9999	403,97	89,56	2746,70
Probability	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Sum	0,3073	-0,1946	-0,3023	-0,0988	0,3922	-0,1472	0,3959	2,3551	2,9991	0,5538
Sum Sq. Dev	0,4586	0,0707	0,2615	0,0535	1,4038	1,1996	2,7620	2 232271	2,8492	0,6507
Observations	518	518	518	518	518	518	518	518	518	518

During the national state of disaster announced by the national government for the COVID-19 pandemic, bonds exhibited the lowest average returns, followed by common equity, while REITs had the highest returns. REITs also had the second lowest variance for the period, between bonds and common equity, which implies that they would have reasonable Sharpe ratios relative to the other asset classes whilst also showing the largest maximum.

In summary, the risk-return relationship gives the impression that REITs are attractive investment opportunities. However, the relatively high kurtosis could exert an impact on their investment performance when the whole distribution is considered rather than only the first two moments.

Table 5 Descriptive Statistics during the national state of disaster between the 27th of March 2020 to the 8th of April 2022.

The table shows the descriptive statistics for the weekly return data of a portfolio with a combination of REITS, Common stock, and Government Bonds during the peak of COVID-19 in South Africa.

	AMS	CP507394	E1595689	E1879470	FSR	GRT	NPN	RDF	SBK	VKE
Mean	0,0024	0,0009	0,0023	0,0008	0,0140	0,0104	0,0099	0,0121	0,0098	0,0102
Median	0,0020	-0,0005	-9,8781	-42371983	0,0048	0	0,0065	0	0,0154	0
Max	0,0602	0,0393	0,1018	0,0313	0,2190	0,3635	0,1625	0,4828	0,3122	0,2036
Min	-0,0598	-0,0189	-0,0439	-0,0215	-0,1894	-0,1898	-0,1823	-0,2695	-0,1667	-0,1491
Std. Dev.	0,0252	0,0090	0,0197	0,0069	0,0612	0,0642	0,0627	0,1090	0,0753	0,0573
Skewness	0,0120	2,0027	1,4685	1,4108	0,2757	1,9545	-0,1314	0,9910	0,4755	0,8240
Kurtosis	2,6631	9,8800	9,2348	8,9271	4,6431	12,2472	3,6701	6,1351	4,3854	5,0904
Jarque-Bera	0,5086	282,5619	211,7671	192,1163	13,3932	449,3544	2,3099	61,3347	12,5887	31,5913
Prob.	0,7754	4,3901	1,0360	1,9163	0,0012	2,6542	0,3151	4,8010	0,0018	1,3805
Sum	0,2610	0,0914	0,2418	0,0817	1,5007	1,1078	1,0592	1,2900	1,0487	1,0885
Sum of Sq. Dev.	0,0671	0,0085	0,0411	0,0051	0,3965	0,4372	0,4163	1,2590	0,6010	0,3485
Observations	107	107	107	107	107	107	107	107	107	107

4.3 CORRELATIONS

Tables 6 and 7 present the correlation matrix between REITs and other asset class returns for the full sample and during the Covid-19 pandemic.

For the full period, higher correlations are observed between the bonds of 0.62 to 0.85 but show very low and negative correlations with REITs. Common equity has very low correlations with each other, which could be a factor of the spread across the various asset classes with different qualities, but also have low and negative correlations with REITs. The correlation between common equity and bonds is also low extremely low. This suggests that REITs could have

diversification benefits in the long term if included in a portfolio with the other two asset classes. During the Covid-19 pandemic, the correlations were relatively similar for all the asset classes. These were lower across the board.

Table 6 Correlation Matrix between March 2013 to March 2023

	Assets									
	CP507394 Corp	EI879470 Corp	EI595689 Corp	NPN S	FSR	SBK	AMS	GRT	VKE	RDF
Assets	CP507394 Corp	1,00								
	EI879470 Corp	0,65	1,00							
	EI595689 Corp	0,62	0,85	1,00						
	NPN	-0,11	-0,09	-0,11	1,00					
	FSR	-0,07	-0,01	-0,05	0,32	1,00				
	SBK	-0,04	0,00	0,03	0,44	0,04	1,00			
	AMS	-0,01	-0,01	0,01	0,07	0,34	0,05	1,00		
	GRT	0,03	0,01	0,01	-0,01	-0,16	-0,01	-0,09	1,00	
	VKE	0,02	0,02	-0,04	0,08	0,10	-0,03	-0,08	0,17	1,00
	RDF	-0,08	-0,06	-0,07	-0,01	-0,06	-0,05	0,02	0,06	0,04	1,00

Table 7 Correlation Matrix during national state of disaster between 27th of March 2021 to the 8th of April 2022

				Assets						
	CP507394 Corp	EI879470 Corp	EI595689 Corp	NPN	FSR	SBK	AMS	GRT	VKE	RDF
Assets	CP507394 Corp	1,00								
	EI879470 Corp	0,73	1,00							
	EI595689 Corp	0,71	0,92	1,00						
	NPN	-0,20	-0,18	-0,28	1,00					
	FSR	-0,27	-0,20	-0,26	0,18	1,00				
	SBK	-0,15	-0,10	-0,09	0,37	-0,12	1,00			
	AMS	-0,03	0,04	0,03	0,03	0,44	0,07	1,00		
	GRT	0,17	0,07	0,13	-0,09	-0,20	0,00	-0,05	1,00	
	VKE	0,17	0,13	0,07	0,07	0,06	0,04	0,02	0,23	1,00
	RDF	0,04	-0,01	-0,10	0,07	-0,07	-0,10	0,06	0,03	0,08	1,00

For the full 10-year horizon, REIT total returns were negatively correlated with stocks and bonds, i.e., FSR vs GRT at -0.11%, GRT vs SBK at -0.09%, and VKE vs EI879470 at -0.08%. This could be ideal for diversification because it means that the returns move in opposite directions, which helps reduce overall portfolio risk. After all, when one asset's value decreases, the other asset tends to offset some losses by increasing in value. The pair showed strong correlations between each other, with a similar trend observed for the two during the national state of disaster. REITs, however, appear to have a stronger relationship with the rest of the market during this period. This could be a factor of all having exposure to the market spread headwind brought by the pandemic, leaving many economies in distress.

Tables 8 and 9 present the correlation matrix between REIT, common equity, and government bond index returns for the full sample and during the Covid-19 pandemic. The tables below are more straightforward due to the number of variables and, therefore, easier to interpret.

Table 8 Correlation matrix for indices from 2013 to 2023

	J8055TR	JALSH_INDEX	IGOV_TR_
J805TR	1		
JALSH	-0,3126	1	
IGOVTR	-0,3772	0,9199	1

Table 9 Correlation matrix for indexes during national state of disaster

	J8055TR_IN	JALSH_INDEX	IGOV_TR_I
J805T	1		
JALSH_	-0,9539	1	
IGOV_	-0,9250	0,9395	1

4.4 PORTFOLIO OPTIMIZATION

In this section, two portfolio sets are re-introduced, which are as follows: portfolio 1: portfolio containing common equity, bonds as well and REITs, and portfolio 2: portfolio with common equity and bonds without REITs.

Below is a comparison of four Sharpe ratios for the portfolios, which show different scenarios to study how portfolio 1 and portfolio 2 perform in the full period and during the Covid-19 pandemic. The risk-free rate is from the South African Reserve Bank.

Table 10 Sharpe ratios of the different portfolios during COVID-19 and the full sample period

	10 Years	Covid-19
Portfolio 1	0,03	0,38
Portfolio 2	0,09	0,20

Figures 3 to 6 present the portfolio opportunity sets for the full sample and, during Covid-19 while figures 7 to 10 present their respective efficiency frontiers. From the various efficient frontiers below and the Sharpe ratios, there are several different outcomes to consider. Firstly, REITs appear to have had a negative impact during the longer period because the portfolio Sharpe ratio when the asset class is included during the pandemic is higher than that of the portfolio without REITs; however, when looking at the Sharpe ratios on the 10-year horizon, the Sharpe ratio lower than the Sharpe ratios are both are lower than 0.1%. When comparing the portfolio comprising all three asset classes during the pandemic vs the portfolio with only stocks and bonds, having REITs in a mixed portfolio would have provided a benefit.

Figure 3 Portfolio 1 Opportunity Set

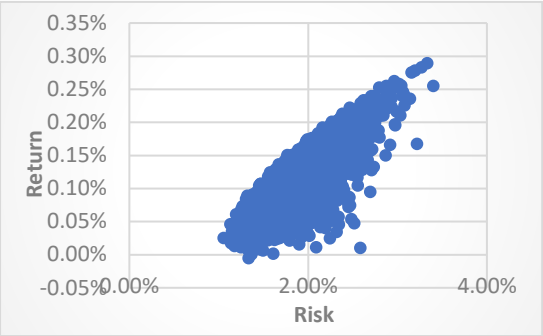


Figure 4 Portfolio 1 Opportunity Set during Covid-19

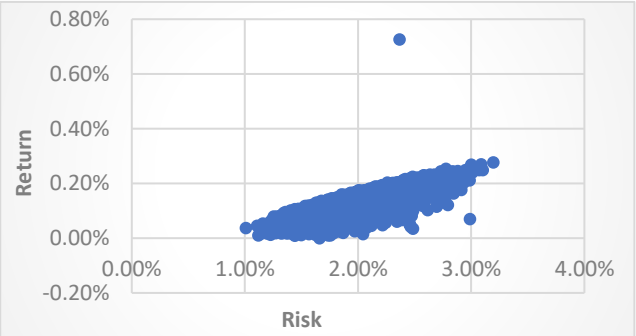


Figure 5 Portfolio 2 Opportunity Set

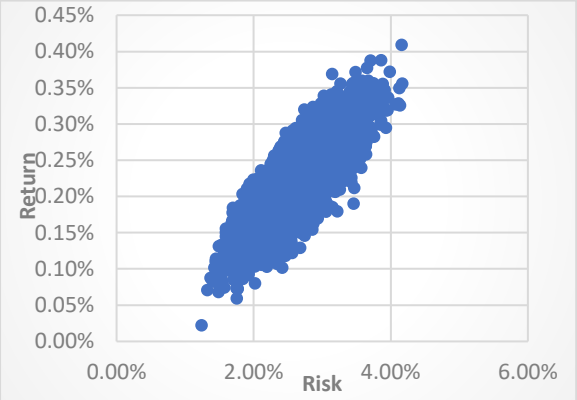


Figure 6 Portfolio 2 Opportunity Set during Covid-19

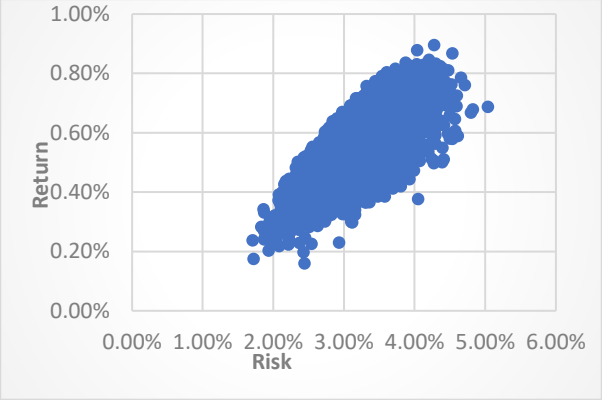


Figure 7 Portfolio 1 Efficient Frontier

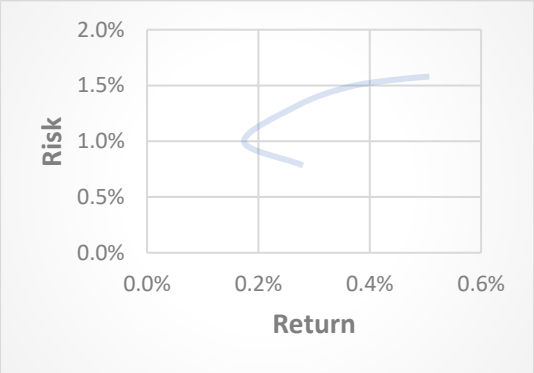


Figure 8 Portfolio 2 Efficient Frontier

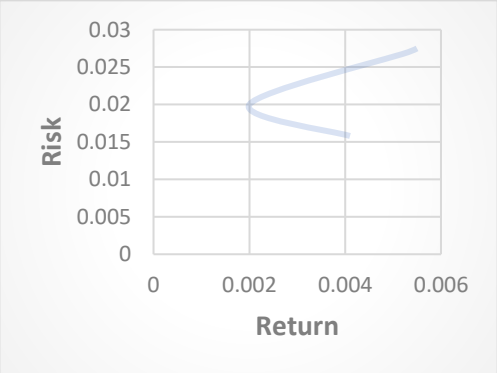


Figure 9 Portfolio 1 Efficient Frontier during Covid-19



Figure 10 Portfolio Efficient Frontier during COVID-19



4.5 MEAN-VARIANCE SPANNING TEST

A Mean-Variance Spanning Test is a method used to evaluate whether one investment portfolio dominates another in terms of mean returns and variance of returns. The test is typically used in the context of Modern Portfolio Theory (MPT). The method of mean-variance spanning, initially introduced by Kandel (1987), statistically tests the impact that the introduction of additional N risky assets, referred to as test assets, has on the efficient frontier of an investment opportunity set of K benchmark assets.

The test is made from the perspective of a South African investor seeking diversified exposure on JSE with REITs as a proxy. If adding more assets does not increase the efficient frontier that a set of assets generates, then the set of assets is said to span the mean variance. Among other things, mean-variance spanning has been used to test linear-factor asset pricing models, analyse mutual fund performance, evaluate the advantages of international diversification, and assess the viability of alternative asset classes.

4.5.1 Mean-variance Spanning Tests under normality.

Having established that this dataset exhibits non-normal behaviour, the standard mean-variance spanning tests is invalidated as this assumes that the returns of assets are normally distributed. If the actual distribution of returns deviates significantly from normality, the results of the tests may be biased or unreliable.

Table 11 Normality tests for Portfolio 1 and 2

	Portfolio 1	Portfolio 2
Jarque-Bera	895.8841	5418383
Probability	0.000***	0.000***

4.5.2 Mean-variance spanning tests under conditional heteroskedasticity.

Generalized Method of Moments (GMMs) spanning tests are performed to control for the non-normality of returns and the heteroscedasticity of error terms. With this, we try to establish whether the portfolio of REITs spans the common equity portfolio, and as a proxy, we also consider the effect of bonds. The dependent variable, portfolio 1, is only common equity, while the independent variable, portfolio 2, is REITs, and portfolio 3 is bonds. The below provides further insight as to whether adding REITs to the portfolio would have provided a diversification benefit. At more than 5% ($p > 0,05$), we reject the serial correlation null hypothesis, implies that the selected REITs portfolio has no significant effect on the existing portfolio. Only bonds in this model prove to be significant ($p < 0.05$). with a negative coefficient which means that bonds have a negative impact on the variable the existing portfolio of common equity.

Table 12 GMM of Portfolio 1 and 3 during full sample period

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.000	0.000	-1.501	0.133
POTFOLIO2	0.000	0.000	5.398	0.000***

R-squared: 0.002

Adjusted R-squared: 0.000

4.5.3 Sub-sample analysis

As a sub-sample analysis for different business cycles, the Covid-19 period is selected as an element of focus for this research. As with the full sample, the dependent variable, portfolio 1, is only common equity, while independent variable portfolios 2 and 3 are REITs and bonds, respectively. This is important for the investor interested in the behaviour of REITs in a portfolio during an economic downturn, particularly the pandemic. This also allows us to better understand the performance of REITs and their resilience to such economic conditions. For this, we continue with the period selected above, which is 27th of March 2020 to the 8th of April 2022. The same period was used for all portfolios. In this instance, the independent variable portfolios had an insignificant effect on the portfolio of common equity.

Table 13 GMM of Portfolio 1 and Portfolio 2 during the COVID-19 period

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.006	0.007309	0.833	0.406
PORTFOLIO2	-0.000	2.19E-05	-7.547	0.000***

R-squared	0.014126
Adjusted R-squared	0.004737

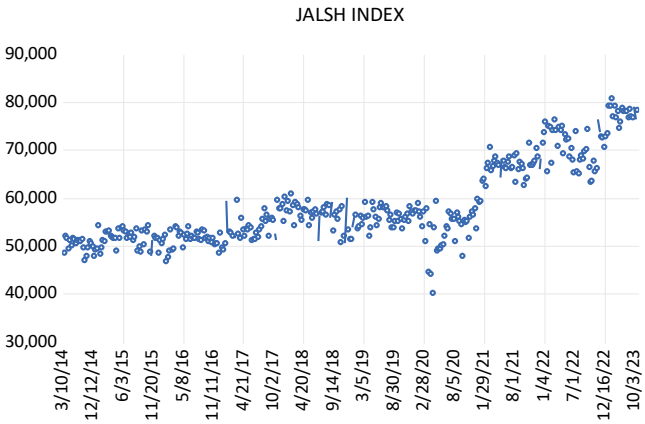
4.6 COINTEGRATION

This section follows (Octavia et al.2020) to analyze the cointegration and causality relationship among the selected market indexes: South African REIT, common equity, and bond markets.

4.6.1 Unit Root Test

Initially, the stationarity of the three indexes is examined using a unit root test and visual observations of the trend over time. A unit root is a characteristic of a time series that indicates it has a stochastic or random trend, making it non-stationary. This is because cointegration refers to a linear combination of non-stationary indices. Specifically, the augmented dickey fuller test Dickey (1981) was selected for this purpose. The Null Hypothesis for this test (H_0) is that the series has a unit root which implies non-stationarity or the variable not reverting to the mean overtime.

Figure 11 All Share Index Graph for the 10 year period



With reference to the JSE All Share Index trend under observation, the variable shows a gradual increase from 2014 to 2017, some oscillation tendency in 2018-2019, and a clear increase until 2023. The REIT Index has seen greater movements from inception, with a large

drop in 2020 (which is clearer observed in the pandemic test), then returning to the initial position. Lastly, the bond index shows consistent growth from 2014 until 2023.

Table 14 All Share Index Unit Root Test

H_0: D (JALSH_INDEX) has a unit root

		t-Statistic	Prob.*
Augmented Dicker-Fuller test statistic		-15,173	0.00
Test critical values:	1% level	-3,447	
	5% level	-2,868	
	10% level	-2,570	

Figure 12 REIT Index Graph for the 10-year period

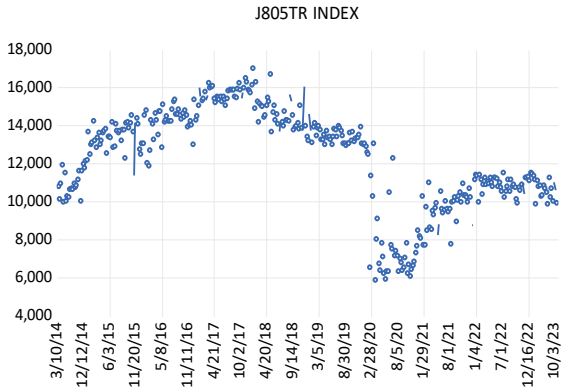


Table 15 REIT Index Unit Root Test

H_0: D (J805TR_INDEX) has a unit root

		t-Statistic	Prob.*
Augmented Dicker-Fuller test statistic		-18,711	0.000***
Test critical values:	1% level	-3,447	
	5% level	-2,868	
	10% level	-2,570	

Figure 13 Bond Index Graph for the 10 year period

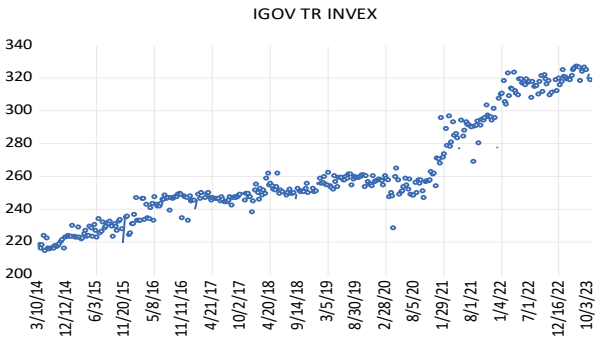


Table 16 Government Bond Index Unit Root Test

H_0: D (IGOV_TR_INDEX) has a unit

		t-Statistic
Augmented Dicker-Fuller test statistic		-15,882
Test critical values:	1% level	-3,447
	5% level	-2,868
	10% level	-2,570

However, after applying the first differences to all the variables, the p-value is less than 5%, which means the null hypothesis can be rejected. With the unit root now absent, it can be concluded that they are stationary at first difference.

4.6.2 Lag Length Selection

Before proceeding, determining the optimal lag length is necessary, providing the optimal trade-off between model fit and complexity. To determine the optimal lag length of the time series, different information criteria were selected and employed, namely LR (sequential modified LR test statistic, each at 5% level), FPE (Final Prediction Error Criterion), AIC (Akaike Information Criterion), SC (Schwarz Criterion) and HQ (Hannan-Quinn Criterion) with lag orders ranging from 1 to 4.

Furthermore, when testing for cointegration between two or more time series variables, the significance of the trend and intercept terms in the cointegration equation can also be crucial. A cointegrating relationship implies a long-term equilibrium association between the variables; the trend and intercept terms in the cointegration equation capture this long-run relationship. Testing the significance of these terms helps in determining whether cointegration is present.

Table 17 Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7810.224	NA	3.14e+14	41.89396	41.92550	41.90649
1	-7695.439	227.1091	1.78e+14	41.32675	41.45291	41.37685
2	-7623.012	142.1352	1.27e+14	40.98666	41.20744*	41.07433
3	-7597.281	50.08089	1.16e+14	40.89695	41.21236	41.02220*
4	-7582.515	28.50367	1.12e+14*	40.86603*	41.27606	41.02885
5	-7578.268	8.128708	1.15e+14	40.89152	41.39617	41.09191
6	-7572.613	10.73441	1.17e+14	40.90945	41.50873	41.14742
7	-7559.890	23.94497*	1.15e+14	40.88949	41.58339	41.16503
8	-7551.652	15.37248	1.16e+14	40.89358	41.68210	41.20669

Where AIC: Akaike information criterion, SC: Schwarz Criteria and HQ: Hannan–Quinn information criterion

Table 18 Trend and Intercept Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	847,367	241,672	3,5062	0,000***
@TREND	-4,448	1,097	-4,0513	0,000***

R-squared	0,041
Adjusted R-squared	0,038

From Table 18, it is clear from the P-value that the end and intercept are statistically significant which means they should be retained for the unit root test.

Table 19 Augmented Dickey-Fuller test for Error Term

Null Hypothesis: has a unit root

		t-Statistic	Prob.*
Augmented Dicker-Fuller test statistic		-2,095	0,5462
Test critical values:	1% level	-3,982	
	5% level	-3,421	
	10% level	-3,133	

Given that the error term is non-stationary at level, this implies that the variables are not cointegrated, however a test for co-integration is carried out in the subsection that follows

4.6.3 Testing for Co-integration

I performed an ARDL to determine whether there are any cointegrating relationships between the variables. From the F bound test, the f-statistic is lower than the upper and lower bounds. The results of the cointegration tests presented below show we fail to reject the null hypothesis that there are no cointegrating relationships in respect to at least two cointegrating equations. Hence, these indicate that a VAR rather than a VECM is appropriate.

Table 20 Autoregressive Distributed Lag Model

Error Correction Regression				
F-statistic	1.482497	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Since cointegration identifies long-horizon relationships that are especially relevant for investors with long investment horizons, this investor will enjoy the benefits of a diversified portfolio of such, including REITs amongst common equity and bonds. This is because assets that are not cointegrated do not share risk profiles and move in opposite directions, and cointegration methods are robust to correlation instability, thereby addressing a major limitation of traditional modern portfolio-based (MPT) techniques.

4.6.4 Vector Autoregression

A Vector Autoregression (VAR) model is often more appropriate for non-cointegrated asset classes than a Vector Error Correction Model (VECM). This is because there is no long-term equilibrium relationship among the variables Nathan et al., 2020). VECM models are specifically designed to capture both short-term dynamics and long-term equilibrium relationships, making them less suitable when no such equilibrium exists. VAR, on the other is better suited for analysing short-term dynamics and interactions among variables in a multivariate time series without assuming a long-term equilibrium relationship. According to Alqaralleh, 2023 this model allows for the exploration of volatility spillovers between the various markets. This makes them more appropriate for non-cointegrated asset classes, as they focus on capturing short-run responses to shocks and interactions among the variables.

Table 21 presents the VAR lag order selection criteria necessary for this research. Using AIC, the preferred lag order for this purpose is 1 to 5. This is also proven by the Residual Serial

Correlation test in table 22, showing that lag 4 is significant. Table 23 shows no root lies outside the unit circle; hence, the VAR satisfies the stability condition.

Table 21 Vector Autoregression Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7810.224	NA	3.14e+14	41.893	41.925	41.906
1	-7695.439	227.1091	1.78e+14	41.326	41.452	41.376
2	-7623.012	142.1352	1.27e+14	40.986	41.207*	41.074
3	-7597.281	50.08089	1.16e+14	40.896	41.212	41.022*
4	-7582.515	28.50367	1.12e+14*	40.866*	41.276	41.028
5	-7578.268	8.128708	1.15e+14	40.891	41.396	41.091
6	-7572.613	10.73441	1.17e+14	40.909	41.508	41.147
7	-7559.890	23.94497*	1.15e+14	40.889	41.583	41.165
8	-7551.652	15.37248	1.16e+14	40.893	41.682	41.206

Where Log L: Loglikelihood, LR: Likelihood ratio AIC: Akaike information criterion, FPE:Final Prediction Error SC: Schwarz Criteria and HQ: Hannan–Quinn information criterion.

Table 22 VAR Residual Serial Correlation LM Tests

Lag	Prob.
1	0.00**
2	0.00**
3	0.00**
4	0.071

Table 23 Roots of Characteristic Polynomial

Root	Modulus
-0.300194 - 0.533999i	0.612
-0.300194 + 0.533999i	0.612
-0.205452 - 0.562572i	0.598
-0.205452 + 0.562572i	0.598
-0.330875 - 0.428329i	0.541
-0.330875 + 0.428329i	0.541

Table 24 shows it is evident that the first lags of government bonds and equity are significant and imply that a dynamic relationship exists between the two variables and REITs. The behaviour of REITs towards government bond returns ranges from 0% to 3% over different time lags. Similar to Wang (2023), which considers a Granger causality approach for stock and global market index, table 25 shows the Granger causality test, a statistical hypothesis test for determining whether lagged variables in a time series are useful in forecasting other variables

in the model. The All Share and Government Bond Indexes, respectively, do not help predict the REIT index. The REIT index and the Government Bond index, however, can be used to forecast the all-share index, while the REIT and all-share index are also able to forecast the government index.

Table 24 Vector Autoregression Estimates

		D (J805TR_INDEX)	D (JALSH_INDEX)	D (IGOV_TR_INDEX)
D (J805TR_INDEX)	(-1)	-0.6568	-0.495	-0.000
		(0.059)	(0.180)	(0.000)
	(-2)	[-11.043]	[-2.748]	[-2.555]
		-0.3749	0.1272	-0.000
		(0.060)	(0.182)	(0.000)
D (JALSH_INDEX)	(-1)	[-6.228]	[0.697]	[-1.101]
		0.0085	-0.517	0.0003
		(0.017)	(0.054)	(0.000)
	(-2)	[0.479]	[-9.539]	[3.208]
		0.0238	-0.3315	0.000
		(0.017)	(0.054)	(0.000)
D (IGOV_TR_INDEX)	(-1)	[1.327]	[-6.104]	[1.030]
		5.980	60.512	-0.498
		(8.972)	(27.183)	(0.054)
	(-2)	[0.666]	[2.226]	[-9.090]
		-0.247	-11.663	-0.322
		(8.910)	(26.99)	(0.054)
CONSTANT		[-0.027]	[-0.432]	[-5.914]
		-5.678	116.563	0.463
		(46.638)	(141.301)	(0.285)
		[-0.121]	[0.824]	[1.626]
R-SQUARED		0.3152	0.294	0.281
ADJ. R-SQUARED		0.304	0.283	0.269

I ran an impulse response to Cholesky One standard deviation to assess how the different variables behave in relation to each other's shocks, specifically for REITs. Computing and visualizing Impulse Response Functions (IRF) show the dynamic responses of each variable to a shock in one of the variables (Rout, 2019). The impulse response functions reveal that innovation to the all-share index caused a minor impulse response to the REIT index, reverting to normal shortly after one quarter. This is similar to the response of the REIT index to a government bond shock, with the initial shock being more negligible. On the other hand, the REIT index induces negative responses from both the government and all share index results; therefore, it is in accord with those of the Granger Causality and the VAR estimation. The

forecast error variance decompositions in Table 26 show the extent to which a shock in one variable can predict another. Only the REITs index has a forecast error variance decompositions significant impact on forecasting the all-share index at 94 times while also having a high impact on the Government Bond index being greater than 70. The all-share index also helps predict the government index but to a much lesser extent at 19 times.

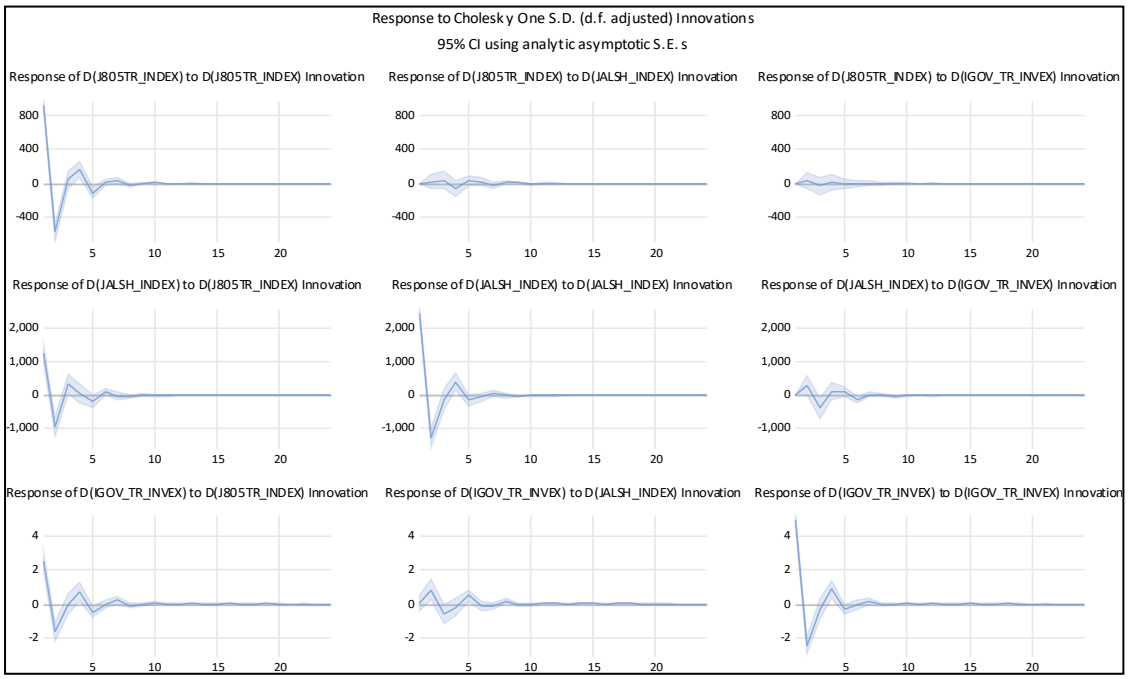
Table 25 VAR Granger Causality

Dependent variable: D (J805TR_INDEX)	
D (JALSH_INDEX)	0.413
D (IGOV_TR_INDEX)	0.761
Dependent variable: D (JALSH_INDEX)	
D (J805TR_INDEX)	0.003
D (IGOV_TR_INDEX)	0.031
Dependent variable: D (IGOV_TR_INDEX)	
D (J805TR_INDEX)	0.031
D (JALSH_INDEX)	0.005

Table 26 Forecast error variance decompositions

	Total return series	**Forecast error variance decompositions**
REIT index	All share index	0,566
	Government bond index	0,168
All share index	REIT index	94,315
	Government bond index	0,129
Government bond index	All share index	19,117
	REIT index	72,832

Figure 14 Impulse Response Functions



5 CHAPTER FIVE - CONCLUSION

5.1 INTRODUCTION

This section deals with the finalization of the report by first providing an outline of the findings made in the data analysis section. Thereafter, suggestions are given on how further academic work can improve from where this paper has ended.

5.2 SUMMARY OF FINDINGS

Following modern portfolio theory principles, the study first looks at the possibility of a risk-averse investor optimizing the risk-adjusted return by allocating some of their investments to REITs. From this, the portfolio with REITs showed a superior Sharpe ratio during the pandemic, contrary to Hanif (2013), while maintaining no improvement for the sample full period. A mean-variance spanning test estimated using a GMM model is then presented to assess if the returns of a portfolio, including REITs, dominate those of a portfolio without spanning the M-V. However, this shows how REITs returns do not have a significant role in the performance of the former portfolio's returns for the full and sub-sample.

Cointegration was also included to examine the degree of interdependence between the REIT, government bond, and all-share indexes, respectively. An ADRL test was carried out for this purpose, which revealed that there was no cointegration and, hence, no long-term relationship between the three variables. With this being the result, a VAR instead of a VECM, preferable for cointegrating variables, was then selected for studying the dynamic behaviour of the indexes over time. By interpreting IRFs, we understand the short-term and long-term effects of shocks on the system. The impulse response results show that a shock in the REIT market leads to a short-term decrease in both bonds and equity with the post-shock equilibrium level being lower for both in the long run. The variance decompositions further suggest a non-reaction by REITs to government bonds and common stock shocks. These results thus imply that REITs do not react to sudden movements from the other asset classes found in a traditional portfolio of a diverse nature.

5.3 CONCLUSION

Since the listing of REITs on the JSE in 2013, there has not been enough work done to analyse their effect on wealth growth. This paper analyses the diversification potential of South African REITs in a mixed asset portfolio after their introduction to the JSE just over ten years ago. Furthermore, the global Coronavirus pandemic, commonly referred to as Covid-19 has resulted in most countries having to impose restrictions to alleviate the spread of the disease, with the consequence being a negative effect on economic growth and ripple effects on many asset classes, including REITs. This paper continues from earlier work like Akinsomi (2020) in analysing the resilience of REITs to the pandemic.

The study reveals that the portfolio optimization section which allows a combination of asset allocations and, the cointegration test, it can be concluded that REITs have the potential to add value to an existing portfolio during periods of economic crises like the pandemic, as studied by this paper. This is in line with Cartens (2019) and further fortifies the initial inference drawn from the (lack of) correlation of REITs with other asset classes. The evidence is however, absent from the mean-variance spanning section, which does not confirm that the inclusion of REITs makes a mixed asset portfolio superior to that without this allocation. Therefore, there is a possibility that adding REITs to a fund management portfolio to diversify is worthwhile but with further analysis on the selection of REITs and further due diligence.

5.4 IMPLICATIONS ON STAKEHOLDERS

The policy implications of the findings of this study are as follows:

1. Investors, now with a better understanding of how REITs the diversification benefits in mixed-asset portfolios in the long run will have the ability to better allocate funds to suit their requirements.
2. Given that this paper confirms the diversification benefit of REITs, Managers can take advantage of this in aligning their Investor strategy.

5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

In improving on this paper, various areas could be considered. These include limitations from data available during this research or topics that could be explored by unpacking some of the findings further.

Below are some of the recommendations:

1. Research can be undertaken to understand how monetary policy easing and the subsequent tightening during the periods before and after the pandemic has affected REIT performance and how this will have an impact on mixed asset portfolios similar to (Feng et al., 2022).
2. Another focus on geographical investment can be a basis for further research: Comparing REIT performance between development and emerging markets.
3. A distinct focus on the real estate sub-classes mentioned earlier and their contrasting behavior can be considered.
4. There can also be a study of REITs during other macroeconomic conditions, including economic recoveries emerging from periods like the pandemic, to understand if it is beneficial to consider the weighting towards REITs.

REFERENCES

Ahmed Bossman a, Z. U. (2022). Modelling the asymmetric effect of COVID-19 on REIT returns: A quantile-on-quantile regression analysis. *The Journal of Economic Asymmetries*.

Akinsomi, O. (2020). How resilient are REITs to a pandemic? . *COVID-19 effect REITs*.

Aleksandar Andonov, Piet Eichholtz, Nils Kok, (2015) Intermediated investment management in private markets: Evidence from pension fund investments in real estate, Journal of Financial Markets, Volume 22, 2015, Pages 73-103,

Aroop Chatterjee, L. C. (2022). Wealth Inequality in South Africa. *The World Bank Economic Review*.

Atsushi Inoue, B. R. (2021). A new approach to measuring economic policy shocks, with an application to conventional and unconventional monetary policy.

Berle A., Means G. (1932) *The Modern Corporation and Private Property* (Macmillan).

Biswas, D. (2015). The Effect Of Portfolio Diversification. *Journal of Commerce & Management Thought*.

Brown, R. (2020). *Private Investor Holding Period.* Journal of Real Estate Portfolio Management.

Brown, J. (2019). The REIT Footprint Expands Globally. *Global Trends in Listed Real Estate*. www.greenstreet.com/insights

Carstens, R., Freybote, J. & De Villiers, J. 2019, "INTERNATIONAL ARTICLES: THE IMPACT OF SOUTH AFRICAN REIT PORTFOLIO COMPOSITION ON DIVERSIFICATION BENEFITS FOR FOREIGN REIT INVESTORS", Journal of Real Estate Literature, vol. 27, no. 1, pp. 77-101.

Chandrashekaran, V. 1999, "Time-series properties and diversification benefits of REIT returns", The Journal of Real Estate Research, vol. 17, no. 1, pp. 91-112.

Chang, K.-L. (2017). Does REIT index hedge inflation risk? New evidence from the tail quantile dependences of the Markov-switching GRG copula. *The North American Journal of Economics and Finance*.

Cheng, Z. L. (2017). The Role of illiquidity and Investment Horizon. *Optimal Portfolio Selection*, 530-532.

Child, K. & Gous, N. 2023, Pick n Pay expects to fall into first-half loss, Johannesburg.

Chyi, L. L., & Ming-Long, L. (2012). Hedging effectiveness of REIT futures. *Journal of Property*

Investment & Finance, 30 (3), 257-281. https://doi.org/10.1108/14635781211223824

Colin Haslama, ∗. N. (2015). Real Estate Investment Trusts (REITS): A new business model in FTSE100.

Darst, David M. The Art of Asset Allocation: Principles and Investment Strategies for Any Market. McGraw-Hill, 2008, https://go.exlibris.link/ClNLfjsh, Accessed 26 Sept. 2024.

De Klerk, E, (2013). Real Estate Investment Trust Legislation in South Africa. Property Loan Stock Association.

Dickey, D. &. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49.

Elumalai, V. (2022). Burning urban cities of South Africa due to civil turmoil 202. *Socio-economic and environmental consequences*.

Emanuele Borgonovo a, S. G. (2013). Risk analysis with contractual default. Does covenant breach matter? European Journal of Operational Research.

Engle, R. F. (1987). Co-integration & error correction: representation, estimation, & testing. *Econometrica*.

Feng, Z., Hardin, W. G., & Wang, C. (2022). Rewarding a Long-Term Investment Strategy: REITs.

Friday H.S, G. S. (1999). Ownership Structure and the Value of the Firm: The Case of REITs. *Journal of Real Estate Research*, 71-90.

Fuss, R. (2011). Diversification benefits of securitized. *Prospects of Economic Policy*, 28.

Kaliyadan F, Kulkarni V. (2019). Types of Variables, Descriptive Statistics, and Sample Size. Indian Dermatol Online J.

Black, Fischer. "The Dividend Puzzle (Winter 1976)". Streetwise: *The Best of The Journal of Portfolio Management*, edited by Peter L. Bernstein and Frank J. Fabozzi, Princeton: Princeton University Press, 1998, pp. 10-13. https://doi.org/10.1515/9781400829408-003.

Glascock, J. L. (2018). Can Investors Hold More Real Estate? Evidence from Statistical Properties of Listed REIT versus Non-REIT Property Companies in the U.S. *J Real Estate Finan Econ*.

Gyourko Joseph & Sinai Todd (1999). The REIT Vehicle: Its Value Today and in the Future. *Journal of Real Estate Research*

Hanif, W. (2013). Are REITS hedge or safe haven against oil price fall? *International Review of Economics and Finance*.

Hansz, J. Z. (2017). An investigation into the substitutability of equity and mortgage REITs in real estate portfolios. *Journal of Real Estate Finance and Economics.*

Hansz, J. Z. (2017). An investigation into the substitutability of equity and mortgage REITs in real estate portfolios. *Journal of Real Estate Finance and Economics.*

Harry DeAngelo, Linda DeAngelo (2015) The irrelevance of the MM dividend irrelevance theorem, *Journal of Financial Economics*, Volume 79, Issue 2,
2006, Pages 293-315

Hartzell J., Starks L. 2003. “Institutional Investors and Executive Compensation.” Journal of Finance 58: 2351–2374.

Hill, W. H. (2008). REIT Dividend Determinants: Excess Dividends and Capital Markets. 19.

Hoesli, J.-C. D. (2019). Real Estate in Mixed-Asset. *The Journal of Portfolio Management*, 156.

Huberman, G., & Kandel, S. (1987). Mean-variance spanning. *The Journal of Finance*, *42* (4), 873–888.

Huthaifa Alqaralleh a, A. C. (2023). Dynamic relations between housing Markets, stock Markets, and uncertainty in global Cities: A Time-Frequency approach. *The North American Journal of Economics and Finance*.

Itua Omokhomion1, C. E. (2018). Corporate governance and investment decision-making in real estate investment trusts (REITs). 3.

KarlDemers-Bélanger. (2020). Diversification benefits of cat bonds: An in-depth examination. 168-173.

Kevin C.H. Chiang, R. -L. (2018). REIT Governance , E ntrepreneuria l Control , and Corporate Value. JRER.

Klerk, E. d. (2019, May 8). *Real Estate Investment Trusts*. Retrieved from South African Instute of Taxation: https://www.thesait.org.za/news/450521/Real-Estate-Investment-Trusts.htm

Koumou, G. B. (2020). Diversification and portfolio theory: a review. *Financial Markets and Portfolio Management*.

Kritzman,M. & Li, Y. (2010). Skulls, financial turbulence, and risk management. Financial Analysts Journal, 66 (5), 30–41.

Lisi, G. (2022). Property valuation: the hedonic pricing model: the application of search-and matching models. Journal of Property Investment & Finance, 40 (1), 68-76. https://doi.org/10.1108/JPIF-12-2020-0138

LÓPEZ-PENABAD. (2017). REIT IN BRAZIL: AN OPPORTUNITY FOR INTERNATIONAL DIVERSIFICATION.

MacKinnon, J. G. (1996). Numerical Distribution Functions for Unit Root and Cointegration Tests. Journal of Applied Econometrics, 11 (6), 601–618. http://www.jstor.org/stable/2285154

Massyn, M. W., McGaffin, R., Viruly, F., & Hopkins, N. (2015). The challenge of developing higher density, affordable housing in the inner city of Cape Town. *International Journal of Housing Markets and Analysis, 8* (3), 412-428. https://doi.org/10.1108/IJHMA-11-2014-0049

Markowitz, H. (1952). Portfolio selection. *Journal of Finance*, 77-91.

Maurer, R. & Reiner, F. 2002, "International asset allocation with real estate securities in a shortfall risk framework: The viewpoint of German and U.S. investors", Journal of Real Estate Portfolio Management, vol. 8, no. 1, pp. 27-43.

Michael C. Jensen, William H. Meckling, Theory of the firm: Managerial behavior, agency costs and ownership structure, Journal of Financial Economics, Volume 3, Issue 4, 1976, Pages 305 360, ISSN 0304-405X, https://doi.org/10.1016/0304-405X (76)90026-X.

Miller, M. H., & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. The Journal of Business, 34 (4), 411-433.

Montgomery, N., Squires, G. & Syed, I. 2018, "Disruptive potential of real estate crowdfunding in the real estate project finance industry: A literature review", Property Management, vol. 36, no. 5, pp. 597-619.

Mooradian, R., & Yang, S. (2001). Dividend Policy and Firm Performance: Hotel REITs vs. Non-REIT Hotel Companies. *Journal of Real Estate Portfolio Management*, 7 (1), 79–87. Ahttps://doi.org/10.1080/10835547.2001.12089629

Myer, F. C. (1997). Stationarity and co-integration in systems with three national real estate indices. *Journal of Real Estate Research*, 369-381.

NAREIT (2010). History of REITs. National Association of Real Estate Investment Trusts, United States of America, Available online at: http://www.reit.com

Newell, G., Adair, A., & Kim Nguyen, T. (2013). The significance and performance of french REITs (SIICs) in a mixed-asset portfolio. Journal of Property Investment & Finance, 31 (6), 575-588. https://doi.org/10.1108/JPIF-01-2011-0004

Newell, G., & Marzuki, M. J. B. (2016). The significance and performance of UK-REITs in a mixed-asset portfolio. Journal of European Real Estate Research, 9 (2), 171-182. https://doi.org/10.1108/JERER-08-2015-0032

Newell, G., Pham, A. K., & Ooi, J. (2015). The significance and performance of singapore REITs in a mixed-asset portfolio. Journal of Property Investment & Finance, 33 (1), 45-65. https://doi.org/10.1108/JPIF-12-2010-0027

Ntuli, M., & Akinsomi, O. (2017). An overview of the initial performance of the South African REIT market. Journal of Real Estate Literature, 25 (2), 365-388. Correct reference of this paper.

Ntuli, M. (2020). Journal of Real Estate Literature. *An Overview of the Initial Performance of the South African REIT Market*, 365.

Octavia, M., & Wijaya, C. (2020). Analysis of Cointegration and Causality Relationship among Selected Stock Market Indexes in the World and Indonesia Stock Exchange Composite Index (IHSG) for the Period 2005-2017. Open Journal of Business and Management, 8, 1226-1242.

Pancho Vallespin, B. E., Lopez De Guzman, D., & Nayat Young, M. (2021, January). Analysis of US REIT Portfolio Performance on Pre and During COVID-19 Pandemic. In 2021 The 2nd International Conference on Industrial Engineering and Industrial Management (pp. 25-31)

Patrick John Kelly, H. S. (2018). The regulatory governance of retail electricity tariff setting in South Africa. *Regional Science Policy & Practice*.

Petter N. Kolm a, R. T. (2014). 60 Years of portfolio optimization: Practical challenges and current trends. *European Journal of Operational Research*.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics, 16 (3), 289–326. http://www.jstor.org/stable/2678547Ping

Rafiq Bhuyan1*, J. K.-D. (2015). *Portfolio Diversification Benefits Using Real Estate Investment.* International Journal of Economics and Financial Issues.

Randy Anderson, E. B. (2022). The Effect of Interest Rates. *Journal of Investing*.

Riëtte Carstens, N. W. (2019). The impact of South African real estate investment. *South African Journal of Economic and Management Sciences*.

Roberts, E. B., & Southfield. (10 Jan 2023). 4 High-Yield REITs With Low Payout Ratios.

Robinson, I. O. (2018). *CORPORATE GOVERNANCE AND INVESTMENT DECISION-MAKING IN REAL ESTATE INVESTMENT TRUSTs .* Department of Built Environment and Architecture, London South Bank University, 103 Borough Road, SE1 0AA, London, United Kingdom.

Rout, B. S., Das, N. M., & Rao, K. C. (2019). Volatility Spillover Effect in Commodity Derivatives Market: Empirical Evidence Through Generalized Impulse Response Function. *Vision*, *23* (4), 374-396.

Seiler, M. J. (2001). Can Private Real Estate Portfolios Be Rebalanced/Diversified Using Equity REIT Shares? *Journal of Real Estate Portfolio Management* .

South African Institute of Valuers. (2022, July 1). The Aftermath of the KZN Floods and Looting on the Property Market. Durban, KwaZulu-Natal, South Africa.

S&P Dow Jones Indices. (2023) Historical S&P Dow Jones Indices REIT/RESI Industry Classification Hierarchy.

Timothy Riddiough, E. S. (2020). Financial Flexibility and Manager–Shareholder Conflict: Evidence. *Real estate economics*.

Tsang, Y. D. (2016). The Role of Debt Covenants in the Investment Grade Bond Market – The REIT Experiment. *Journal of Real Estate Finance and Economics*.

Wang, K., J. Erikson and G. Gau. 1993. Dividend Policies and Dividend Announcement Effects for Real Estate Investment Trusts. Journal of the American Real Estate and Urban Economics Association

Yunong Wang a b c, J. W. (2023). Stock index prediction using global market indices: A Granger causality-based graph representation learning method. *Index prediction using global market in*.

Zhilan Feng, S. M. (2009). AN OVERVIEW OF EQUITY REAL ESTATE.

Zhilan, Feng., Chinmoy, G., & Sirmans, C. F. (2007). On the Capital Structure of Real Estate Investment Trusts (REITs). Journal of Real Estate Finance and Economics, 34 (1), 81-105.

Ziobrowski, A. J., Caines, R. W., & Ziobrowski, B. J. (1999). Mixed-asset portfolio composition with long-term holding periods and uncertainty. Journal of Real Estate Portfolio Management, 5 (2), 139-144.