A COMPARISON OF THE PERFORMANCE OF REIT STRATEGIES IN SOUTH AFRICA

NTOMBENKULU KUBHEKA

STUDENT NUMBER: 812643

TEL: 079 073 7536

EMAIL: ntombenkulukubheka@gmail.com

SUPERVISOR: KWASI OKYERE-BOAKYE

In partial fulfillment of the requirements for the degree of

Master of Commerce

University of the Witwatersrand

Abstract

As the objective of investing is the maximization of wealth, it is imperative for investors to find instruments which will help them achieve their goal. A real estate investment trust can be a form of wealth maximization if an investor is knowledgeable about its long-term performance and the drivers of this performance.

This study employed the use of panel regression models to isolate the performance of South African REITs, in order to compare the risk-adjusted returns of REIT segments over the long term and to identify the determinants of REIT risk-adjusted returns. Risk-adjusted performance ratios were used to measure return on real estate investment funds to conclude on the performance of SA REITs. The Sharpe ratio, Treynor index and Jensen's Alpha were performance measures of 55 JSE-listed and delisted REITs over 18 years (2000 – 2017) thus incorporating 433 firm-years.

The empirical evidence suggests that size, book-to-market, property asset intensity, dividend yield and real GDP growth influence the performance of South African real estate investment trusts and Hotel and Resort REITs as well as Retail REIT significantly underperformed the other REIT sectors, under the Sharpe ratio and Jensen's Alpha. Furthermore, the REIT performance during the financial crisis outperformed their performance during the other market phases.

Keywords:

REITs, Sharpe ratio, Treynor index, Jensen's Alpha, Panel Regression

Plagiarism Declaration

University of the Witwatersrand, Johannesburg

School of Accountancy

SENATE PLAGIARISM POLICY

Declaration by Students

I Ntombenkulu Kubheka (Student number: 812643) am a student registered for Master of Commerce in the year 2018. I hereby declare the following:

- **I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.**
- **I confirm that ALL the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise.**
- **I have followed the required conventions in referencing the thoughts and ideas of others.**
- **I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.**

Signature: Ntombenkulu Kubheka **Date: 11 November 2019**

Acknowledgements

I would like to show my gratitude to my supervisor, Kwasi Okyere-Boakye, whose support, encouragement and guidance has enabled me to understand the subject matter and complete my thesis.

I am also grateful to my family and friends for encouraging me to embark on this journey and for their support.

Table of Contents

Chapter 1

1. Introduction

According to the latest research released by the Property Sector Charter Council (PSCC), the South African property market is currently valued at a staggering USD $403 billion (African Property News, 2017). This presents ample property investment opportunities for investors. Investors may consider a wide array of alternatives in today's real estate investment market. Investors seeking real estate exposure can invest in the equity of Real Estate Investment Trusts (REITs) (Kola & Kodongo, 2017). According to National Association of Real Estate Investment Trust`s (Nareit) - a trade association that represents United States (U.S.) Real Estate Investment Trusts (REITs) and listed real estate companies - REITs invest across the spectrum of real estate property types, including offices, apartment buildings, warehouses, retail centers, medical facilities, data centers, cell towers, infrastructure and hotels. Most REITs focus on a particular property type, but some hold multiple types of properties in their portfolios. Risk and return of real estate assets is an area of great interest for practitioners, academics and investors (Gyourko & Keim, 1993; Kola & Kodongo, 2017).

South African REITs rank high among the Johannesburg Stock Exchange (JSE)-listed companies that earn the most returns for shareholders (Kilian, 2017). The sector featured strongly overall in the list of the Top 100 Companies on the JSE for its performance and gives local and international investors exposure to the leading capital markets in South Africa and the broader African continent. The REITs made up a significant 12% of the Top 100 Companies over five years (2012-2017) based on a compound annual growth rate (Kilian, 2017).

According to the sentiment shared by the chairperson of South Africa REIT Association, Izak Petersen, the sector remains the best income producer, a defensive investment through cycles and a powerful shield against inflation and it has held up well, despite the current negative sentiment (Kilian, 2017).

Although a number of studies, such as Kryzanowski and Tcherednitchenko (2007), Brounen and de Koning (2013), Bhuyan, Kuhle, Al-Deehani, and Mahmood (2015), express the sentiments that the REIT market offers investors an opportunity to earn returns, there has been limited research on identifying the top performers in the entire REIT industry (Kuhle, 1987). Although Kola and Kodongo (2017) and Ntuli and Akinsomi (2017) have added to the body of finance research which relates to South African REIT performance, research on the performance of South African (S.A) REITs, across different financial market conditions, and identifying factors that influence the performance of S.A REITs is still limited. This empirical study aims to add to the literature.

1.1. Background

The U.S. Congress created REITs in 1960 for the explicit purpose of providing investors with an opportunity to invest in real properties and, at the same time, to enjoy the same benefits provided to shareholders in investment trusts (S. H. Chan, Erickson, & Wang, 2003; Zietz, Sirmans, & Friday, 2003). Before the creation of REITs, investors could get exposure to properties only from the physical property market. However, with the creation of REITs, it is possible to invest in properties by purchasing the stock of property focused corporations and trusts (S. H. Chan et al., 2003). According to the Savills World Research, real estate comprises a significant portion of the world's wealth (Estate, 2017). The

consensus is that real estate comprises 40% - 50% of the total wealth in the United States and statistics published by the Property Sector Charter Council (PSCC) and Statistics South Africa (Stats SA), indicated that real estate makes up more than 50% of the total wealth in South Africa (African Property News, 2017).

South African REITs sector dates back to 1969, when the first two property funds listed on the JSE and were established to allow individual and institutional investors to invest in a diversified portfolio of investment grade properties on the same basis as if they had bought the properties directly (SAREIT, 2016). The South African listed property sector has seen market capitalization rise from below R5 billion in the early 1990s to approximately R 6 billion in 2000, then soar to R24 billion in 2004, R380 billion in 2016 (SAREIT, 2016) and approximately R409 billion in mid-2018 (Osiris, 2018). The different categories of South African REITs include industrial, office, hotel and resort, residential, retail, specialized and diversified REITs (Diversified REITs include all sub-sectors of REITs). The largest property categories, which are diversified and retail, have a market capitalization of R335.423 million and R73.038 million respectively for mid-2018 (Osiris, 2018).

Despite the constant focus on stocks and bonds, real estate remains a significant part of the institutional investment portfolio (Georgiev, Gupta, & Kunkel, 2003). The popularity of REITs is due to several different factors. REITs allow investors to hold illiquid real estate assets in their portfolios with the convenience and marketability of traditional stock market securities (Zietz et al., 2003). Other studies by Brueggeman, Chen, and Thibodeau (1984), Titman and Warga (1986), Mull and Soenen (1997) and Chan, Hendershott, and Sanders (1990), indicated that REITs appear to offer a diversification benefit and hedge

against inflation. The researchers also identified that real estate earned substantial risk-adjusted excess returns and from a capital structure standpoint, REITs tend to use less leverage and pay out more dividends than non-REIT companies (Brueggeman et al., 1984; Chan et al., 1990; Mull & Soenen, 1997). Lastly, according to the JSE, REITs have various tax benefits; they are well regulated and are more liquid than the physical properties (JSE, 2018).

REITs offer a range of investment benefits that help to build an optimal portfolio, however, REITs like all investment opportunities expose investors to risks (Zietz et al., 2003). Firstly, REITs invest in different properties, therefore, investors are exposed to risk factors specific to immovable property. Secondly, increasing interest rates are a significant risk factor as this reduces demand for REITs. Historical evidence indicates that REIT returns are inversely related to interest rates (Chen & Tzang, 1988; Devaney, 2001). And lastly, current trends influence which properties are popular investment destinations. For example, millennials prefer urban living for convenience and cost-saving purposes, therefore, urban shopping centers are likely to be a better investment opportunity currently (Moskowitz, 2018).

Although, risks and returns of real estate portfolios are documented by researchers, Ooi and Liow (2004) and Fisher and Goetzmann (2005), there is little to no research on property performance analysis across different REIT segments, in South Africa. This paper aims to address the need to summarize and synthesize evidence about REIT investments in a systematic way.

1.1.1. Tax legislation and Regulation

The new REIT legislation was only introduced on 25 October 2012 and effectively implemented on 1 April 2013. South African legislators introduced the REIT structure and amended the tax legislation for the listed property sector as South Africa needed legislation that was internationally accepted and comparable to generally accepted international REIT legislation. The new legislation would also promote economic growth through attracting foreign investors to South Africa (Kantilal, 2016).

Before the REIT legislation, the listed property sector in South Africa consisted of Property Unit Trusts (PUTs) and Property Loan Stock (PLS) companies. The regulation and tax treatment of these listed property vehicles were different and this discouraged foreign investors from investing in South Africa's property sector (Kantilal, 2016). The inconsistencies between the two property investment structures were evident in the fact that PUTs were more strictly regulated compared to PLS companies; this is because PUTs are regulated by the Financial Services Board in terms of the Collective Investment Schemes Control Act. A PLS company is regulated by the Companies Act (71 of 2008) and the JSE regulations and it was not under the Collective Investment Schemes Control Act unlike a PUT.

The tax treatment was different in the sense that the income of PUTs was taxed in the hands of the investors (beneficiaries of the trust) as soon as the income was distributed to the investors. As PLS companies were companies as defined in the Income Tax Act, the income received by PLS companies was taxed in the hands of the company at a rate of 28%. PLS companies were more popular amongst investors as distributions from the

unit trusts were in the form of interest from the debenture portion and dividends from the equity portion, therefore, the interest was exempt from normal tax in terms of section 10(1)(i)(xv) and the dividends were also exempt from normal tax in terms of section 10(1)(k)(i) (Kantilal, 2016).

Therefore, a new legislation had to be developed to correct the discrepancies between the two property investment vehicles. This new legislation allowed PUTs and PLS companies to convert into REITs if these vehicles were a South African resident, complied with JSE REIT Listing Requirements and register with the Registrar of Collective Investment Schemes Control (Kantilal, 2016). The new tax legislation (Section 25BB) follows the same procedure as the tax treatment for PUTs and the income is taxed in the hands of the investors if the distribution constitutes a “qualifying distribution”. A REIT is also exempt from capital gains tax if an immovable property is disposed of.

1.2. Statement of the problem and research questions

REIT investors may not be able to make optimal decisions if the long-term performance of South African real estate investment trusts is unknown.

Therefore, it is imperative to understand the following:

1. How do the different South African REITs perform, on a risk-adjusted basis, against one another in the long time?
2. How do the different South African REITs perform, on a risk-adjusted basis, during different periods of crisis?
3. How are South African REITs influenced by macroeconomic and firm-specific factors?

1.3. Research Objective

As the objective of investing is the maximization of wealth, the performance of real estate investment trusts on a long-term basis is needed for investors to make optimal investment decisions (Graeme & James, 1996).

This paper analyses how different real estate investment trusts perform against one another on a risk-adjusted basis, across time and within different financial market conditions. It further seeks to identify determinants of the risk-adjusted returns of real estate securities traded on the JSE.

The performance of real estate investment trusts will be evaluated using risk-adjusted measures.

1.4. Purpose of the study

The purpose of the study is to isolate the performance of South African REITs, in order to compare the risk-adjusted returns of REIT segments over the long term and to identify the determinants of REIT risk-adjusted returns.

1.5. Significance of the study

The research is significant to real estate investment trust investors because firstly, it will enable them to make more informed decisions in terms of which REIT would maximize their wealth and determine factors investors should pay attention to in order to develop expectations about the REIT market performance. This will result in investors making optimal investment decisions under different economic conditions.

Secondly, Portfolio managers rely heavily on historical information to make asset allocation decisions. Therefore, this research is important for managers in developing REIT investment strategies (S. H. Chan et al., 2003).

Thirdly, from a global investor's prospective, there is more scope for risk diversification in developing markets as developed markets are already completely integrated into the global capital market (Ooi & Liow, 2004).

Lastly, the research will add to the body of research on real estate investment trusts (as research on REIT performance in South Africa is limited), which will also enable portfolio managers to develop investment principles on REITs (Kola & Kodongo, 2017).

1.6. Hypothesis

As South Africa is a developing country and recent statistics from NAREIT indicate that REIT Segments have different return performance in the short-run (in a space of 3 years) (Alpha, 2018), the paper aims to test the following hypotheses:

1. REIT segments have different and significant risk-adjusted performance.

2. The comparative risk-adjusted performances are not stationary and differ during a crisis, before a crisis and after a crisis period.

3. The risk-adjusted returns of South African REITs are influenced by macroeconomic (interest rates, inflation and real Gross Domestic Product growth (GDP)) and firm specific variables (book-to-market value, capital structure, leverage, effective tax, property asset intensity and dividend yield).

1.7. Assumptions, limitations and delimitations

This paper focuses on JSE-listed and delisted Real Estate Investment Trusts. The analysis focuses on comparisons within the South African REIT market and not against other markets/ asset classes of the JSE. The redemption date for RSA R186 Government bonds is December 2027. There was no information available on the 2000-2003 yield on the RSA R186 Government bond, therefore the yield on RSA 10-year Government bonds was used for 2000-2003 and the coupon payments were used to purchase RSA R186 Government bonds at the end of 2003. It is assumed that the coupon payments on these bonds are used to purchase more bonds on a yearly basis.

1.8. Definition of terms

Economic cycles: Upswing (growth) and downswing (recession) fluctuations in the economy.

Linked units: A fund that consists of both a debenture and an equity portion

Millennials: Known as generation Y, it is the last-born generation in the 20th century.

Net Asset Value: A fund's assets less its liabilities

Property Loan Stock companies (PLS): A PLS company was the other type of property investment vehicle, besides a PUT, that investors used for indirect investment in the South African property sector (Kantilal, 2016). It derived its income from the holding of a property portfolio, and mostly consists of linked units.

Property Unit Trusts (PUTs): It is a vesting trust that is listed on the JSE and in which investors hold a participatory interest. It mainly consists of property shares and indirectly

or directly holds a portfolio of investment grade properties for capital appreciation or rental income purposes.

Qualifying distribution: a dividend paid or payable or interest incurred from the income received by the REIT if at least 75% of the income distributed consists of rental income.

The remainder of the paper will firstly discuss the prior literature on the performance and diversification benefits of REITs as well as the determinants of risk-adjusted returns of real estate securities. The literature review will be followed by the methodology and the research findings. Lastly, there will be a conclusion.

Chapter 2

2. Literature Review

This section will provide a summary of prior finance literature. The presentation of the section will be structure in the following manner:

2.1. Performance of REITs and Diversification Benefits

2.2. Determinants of risk-adjusted returns of real estate securities

2.3. Panel regression analysis

2.1. Performance of REITs and Diversification Benefits

2.1.1. Evidence from Developed Markets

2.1.1.1. Performance of REITS

The performance of real estate-related organizations is extensively researched in the real estate literature (Ooi & Liow, 2004). The earliest research, specifically on the U.S., on the performance of real estate investment funds suggests that real estate generally outperformed bonds and stock (Brueggeman et al., 1984). Titman and Warga (1986) examined the risk-adjusted performance of a sample of REITs using both the Capital Asset Pricing Model (CAPM), which describes the relationship between systematic risk and expected return for assets, particularly stocks, and Arbitrage Pricing Theory (APT), which describes the relationship between the asset's expected return and a number of macroeconomic variables that capture systematic risk. Results showed that the differences in investment performance across trusts generally are not statistically significant, the reason being the high volatility of these real estate investments (Brueggeman et al., 1984). The research authors only considered risk-adjusted measures that only take systematic factors into account for the calculation of expected returns. Firm-

specific factors also play a vital role in the determination of expected returns. Therefore, the Sharpe, Treynor and Jensen's Alpha were used employed for this study.

Gyourko and Keim (1993) evaluated the return behavior of a stock-market-based index of real estate performance. The stock-market-based index utilized comprised of real-estate-related securities traded on the New York and American stock exchanges (NYSE and Amex). The findings indicated that the performance of real estate stock returns certainly looks more sensible and timely than does that of a prominent appraisal-based series, meaning that the stock market reliably measure real estate stock returns (Gyourko & Keim, 1993).

Lastly, REITs also offer an opportunity to earn return on real estate investments without investing directly in the physical property. The study performed by Goebel and Kim (1989) analyzed the investment performance of real estate investment trusts, by comparing the finite-life trusts (FREIT) with traditional REITs and stock returns. This study concluded that traditional REITs outperformed FREITs and that both REITs had diversification benefits. This study also evidenced that REITs have the capabilities to hedge anticipated inflation; however unanticipated inflation is not hedged. The study explored the comparison of different REITs to stock returns and further tested whether REITs served as a hedging mechanism for inflation. The authors were able to indicate that only anticipated inflation is hedged by REITs, as opposed to just stating that inflation is hedged by REITs (as evidenced in prior studies). Kuhle, Walther, and Wurtzebach (1986) supported prior research on REITs, in the sense that REITs significantly generate high returns compared to the stock market, because results of the study indicated that REITs

generated significant alpha or excess returns between a 10-year and 13-year investment horizon.

In Canada, REITs have outperformed the equities and fixed income asset classes on an annualized return basis over the past 20 years and recent studies indicate that Canadian Equity REITs (E-REITs) outperformed the S&P/TSX Composite index over the 1996-2004 periods on a risk-adjusted basis (Kryzanowski & Tcherednitchenko, 2007). In contrast, Australian REITS appear to have underperformed the market on average by 30%. The negative performance was said to be caused by the global financial crisis (Stevenson & Dimovski, 2014). The study explained how Australian and Canadian REITs performed against a benchmark, however, the authors failed to further explain how the Canadian and Austrian REITs performed during different periods of financial crisis. Therefore, this paper intends to fill the gap, however, the focus will be on the South African REIT market.

2.1.1.2. Diversification benefits

Prior research suggests that real estate has historically provided strong risk-adjusted returns and low correlations relative to other assets and has therefore delivered diversification benefits to existing portfolios of stocks, bonds, and other asset classes (Brueggeman et al., 1984; Gordon, Canter, & Webb, 1998; Kryzanowski & Tcherednitchenko, 2007). Moreover, Brueggeman et al. (1984) found that real estate offered diversification benefits if included in a portfolio and also provided a hedge against inflation. The study provided evidence that REITs provide a hedge against inflation,

however, the study did not specify whether it is anticipated or unanticipated inflation that is hedged.

Prior research conducted in the 1990s showed a comparison of the returns and diversification benefits of U.S REITs and international real estate equities. The research found that international real estate equities offered U.S. investors with significant diversification benefits in a mixed U.S portfolio. Gordon et al. (1998) evaluated the diversification benefits international real estate securities have on a mixed portfolio. The mixed portfolio consisted of U.S real estate securities, U.S stocks, U.S corporate bonds and international common stocks. The results indicated that international real estate securities offered U.S investors with significant diversification benefits in a mixed portfolio over the period of the study (1984 to 1997).

Kuhle (1987) examined the effects of diversification in the reduction of total portfolio risk in REITs. The results indicated that common stocks offered greater risk reduction benefits than REITs. In the U.S REIT market, Bhuyan et al. (2015)'s results indicated that equity REITs offered investors diversification benefits, which contradicted the findings of Kuhle (1987). The evidence further showed that small investors could use these REITs to diversify their risks. Recent studies show that Canadian Equity REITs also have diversification benefits (Kryzanowski & Tcherednitchenko, 2007). The diversification benefits were achieved because Canadian Equity REITs returns were driven primarily by non-equity-market risk factors.

2.1.2. Evidence from Emerging Markets

2.1.2.1. Performance of REITS

Ooi and Liow (2004) looked at the performance of real estate stocks listed in seven developing markets in East Asia between 1992 and 2002. The empirical results from the study indicated that on a risk-adjusted basis, the real estate sector in a majority of Asian markets (namely Hong Kong, Malaysia, Indonesia, Singapore and Thailand) underperformed the general stock market over the period considered (1992 – 2002). The study further concluded that the performance of the real estate stocks in East Asia is largely influenced by macroeconomic factors (Ooi & Liow, 2004).

Newell and Osmadi (2009) focused their study on Islamic REITs in Malaysia. The study assessed the risk-adjusted performance and diversification benefits of Islamic REITs from 2006 to 2008 and this was compared to conventional REITs in the Malaysian Market. Evidence from the study indicated that on a risk-adjusted basis, Malaysian conventional REITs outperformed Islamic REITs during 2006 -2008 (Newell & Osmadi, 2009).

Hamzah, Rozali, and Tahir (2010) conducted further empirical research on Malaysian REITs and this paper examined the risk-adjusted performance of Malaysian REITs from 1995 to 2005, in different economic cycles. The study measured performance by using the Sharpe index, Jensen Index and Treynor Index. The evidence indicated that REITs outperformed the market during the 1997-1998 financial crisis and underperformed the market portfolio during the period preceding the financial crisis (1995-1997) and post-financial crisis (1998-2005).

A comparison of the performance of Malaysian and Nigerian REITs measured the risk-adjusted performance REITs by using dividend distributions as a measure of returns (Olanrele, Said, & Daud, 2015). Results showed that Nigerian REITs underperformed Malaysian REITs both in terms of average returns and risk-adjusted return. This study proved that highly favourable returns do not exist in all REIT markets, as was the case for the Nigerian REIT market. Earlier research on the performance of Nigerian real estate stocks is not consistent with earlier research from real estate stocks in developed markets, as these Nigerian stocks generally do not have attractive excess returns (generally underperformed the market) (Abdul-Rasheed, Bioye Tajudeen, Muhammad Bashar, & Muibi Olufemi, 2008; Abdul-Rasheed & Tajudeen, 2006; Emele & Umeh, 2013). Recent research further supports earlier research in the sense that Nigerian REITs underperform the market. Olanrele, Said, Daud, and Ab (2015) found that the Nigerian REIT underperformed the Nigerian Stock Market All Share Index on a risk-adjusted basis.

Ntuli and Akinsomi (2017) found that South African REITs offer international and local investors great investment opportunities as they exhibited good risk-adjusted performance from 2013 to 2016. The asset types considered in the research paper were bonds, REITs, listed property, stocks and Treasury-bills. There were 33 South African REITs during the period of study. The study, however, found that REITs do not outperform common stocks, as common stocks appear to be the best risk-adjusted performing securities. The study only focused on a limited time period and this paper aims to cover a longer period, for the purposes of measuring performance over the long-term.

The studies above represent literature that has inspired the research objective of this study. The literature measures the performance of different REITs and REIT performance

drivers in emerging markets. However, there is limited research on South African REITs and this paper aims to bridge the research gap.

2.1.2.2. Diversification benefits

Evidence from emerging markets was mostly based on the Nigerian Market. The evidence produced conflicting results. Research conducted by Abdul-Rasheed and Tajudeen (2006) examined the stock performance of a property development company and construction companies against the All Share Index (used as a proxy for stocks) over an eight year period. The study found that the stocks of these companies had diversification benefits when included in an investment portfolio (Abdul-Rasheed & Tajudeen, 2006). However, a number of studies indicate that Nigerian real estate stocks do not appear to exhibit diversification benefits (Abdul-Rasheed et al., 2008; Emele & Umeh, 2013).

Emele and Umeh (2013) performed a comparison between real estate securities and common stocks in order determine if real estate securities have diversification benefits when included in an investment portfolio. This analysis was performed from 2003 to 2009. The findings were in disagreement with the findings of Abdul-Rasheed and Tajudeen (2006) as the study concluded that no diversification benefits existed because the stocks are positively correlated.

Ntuli and Akinsomi (2017) also looked at the diversification benefits of South African REITs and found that the correlation between stocks and REITs indicated that good diversification benefits exist between these asset types. However, the findings suggested that diversification benefits between REITs and bonds do not exist.

2.1.3. Evidence from Cross-market Comparisons

Prior research conducted in the 1990s compared the returns of U.S REITs and international real estate equities. The research found that international real estate equities generated higher risk-adjusted returns in a mixed U.S portfolio. Paul, Robert, and Carl (1991) employed the use of the Treynor ratio, Jensen ratio and Sharpe ratio to measure the performance of the securities and concluded that international real estate securities outperformed the S&P 500 Index and domestic real estate companies when using Treynor and Jensen measures. However, international real estate securities performed poorly under the Sharpe ratio; which indicates that international real estate securities have significant unsystematic risk. The study used risk-adjusted return measures that capture both systematic and unsystematic risk and this study also intends to achieve this.

Recent research looked at the performance of real estate securities across different countries. Ling and Naranjo (2002) evaluated the risk-adjusted performance of over 600 publicly traded real estate companies in 28 countries. The study found that during the period 1984 to 1999, that there is substantial variation across the countries in excess returns on a risk adjusted basis. Furthermore, evidence suggests that real estate securities may provide international diversification opportunities because country-specific systematic risk is significantly statistically independent across countries. Brounen and de Koning (2013) analysed the performance of the international REIT market and found that the European REIT market outperformed all the other markets and Asian REITs had the

highest systematic REIT risk because of firm leverage, during the period of study (2000 – 2010).

2.2. Determinants of the risk-adjusted returns of real estate securities

Several authors have attempted to explain the drivers of risk and returns for securities (Chen & Tzang, 1988; Ewing & Payne, 2005; Fama & French, 1992; Ling & Naranjo, 2002). A large body of evidence indicates that real estate returns are negatively affected by an increase in interest rates (Chui, Titman, & Wei, 2003; Devaney, 2001; Ling & Naranjo, 2002; Titman & Warga, 1986).

Studies have also shown that real estate returns are affected by macroeconomic variables such as shocks in the monetary policy, economic growth, inflation and the default risk premium (Chen, Hsieh, Vines, & Chiou, 1998; Ewing & Payne, 2005). Ewing and Payne (2005) found that shocks to the monetary policy, economic growth and inflation tend to decrease expected returns, however, shocks to the default risk premium causes an increase to future returns.

Firm specific variables that have been identified as drivers of the return of stocks include size, capital structure, book-to-market variables, leverage and dividend yield (Alcock, Baum, Colley, & Steiner, 2013; Chen et al., 1998; Gu & Kim, 2003; Ooi & Liow, 2004). Several authors have identified size as a significant factor, and although several authors conclude that size is inversely related to real estate returns (Chen et al., 1998; Ling & Naranjo, 2002), Brounen and de Koning (2013) believe that a positive relationship exists. Chui et al. (2003) examined the cross-sectional determinants of expected REIT returns.

The period of study was pre- and post- 1990, as the structure of the U.S. REIT market substantially changed during 1990. The results indicated that in the pre-1990 period, momentum, size, turnover and analyst coverage were drivers of REIT returns, however only momentum drove REIT returns in the post-1990 period. In addition to evaluating the performance of Asian REITs, Ooi and Liow (2004) also employed the use of panel regressions to identify the determinants of the risk-adjusted returns of Asian REITs. The evidence identified size, book-to-market value, capital structure and market diversification as factors that significantly influence the performance of these real estate securities.

This study will explore how these determinants influence the risk-adjusted performance of REITs in a South African context. This will enable us to understand the drivers of SA REIT performance.

Chapter 3

3. Methodology

3.1. Summary of Methodology

As the purpose of this study is to isolate the performance of REITs, in order to compare the risk-adjusted returns of REIT segments over the long term, this study will apply an empirical quantitative methodology.

The methodology used for the purpose of this study is similar to Ooi and Liow (2004). Ooi and Liow (2004) used risk-adjusted performance ratios to measure return on real estate investment funds, in order to conclude on the performance of these investments. Further, their paper also employed panel regression to explain the variations in the REITs risk-adjusted performance. As the study aims to isolate the performance of REIT segments, risk-adjusted return ratios are used because these are statistical tools that measure stock performance. More specifically, the Sharpe ratio (Sharpe, 1966), Treynor ratio, as cited by Sharpe (1966), and the Jensen's Alpha ratio (Jensen, 1968). These methods are appropriate because the ratios are widely used methods of calculating risk-adjusted returns.

3.2. Panel regression Analysis

Ooi and Liow (2004) made use of a fixed-effects panel regression to determine factors that influence the risk-adjusted performance of REITs in seven developing markets in Asia. The panel regression model employed by Ooi and Liow (2004) to explain the risk-adjusted returns of REITs in these developing markets:

$$S_{it} = a + \beta X_{it} + \gamma M_{it} + \mu_{it}$$

The regression results suggested that size, book-to-market value, market diversification and capital structure significantly influenced the risk-adjusted returns of Asian REITs between 1992 and 2002.

A panel regression model has also been used across different disciplines in finance. Van der Wijst and Thurik (1993) employed the use of this model for the purpose of identifying determinants of small business debt ratios. The empirical evidence indicated that asset structure, total assets, inventory turnover and return on investment influenced the debt ratios of small firms and that majority of the variables influenced the maturity structure of debt rather than leverage. Hidayat and Abduh (2012) added to the body of banking research through the use of a panel regression model. The purpose of the study was to see if the global financial crisis impacted on the financial performance of the Bahrain Islamic banking industry. The evidence suggested that the impact of the global financial crisis was insignificant on the financial performance of the respective banking industry during the crisis (2007-2008); however, the financial performance of the Bahrain Islamic banking industry was affected after the crisis period.

3.3. Research Design

The time period chosen for this study is from 2000 to 2017. This period covers a period of financial stability, financial crisis and post financial crisis; pre-crisis (January 2000 to November 2007), during crisis (December 2007 to June 2009) and post-crisis (July 2009 to December 2017) (Hamzah et al., 2010). The time period was chosen as it takes into the different period of crisis and it covers a greater time period of the performance of indirect property investment.

3.3.1. Dependent Variable

All the REITs selected for the research will have their annualized monthly risk-adjusted returns calculated as follows:

Ex-post Sharpe ratio: $$\mathbf{SR}_t = \frac{[R_{pt} - \mathbf{R}_{ft}]}{S_{pt}}$$ **Equation 1**

Alpha Ratio: $$\boldsymbol{\alpha}_{it} = R_{it} - [\mathbf{R}_{ft} + \boldsymbol{\beta}_{it}\,(\mathbf{R}_{mt} - \mathbf{R}_{ft})]$$ **Equation 2**

Treynor ratio: $$TR_t = \frac{[R_{pt} - R_{ft}]}{\beta_{it}}$$ **Equation 3**

Table 1: Description of equation variables

Symbol	Description
R_p	Compounded portfolio returns or geometric return i.e. $\prod(1+r_{mt})^{1/M}-1$ where *m* is month *m* in year *t* and M=12 months; It was assumed that dividends were used to purchase more shares in the REIT. Furthermore, the monthly returns were calculated as $r_{mt}=\ln(p_{mt}/p_{mt-1})$ where p= share price
R_f	Risk-free rate of return, which is the yield on the RSA R186 Government bond (Compound returns were used where it was assumed that coupons were used to purchase additional bonds. Hence the returns include both coupon and capital appreciation.
S_p	Geometric standard deviation of the portfolio calculated as follows: $$\sigma_g = exp\left(\sqrt{\frac{\sum_{i=1}^{n}\left(ln\frac{A_i}{\mu_g}\right)^2}{n}}\right)$$ Where $A_i = 1+r_{mt}$ and μ_g = geometric mean of observation i to n
i	The i^{th} REIT portfolio

R_i	Actual Portfolio return
β_{im}	Portfolio Beta, as measured by its sensitivity against the JSE All-Share Index.
R_m	Compounded/Geometric market return on the All-Share Index.
α	Alpha for the portfolio

Share price adjustments are imperative to eliminate certain events or changes in a company's structure that discontinuously changes a company's nominal stock price, especially if the change or event is due to corporate actions. The issuance of dividends by REITs discontinuously changes the nominal share price of the REITs. The share price, which represents the returns of the respective REITs, will be adjusted for dividends – as dividends impact the stock's total returns (Abraham, 2016).

The closing prices on the shares/ All-Share Index (ALSI) and R186 were adjusted by assuming that on declaration date the investor would purchase more shares with their dividends/coupons. Geometric returns and standard deviation were used instead of the conventional average returns and standard deviation because the geometric method takes into account the compounding that occurs from period to period. Thus, the new dividend adjusted price of the share would be:

$$P_{adj,t} = Pt * (\#shares_{t-1} + \frac{P_t}{dps_t}) \qquad \text{Equation 4}$$

Symbol	Description
$P_{adj,t}$	Adjusted share price

$\boldsymbol{P_t}$	Share price before the price adjustment
$\#\boldsymbol{shares_{t-1}}$	Number of accumulated shares prior to dividend declaration
$\boldsymbol{dps_t}$	Cash dividend per share issued at time t

Geometric returns and standard deviation have been used instead of the conventional average returns and standard deviation as the geometric method considers the compounding that occurs from period to period.

3.3.2. Regression Analysis

The panel regression was firstly applied to all REITs in the study to produce results for the entire period under study and then for the sub-periods (pre-crisis, during the crisis and post-crisis) in the study.

The basic form of the panel regression employed to explain the risk-adjusted returns of real estate securities is specified as follows:

$$S_{it} = \varphi_i + \beta X_{it} + \gamma M_{it} + \mu_{it} \qquad \text{Equation 5}$$

(Refer to table 2 for an explanation of variables)

3.3.2.1. Explanatory variables

The explanatory variables in the regression models can be classified into two categories: X_{it} is the predetermined vector of firm-specific attributes, and M_{it} represents the time-variant macroeconomic factors. In total, six firm-specific attributes and three

macroeconomic factors are incorporated into the regression models. Six fundamental factors—size (natural log of market capitalization), book-to-market value ratio (book value of equity/ market value of equity), debt ratio (book value debt/book value total assets), dividend yield (dividend per share/ market price per share), property asset intensity ratio (Book value of property assets/ book value of total assets) and effective tax of the individual firms—were included in the regression models to explain the cross-sectional variations in real estate returns. Three macroeconomic factors- interest rates (the Prime interest rate), inflation (Consumer Price Index (CPI)) and Real GDP growth (Ooi & Liow, 2004).

Larger REITs have more resources to identify good real estate opportunities to include in their portfolios, thus enhances return prospects. Therefore, expected risk will be lowered by the return prospects and expected risk-adjusted returns will increase, as supported by Ooi and Liow (2004).

Book-to-market measures the asset quality and in turn captures the growth potential of the REITs. It is expected that the potential for growth increases if REIT managers include quality real estate in their portfolios, as supported by Ooi and Liow (2004). Therefore, the expected relationship between book-to-market and risk-adjusted returns is that risk-adjusted returns are positively correlated to book-to-market.

The debt ratio measures the relationship between book value of debt and total book value of assets. Debt is used to leverage returns and more debt increases returns if the entity does not increase default risk. Given that property carries lower risk relative to other securities, an aggressive capital structure is expected. The more aggressive the capital

structure the greater the risk-adjusted returns the REITs will generate if the returns can absorb default risk (Miller and Modigliani theory), as supported by Ooi and Liow (2004).

REITs mostly attract income-seeking investors. Therefore, a higher dividend yield is expected, as property is an income-generating asset. High dividend yields attract more investors thus reducing perceived risk if the REIT is able to pay the dividend. High dividend yields are expected due to investors preferring dividends over capital appreciation as it reduces their risk (Bird-in-hand theory) and based on section 25BB of the Income Tax Act a REIT is supposed to distribute at least 75% of its income to its shareholders, as supported by Gu and Kim (2003).

The property asset intensity ratio measures how well fund-managers deployed investments to generate returns. A strong deal pipeline should lead to higher returns. It is expected that managers who have a strong deal pipeline will generate higher risk-adjusted returns, as supported by Ooi and Liow (2004).

An increase in inflation is due to increase property income returns, as inflation will increase property replacement costs thus increasing the value of the property. Furthermore, rental will increase with higher inflation. This provides a hedge against dropping property prices catalysed by reduced demand to own property, which in turn is affected by rising interest rates. Therefore, it is expected that REIT returns will increase if inflation increases, as supported by Mull and Soenen (1997).

Prior literature suggested that an increase in interest rates leads to a decrease in property returns, as high interest rates decrease the capital gains portion of the returns. Therefore, it is expected that risk-adjusted returns will increase during periods of lower interest rates

and start to decline as interest rates increase, as supported by Devaney (2001). The prime rate was selected as it has an effect on the ability to fund property investments.

Effective tax measures the ability that managers have to manage or structure their tax affairs. Conventionally, lower effective tax rate leads to an increase in profitability as the cost of tax is lower. However, the tax treatment of South African REITs is of a specialised nature and normal effective tax measurement rules do not apply. As per Section 25BB of the Income Tax Act, REITs are exempt from capital gains tax when they dispose of their immovable property and they are afforded a deduction for the rental income (as defined) distributed to its investors (JSE, 2018). REITs are required to distribute at least 75% of their rental income as dividends, which entails that at least 75% of their returns are exempt from taxation. Therefore, it is expected that REITs effective tax will not influence the direction of returns as 75% or more of the returns are not taxed. Secondly, investors value dividends more than capital appreciation if dividend taxes are lower than capital gains tax. As dividend tax (20%) is higher than capital gains for the highest tax bracket (18%), it is expected that investors prefer capital appreciation (JSE, 2018). Due to the nature of the tax treatment of a REIT, the effective tax of REITs is significantly low and therefore, would have an insignificant effect on the performance of South African REITs post 1 April 2013. The income tax of PLS companies was taxed in the hands of the company at a rate of 28%, therefore effective tax could have had an influence on the performance of these property investment vehicles (Kantilal, 2016). However, as the significance of influence on the performance of PLS companies is very low as well, effective tax was excluded as a firm-specific variable for the purposes of this study.

An increase in real GDP will in turn increase property returns, as an increase in GDP means that the country's economy is growing, and individuals have more money to invest in REITs (Liow and Webb, 2009).

3.3.2.2. The Panel Regression Models

In order to test the research questions, the panel regression model presented as Equation 5 has been used in the following manner:

1) The following panel regression model will be utilised to explain the factors that drive the performance of each REIT sector:

$$S_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \mu_{it}$$ Equation 6

(Refer to table 2 for an explanation of variables)

Where, μ_{it} represents any unobservable firm- or country-specific effect that is not included in the regression model, and v_{it} represents the remaining disturbances in the regression, which varies with individual firm and time (Ooi & Liow, 2004). In the estimation model, μ_{it} is fixed for each company over the study period. This represents the effects of omitted variables unique to each company that stay constant over time.

2) The following panel regression model includes a sector indicator variable to explain how the REIT sectors perform against each other:

$$S_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \emptyset_e I_{eit} + \mu_{it}$$ Equation 7

(Refer to table 2 for an explanation of variables)

3) To capture REIT performance across different states of the market the panel regression model was expanded to include an indicator variable to explain the performance of REITs during the 2007 financial crisis, before the crisis and after the crisis period:

$$S_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \psi_c E_{cit} + \mu_{it} \qquad \text{Equation 8}$$

Table 2: Description of independent and dependent variables for equations 4-7,

Symbol	Description	Variable Symbol	Description
it	Denote the cross-sectional and time-series dimensions respectively, i.e. ith REIT in time t.		
S_{it}	The excess returns, measured by the Treynor ratio, Jensen ratio and Sharpe ratio.	SR	Sharpe Ratio
		TR	Treynor Ratio
		JA	Jensen's Alpha
X_{it}	The predetermined vector of firm-specific attributes, which are size, book-to-market value, capital structure (using book value debt ratios) dividend yield,	DA	Debt-to-Asset Ratio, $\frac{Book\ value\ of\ debt}{Book\ value\ of\ total\ assets}$
		BTM	Book-To-Market Ratio, $\frac{Book\ value\ of\ equity}{Market\ value\ of\ equity}$

	property asset intensity ratio, as supported by Ooi and Liow (2004), Gu and Kim (2003) and Alcock et al. (2013).	PAI	Property Asset Intensity Ratio, $\frac{Book\ value\ of\ property\ assets}{Book\ value\ of\ total\ assets}$
		DIVY	Dividend Yield, $\frac{Dividend\ per\ share}{Market\ price\ per\ share}$
		LNMARC	Natural log of Market Capitalisation
$\boldsymbol{M_{it}}$	The time-variant vector of macroeconomic factors, which are interest rates and inflation as used by Chen et al. (1998) and Ooi and Liow (2004).	INF	Inflation, the CPI
		RGDP	Real Gross Domestic Product growth
		INTP	Prime Interest Rate
$\boldsymbol{\varphi}$	Intercept		
$\boldsymbol{\mu_{it}}$	An error term that can be further specified as $\mu_{it} + \nu_{it}$		
$\boldsymbol{\gamma}$	Column matrices of the partial regression coefficients for the macroeconomic variables to be estimated (Ooi & Liow, 2004).		
$\boldsymbol{\beta}$	Column matrices of the partial regression coefficients for the firm specific variables to be estimated (Ooi & Liow, 2004).		

I_e	An indicator variable that captures the relative performances of the different REIT sectors i.e. diversified industrial, office, hotel and resort, residential, retail and specialty REITs. These indicator variables will take on 1 or 0. N-1 indicator variables were included in the regression model i.e. 6 indicator variables	RETR	Retail REITs, these REITs only invest in Retail property.
		DIVR	Diversified REITs, these REITs invest in different types of property.
		OFFR	Office REITs, these REITs only invest in office spaces.
		INDR	Industrial REITs, these REITs only invest in industrial property.
		HORES	Hotel and Resort REITs, these REITs only invest in hotels and resorts.
		RESR	Residential REITs, these REITs only invest in residential property.
		SPECR	Specialized REITs, these REITs only invest in a unique mix of property types and collect rent from tenants. These property types include movie theatres, casinos and outdoor advertising sites.
$\emptyset_e$ and ψ_c	Regression coefficients, $\emptyset_e$ is associated with the variable that captures the relative performance of the REIT sectors and ψ_c is associated with the different crisis periods.		

n	The n^{th} macroeconomic factor		
k	The k^{th} firm specific factor		
E_{cit}	The different crisis periods i.e. pre-crisis period, during the crisis and the post-crisis period. N-1 indicator variables were included in the regression model i.e. 2 indicator variables	PRECR	Pre-crisis (January 2000 to November 2007)
		CRIS	During the crisis (December 2007 to June 2009)
		POSTCR	Post-crisis (July 2009 to December 2017).
ROErsi	Return on equity for each REIT sector		
REITseci	The return on equity for each REIT sector minus the average return on equity for each REIT sector		

3.4. Population and study sample

The population for this study is JSE listed and delisted real estate investment trusts. This comprises of a total of 57 REITs, according to the McGregor BFA databases (formerly known as IRESS). As the study will analyze all listed and delisted REITs, the population represents the sample size; however, 2 REITs were excluded due to the companies listing post 31 December 2018. Firm years were excluded from the sample size where there was insufficient financial data available. Furthermore, some REITs initially had Class A and B shares, which were later consolidated. Thus, data of the surviving class was used, and it was assumed that the financial behavior represented the behavior of the class that

was terminated. Following these sampling criteria, the final sample comprised of 55 REITs consisting of a total of 434 firm-year observations.

The sample includes both JSE-listed and -delisted REITs, to avoid survivorship bias. The trusts in total represent a majority of the REIT population in South Africa, which have available information (listed and delisted entities). Therefore, this is a representative sample of the industry. Table 3 provides a breakdown of the total sample used in the study.

The frequency of data is annual as REITs pay their dividends yearly, therefore this made it easier for data to be comparable and for returns, betas and standard deviations to be calculated.

Table 3: Total number of listed and delisted S.A REITs

REIT Sectors	Total Number of Companies	Listed Companies	Delisted Companies
Diversified	28	22	6
Hotel and Lodging	0	0	0
Industrial and Office	8	5	3
Residential	2	2	0
Retail	16	13	3
Specialized	3	2	1
Totals	**57**	**44**	**13**

The data to be used for the purposes of this study was from three main sources, namely the OSIRIS database and IRESS database for the firm data and Business Monitor Online (BMI) for the macroeconomic data.

3.5. Model Specification and Diagnostic Tests

In order for the risk-adjusted performance measures to be used, all the data used in the study was tested to determine if it is normally distributed as non-normally distributed data can distort the results of the ratios used for analysis (Ledoit & Wolf, 2008).

3.5.1 Model Specification

Model specification tests were performed in order to determine the linear relationship that exists between the dependent and independent variables and in order to determine whether additional variables had to be included in the analysis.

A two-way graph was used to test whether the independent variables have a linear relationship with the dependent variable. The test was conducted for each dependent variable, namely, the Sharpe ratio, Treynor ratio and the Jensen's Alpha. The test indicated that a linear relationship exists between the firm-specific and macroeconomic variables and the Sharpe, Treynor and Jensen's Alpha. The Treynor shares a horizontal linear relationship with majority of the firm-specific variables. REITS with BTM>100 were excluded for being outliers; one REIT company was excluded for being an outlier.

3.5.2 Diagnostic Tests

The test for the normal distribution of y-variables was conducted using a histogram (10 number of bins) and the results indicated that the Sharpe ratio is reasonably normally distributed, however minor outliers existed leading to a slight right-skewed distribution. Observations where Treynor index was greater than 100 were excluded which made the data conform to a normal distribution.

Multi-collinearity between independent variables is a common problem; therefore the independent variables in the regression model was tested for multi-collinearity (Gu & Kim, 2003), by examining the variance inflation factor (VIF) of independent variables and the correlation matrix (using a pairwise correlation).

A test for multi-collinearity was conducted and this was achieved through a correlation matrix (pairwise correlation) and VIF. A 90% significance level was used to identify significantly correlated variables. The VIF test performed indicated that there was no risk of multi-collinearity for each of the dependent variables as the mean VIF was 1.47 for the first regression model ran (equation 6). The VIF test produced results indicating insignificant multi-collinearity for the third regression model (equation 8), as the Mean VIF was less than 2.6. Refer to the Appendix for the VIF results and table 6 for the pairwise correlation results. Breusch Pagan test was also performed to test for heteroscedasticity in the panel regression model. This is because the “white robust errors” or random disturbance in the relationship between the independent variables and the dependent variables should be the same across all values of the independent variables. To further avoid a multicollinearity problem, N-1 variables were used when running the regression models, i.e. where there were 3 indicator variables, only 2 indicator variables were used.

Hausman's Test was performed to identify whether a random or fixed effects panel regression should be relied upon. Table 4 summarises the type of panel regression model that should be used for each model and dependent variable.

Stata (Data analysis and statistical software) was utilized to perform these tests.

Table 4: Results from the Hausman's Test

Regression Model	SR	TR	JA
Model 1	Fixed Effects Prob>chi2 = 0.058	Random Effects Prob>chi2 = 0.9788	Fixed Effects Prob>chi2 = 0.0000
Model 2	Fixed effects at the 90% confidence level; Random effects at the 95% level Prob>chi2 = 0.0702	Random Effects Prob>chi2 = 0.9793	Fixed Effects Prob>chi2 = 0.0001
Model 3	Random Effects Prob>chi2 = 0.3680	Random Effects Prob>chi2 = 0.9526	Fixed Effects Prob>chi2 = 0.0500

Chapter 4

4. Empirical Results

This section will focus on presenting the descriptive analysis and the regression results. The regression results will be discussed under the following headings:

- Determinants of Risk-adjusted Performance
- Comparison Performance between REIT Sectors
- Performance analysis during different periods of crisis

Both the fixed and random effects as well as heteroscedastic and non-heteroscedastic results are presented. This has been done to provide all the possible results on REIT performance.

4.1 Descriptive Analysis

Table 5 presents the results of the descriptive analysis. The sample included a total of 433 observations. The mean for the Sharpe, Treynor and Jensen's Alpha 0.031, 1.284 and 0.086 respectively. The Treynor Index provided the highest average risk-adjusted returns. The minimum return and maximum return for the Treynor index is -30.194 and 417.617. The mean, min and max returns and the geometric standard deviation of 20.436 indicate that the returns are largely disbursed. Treynor Index produced the highest returns, however, the mean and standard deviation are not appropriate as the index is significantly skewed, as the skewness and kurtosis are 19.594 and 399.747. The Sharpe and the Jensen's Alpha are reasonably distributed, and the data is not largely disbursed, therefore, more reliance can be placed on the regression results of the Sharpe Ratio and the Jensen's Alpha.

Table 5 further provides measures of central tendency and the measures of spread for the firm-specific variables. The dividend yield and market capitalization of the REITs are relatively higher than the other firm-specific variables with means of 3.5 and 2.7 respectively. The dividend yield results corroborate the fact that South African REITs payout high dividends on a regular basis. The data of the different firm-specific variable are normally distributed as they are normally skewed, apart from the market capitalization, which is slightly skewed as its skewness is 3.134 and the kurtosis is 13.538 – this is slightly higher than the skewness and kurtosis of the other variables.

Table 5: Descriptive statistics: Returns - Financials

	Count	mean	med	min	max	sd	skewness	Kurtosis
SR	433	0.031	0.028	-0.246	0.628	0.062	2.213	26.095
TR	433	1.284	0.241	-30.194	417.617	20.436	19.594	399.747
JA	433	0.086	0.087	-0.856	1.877	0.221	1.195	15.863
DA	433	0.484	0.439	0.000	1.107	0.287	0.251	2.026
BTM	433	0.678	0.701	0.000	3.338	0.517	0.785	4.502
PAI	433	0.838	0.893	0.000	1.959	0.365	0.310	6.329
DIVY	433	4.520	3.947	0.000	20.162	4.657	0.749	2.960
MARC	433	8.32e+09	2.70e+09	1.19e+06	9.94e+10	1.48e+10	3.134	13.538
Observations	433							

Sd = standard deviation; med = median, which means that 50% of the estimates will exceed the 50^{th} percentile. Min is the minimal value and max is the maximum value.

The pairwise correlation test (Refer to Table 6) indicated that there is a significant level of correlation between the Sharpe ratio and the property asset intensity ratio, book-to-market, prime interest rate and ln(market capitalisation). The test indicated that there is a significant level of correlation between the Treynor ratio and office REITs and REITseci; there was a significant level of correlation between the Jensen's Alpha and book-to-market, property asset intensity, size and Hotel and Resort REITs. The book-to-market and interest rates are negatively correlated to the Sharpe, Treynor and Jensen's Alpha.

While all the other firm-specific and macroeconomic variables are positively correlated to the Sharpe, Treynor and Jensen's Alpha.

Table 6: Correlation matrix

	sr	tr	ja	da	btm	pai	divy	lnmarc	inf	rgdp	intp	reitseci
sr	1.000											
tr	0.010	1.000										
ja	0.947***	0.014	1.000									
da	0.014	0.038	0.030	1.000								
btm	-0.207***	-0.030	-0.203***	-0.525***	1.000							
pai	0.153**	0.008	0.172***	0.260***	0.025	1.000						
divy	0.050	0.038	0.087	0.199***	-0.300***	-0.172***	1.000					
lnmarc	0.244***	-0.014	0.234***	-0.280***	0.143**	0.019	-0.217***	1.000				
inf	0.031	-0.017	-0.013	-0.065	-0.007	-0.086	0.159***	0.002	1.000			
rgdp	0.011	0.011	0.063	0.146**	-0.232***	-0.013	0.355***	-0.193***	0.142**	1.000		
intp	-0.093	-0.036	-0.049	0.032	-0.062	-0.063	0.366***	-0.230***	-0.413***	0.294***	1.000	
reitseci	0.025	0.085	0.020	-0.024	-0.018	-0.016	0.028	-0.061	-0.003	0.126**	0.134**	1.000

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2. Regression results

4.2.1 Determinants of Risk-adjusted Performance

The panel regression results present the determinants of risk-adjusted performance for the whole sample period (the panel results are shown below). To identify the determinants of risk-adjusted returns, the Sharpe Ratio, Treynor Ratio and the Jensen's Alpha of the sampled firms were regressed against the firm-specific and macroeconomic variables.

4.2.1.1. Sharpe Ratio

The Hausman test confirmed that the fixed-effects model is the most appropriate regression model for the Sharpe ratio (refer to Table 4 above). The models are valid as the prob>f is 0 for random and fixed effects regression models. The R-squareds indicate that 12% of the variance in the Sharpe Ratio is explained by the independent variables.

The results from the fixed-effects model, refer to Model 1A and 1B, (controlled and not controlled for heteroscedasticity) indicated that there is overwhelming evidence that book-to-market and size of the REIT significantly influences the risk-adjusted performance of South African REITs, on a systematic measure of risk. The book-to-market is negatively correlated to the returns and the results indicated that size is positively correlated to the risk-adjusted returns. The relationship between performance and size aligned with our expectation. There is strong evidence as well that dividend yield significantly influences the risk-adjusted performance of REITs when the regression is not controlled for heteroscedasticity (refer to Model 1B). The dividend yield is positively correlated to the

Sharpe risk-adjusted returns and this supports our expectations.

Table 7: Regression results - Model 1 – Sharpe Ratio

$$SR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \mu_{it}$$

	A		B		C		D	
VARIABLES	FE	Se	FE Het	Se	RE	se	RE Het	se
da	-0.005	(0.017)	-0.005	(0.029)	-0.013	(0.015)	-0.013	(0.025)
btm	-0.039***	(0.008)	-0.039***	(0.009)	-0.038***	(0.007)	-0.038***	(0.007)
pai	0.012	(0.012)	0.012	(0.022)	0.019**	(0.010)	0.019	(0.019)
divy	0.002**	(0.001)	0.002	(0.002)	0.001*	(0.001)	0.001	(0.001)
lnmarc	0.020***	(0.004)	0.020***	(0.005)	0.015***	(0.003)	0.015***	(0.003)
inf	0.002	(0.001)	0.002	(0.002)	0.001	(0.001)	0.001	(0.001)
rgdp	0.001	(0.002)	0.001	(0.002)	0.001	(0.002)	0.001	(0.002)
Constant	-0.415***	(0.089)	-0.415***	(0.115)	-0.303***	(0.066)	-0.303***	(0.069)
Observations	433		433		433		433	
R-squared	0.126		0.126		0.1234		0.1234	
REITs	55		55		55		55	
Prob > F	0.000		0.000		0.000		0.000	
R2 within	0.126		0.126		0.1234		0.1234	
R2 between	0.220		0.220		0.3004		0.3004	
R2 overall	0.125		0.125		0.1754		0.1754	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.1.2. Treynor Index

The Hausman test (refer to Table 4) established the random-effects regression model is the most appropriate model for the Treynor ratio. It would seem that other variables, perhaps more aligned to measuring systematic risk are drivers of the Treynor Index as the regression models had very low R-squareds and were not valid.

The Treynor ratio did not present strong evidence of significant determinants. The random-effect regression controlled for heteroscedasticity (refer to Model 1H) presented

weak evidence that the property asset intensity significantly and negatively affects the risk-adjusted returns of SA REITs.

Table 8: Regression results - Model 1 – Treynor Ratio

$$TR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \mu_{it}$$

	E		F		G		H	
VARIABLES	FE	se	FE Het	se	RE	se	RE Het	se
da	1.169	(1.593)	1.169	(0.923)	-0.083	(0.864)	-0.083	(0.439)
btm	0.158	(0.720)	0.158	(0.398)	-0.097	(0.455)	-0.097	(0.190)
pai	-0.697	(1.116)	-0.697	(0.806)	-0.529	(0.565)	-0.529*	(0.298)
divy	0.015	(0.071)	0.015	(0.062)	-0.005	(0.051)	-0.005	(0.055)
lnmarc	0.376	(0.339)	0.376	(0.264)	0.032	(0.125)	0.032	(0.077)
inf	-0.082	(0.126)	-0.082	(0.097)	-0.114	(0.114)	-0.114	(0.109)
rgdp	0.136	(0.144)	0.136	(0.106)	0.119	(0.128)	0.119	(0.102)
Constant	-8.528	(8.224)	-8.528	(5.683)	0.402	(3.263)	0.402	(1.435)
Observations	432		432		432		432	
R-squared	0.010		0.010		0.0064		0.0064	
REITs	55		55		55		55	
Prob > F	0.872		0.004		0.004		0.004	
R2 within	0.010		0.010		0.0064		0.0064	
R2 between	0.001		0.001		0.0808		0.0808	
R2 overall	0.004		0.004		0.0091		0.0091	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.1.3. Jensen's Alpha

The Hausman test (refer to Table 4) indicated that focus should be placed on the random-effects regression model. The regression models are valid as the prob>f is 0 for all the different models (refer to Model 1I to 1L) and the R-squareds indicated that 10% of the variance for the dependent variables is explained by the independent variables.

The Jensen's Alpha yielded results that suggested that the firm-specific variables and real GDP influence the risk-adjusted returns of South African REITs (the results are found below). The random-effects regression model not controlled for heteroscedasticity (refer to Model 1K) presented overwhelming evidence that the book-to-market and the size of the REIT play a significant role in determining the risk-adjusted returns of South African REITs. The book-to-market is negatively correlated to returns, however, size is positively correlated to returns. There is also strong evidence that property asset intensity, dividend yield and real GDP positively influences the returns of these REITs. The regression model controlled for heteroscedasticity (refer to Model 1L) had overwhelming evidence favouring the size of the REIT and strong evidence suggesting that real GDP and book-to-market should be areas of focus for portfolio managers in their asset allocation decisions and that these variables are positively correlated to returns.

Table 9: Regression results - Model 1 – Jensen's Alpha

$$JA_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \mu_{it}$$

	I		J		K		L	
VARIABLES	FE	se	FE Het	se	RE	se	RE Het	se
Da	0.072	(0.061)	0.072	(0.110)	0.008	(0.052)	0.008	(0.088)
Btm	-0.076***	(0.027)	-0.076	(0.061)	-0.089***	(0.024)	-0.089**	(0.045)
Pai	0.032	(0.043)	0.032	(0.083)	0.069**	(0.034)	0.069	(0.069)
divy	0.007***	(0.003)	0.007	(0.005)	0.006**	(0.002)	0.006	(0.005)
lnmarc	0.071***	(0.013)	0.071***	(0.018)	0.053***	(0.010)	0.053***	(0.011)

inf	0.001	(0.005)	0.001	(0.006)	-0.001	(0.005)	-0.001	(0.006)
rgdp	0.013**	(0.005)	0.013**	(0.006)	0.011**	(0.005)	0.011**	(0.006)
Constant	-1.591***	(0.314)	-1.591***	(0.444)	-1.118***	(0.236)	-1.118***	(0.268)
Observations	433		433		433		433	
R-squared	0.108		0.108		0.1033		0.1033	
REITs	55		55		55		55	
Prob > F	0.000		0.000		0.000		0.000	
R2 within	0.108		0.108		0.1033		0.1033	
R2 between	0.160		0.160		0.2774		0.2774	
R2 overall	0.114		0.114		0.1786		0.1786	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

To consolidate the results from the three sub-models above, in South Africa larger REITs and REITs with a high dividend yield are most likely to generate larger risk-adjusted returns for their investors. This is in line with expectation, as larger REITs have more resources to choose wealth optimizing properties to add to their portfolios and REITs with higher dividend yields attract more investors which increases their stock price. However, book-to-market has an inverse relationship to risk-adjusted returns. This suggests that REITs with a lower book-to-market yield higher risk-adjusted returns. These results may have been heavily influenced by REITs such as Resilient REIT group of companies (Resilient, Fortress, Greenbay and Nepi Rockcastle) which were caught for market manipulation (by manipulating their financial statements) and insider trading during January 2018. This resulted in a drop in the performance of the Resilient REIT group on the JSE during the first quarter of 2018 (Africa Property News, 2019). The results contradict Ooi and Liow (2014), as the study on Asian REITs suggested that small sized

REITs with a high book-to-market produce higher returns on a risk-adjusted basis. Furthermore, Kim J (2012) indicated that book-to-market and size has a significant influence on the returns of Hotel REITs in the USA REIT market.

Interest rates are postively correlated to risk-adjusted returns but do not yield evidence of determining the returns of SA REITs. This further provides more contradictory evidence to the research of several authors such as (Chen et al., 1998; Ling & Naranjo, 2002). The evidence also suggests that REITs with higher gearing usually share a proportional relationship with returns, although it is insignificant, as suggested by the Treynor Index and the Sharpe Ratio.

Interest rates, inflation and financial gearing were not significant determinants of risk-adjusted returns of SA REIT.

4.2.2 Comparison Performance between REIT Sectors

Model 2 compares the performance of the REIT sectors with each other from 2000 to 2017. The random effects regression model controlled for heteroscedasticity for the Sharpe ratio, Treynor ratio and the Jensen's alpha produced the most significant results. The regression also indicated that the REITs produced negative returns over this period. The fixed effects regression model controlled and not controlled for heteroscedasticity did not produced any superior returns.

4.2.2.1. Sharpe Ratio

The Hausman test (refer to Table 4) indicated that both the fixed and random effects regression models are appropriate to explain the returns of the Sharpe ratio. The choice of a regression model type depended on the level of confidence the research paper sought, which is 90% for fixed effects and 95% for random effects. The models are valid as the prob>f is 0 for random and fixed effects regression models. The R-squareds indicate that 12% of the variance for the dependent variables is explained by the independent variables in the respective models.

The random effects regression model not controlled for heteroscedasticity did not produce any superior returns. However, the random effects regression model controlled for heteroscedasticity (refer to Model 2B) showed overwhelming evidence that Hotel and Resort REITs underperformed the market and there is weak evidence that Residential and Retail REITs also underperformed in the SA REIT market because the coefficient of the REITs is negative. On average Hotel and Resort REITs, Retail REITs and Residential

REITs, respectively, underperform Industrial REITs by 6.8%, 3.5% and 2.6%. Therefore, according to the Sharpe ratio Industrial REITs outperformed the other types of REITs.

Table 10: Regression results - Model 2 - Sharpe Ratio

$$SR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \emptyset_e I_{eit} + \mu_{it}$$

	A		B	
VARIABLES	RE	se	RE Het	Se
da	-0.009	(0.015)	-0.009	(0.026)
btm	-0.038***	(0.007)	-0.038***	(0.008)
pai	0.018*	(0.010)	0.018	(0.019)
divy	0.001*	(0.001)	0.001	(0.001)
lnmarc	0.016***	(0.003)	0.016***	(0.003)
inf	0.001	(0.001)	0.001	(0.002)
rgdp	0.001	(0.002)	0.001	(0.002)
intp	0.001	(0.002)	0.001	(0.003)
retr	-0.035	(0.050)	-0.035*	(0.020)
divr	-0.018	(0.049)	-0.018	(0.019)
offr	-0.013	(0.052)	-0.013	(0.019)
indr	-0.004	(0.064)	-0.004	(0.014)
hores	-0.068	(0.055)	-0.068***	(0.021)
resr	-0.026	(0.054)	-0.026*	(0.013)
reitseci				
Constant	-0.299***	(0.083)	-0.299***	(0.069)
Observations	433		433	
R-squared	0.1234		0.1234	
Number of REITs	55		55	
Prob > F	0.000		0.000	
R2 within	0.1234		0.1234	
R2 between	0.3004		0.3004	
R2 overall	0.1754		0.1754	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.2.2. Treynor Index

The Hausman test (refer to Table 4) indicated that the random effects regression model is appropriate to explain the returns of the Treynor Index. The random effects regression model is valid, however, the R-squared is low as only 0.6% of the variations in the risk-adjusted returns of REITs in South Africa are explained by the explanatory variables and the firm dummies.

The Treynor Index produced more evidence, as the random effects regression model controlled for heteroscedasticity (refer to Model 2D) showed that there is strong evidence that Office, Industrial and Residential have generated poorer returns per unit of systematic risk. Using a systematic measure of risk, the Treynor Index indicates that while the Hotel & Resorts REIT performs on par with the Specialty REITs, the other REIT sectors underperform the Specialty REITS on a risk-adjusted basis. In order of worst performer, the worst performers are the Residential REITs (73%), followed by Office REITs (72%), Retail REITs (63%), Industrial REITs (53%) and lastly Diversified REITs (44%). Hotel and Resorts REITs were the only REITs that produced positive returns.

Table 11: Regression results - Model 2 - Treynor Ratio

$$TR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \emptyset_e I_{eit} + \mu_{it}$$

VARIABLES	C RE	se	D RE Het	Se
da	-0.230	(0.933)	-0.230	(0.487)
btm	-0.066	(0.465)	-0.066	(0.193)
pai	-0.574	(0.575)	-0.574*	(0.305)
divy	-0.008	(0.052)	-0.008	(0.055)
lnmarc	0.046	(0.135)	0.046	(0.082)
inf	-0.117	(0.115)	-0.117	(0.111)
rgdp	0.127	(0.129)	0.127	(0.103)
intp	0.045	(0.140)	0.045	(0.144)
retr	-0.626	(2.886)	-0.626*	(0.350)

divr	-0.444	(2.865)	-0.444*	(0.247)
offr	-0.719	(2.997)	-0.719**	(0.315)
indr	-0.532	(3.468)	-0.532**	(0.253)
hores	0.517	(2.991)	0.517	(0.998)
resr	-0.728	(3.015)	-0.728**	(0.363)
reitseci				
Constant	0.597	(4.473)	0.597	(1.414)
Observations	432		432	
R-squared	0.0065		0.0065	
Number of REITs	55		55	
Prob > F	0.002		0.002	
R2 within	0.0065		0.0065	
R2 between	0.1338		0.1338	
R2 overall	0.0128		0.0128	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.2.3. Jensen's Alpha

The Hausman test (refer to Table 4) indicated that the fixed effects regression model is more appropriate to explain the results of the Jensen's alpha. However, despite the Hausman test indicating preference for the fixed effects model, we rely on the random effects because the paper intended to measure the impact of the REITs by using indicator variables. The regression models are valid as the prob>f is 0 and the R-squareds explained 10% of the variance in the explanatory variables that is caused by the Jensen's Alpha measured returns.

The random effects regression model controlled for heteroscedasticity (refer to Model 2F) produced results similar to the Sharpe ratio. The Hotel and Resort REIT has poorer results as the Jensen's Alpha show overwhelming evidence in this regard. All the REIT sectors show negative returns during the period under study. The Hotel and Resort REITs show

weaker returns than the Retail REITs as it has negative returns of 26%, while the Retail REITs have negative returns of 13%. Therefore, this indicates that none of the REIT sectors were able to navigate the listed property market that can be volatile from time to time.

Table 12: Regression results - Model 2 - Jensen's Alpha

$$JA_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \emptyset_e I_{eit} + \mu_{it}$$

	A		B	
VARIABLES	RE	se	RE Het	se
da	0.028	(0.053)	0.028	(0.094)
btm	-0.089***	(0.024)	-0.089*	(0.047)
pai	0.065*	(0.035)	0.065	(0.071)
divy	0.006**	(0.003)	0.006	(0.005)
lnmarc	0.057***	(0.010)	0.057***	(0.012)
inf	-0.000	(0.005)	-0.000	(0.006)
rgdp	0.012**	(0.005)	0.012**	(0.006)
intp	0.003	(0.006)	0.003	(0.012)
retr	-0.125	(0.178)	-0.125*	(0.071)
divr	-0.066	(0.173)	-0.066	(0.065)
offr	-0.035	(0.187)	-0.035	(0.073)
indr	-0.009	(0.227)	-0.009	(0.053)
hores	-0.260	(0.197)	-0.260***	(0.081)
resr	-0.042	(0.193)	-0.042	(0.046)
reitseci				
Constant	-1.134***	(0.293)	-1.134***	(0.259)
Observations	433		433	
R-squared	0.1033		0.1033	
Number of REITs	55		55	
Prob > F	0.000		0.000	
R2 within	0.1033		0.1033	
R2 between	0.2774		0.2774	
R2 overall	0.1786		0.1786	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

The results indicate that Hotel and Resort REITs produce results that are weaker than

Specialized REITs and its other peers. This shows that Hotel and Resort REIT portfolio managers have managed their assets poorly to optimize risk-adjusted returns. The different REIT sectors all had a beta that was less than 1, the lowest being Residential REITs (beta is 0.1767) and the highest being Industrial REITs (beta is 0.7503). The beta of South African REITs is in line with the U.S as the betas of REIT stocks in America are generally less than one (Chan, Hendershott, and Sanders, 1990). The betas indicated that on a normal basis, Industrial REITs should be more volatile than the other REIT sectors and Residential REITs should be less volatile. However, Industrial REITs generally made the least amount of losses as compared to the other REIT sectors and Residential REITs had higher losses than a number of the other REIT sectors.

4.2.3 Performance Analysis during different periods of crisis

Model 3 presents the regression results of the different periods of crisis. The R-squared values show that the explanatory variables and the set of dummy variables for the entities were able to explain 15%, 1% and 14% of the variation in the Sharpe, Treynor and Jensen's Alpha respectively.

4.2.3.1. Sharpe Ratio

There is evidence that during the financial crisis REITs' performance was higher than the performance during the other phases of the market performance. This contradicts Ooi and Liow (2004) as their study found that the financial crisis had an adverse impact on the performance of Asian REITs.

Table 13: Regression results - Model 3 - Sharpe Ratio

$$SR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \psi_c E_{cit} + \mu_{it}$$

VARIABLES	A RE	se	B RE Het	se
da	-0.014	(0.014)	-0.014	(0.025)
btm	-0.034***	(0.007)	-0.034***	(0.006)
pai	0.016*	(0.009)	0.016	(0.020)
divy	0.001	(0.001)	0.001	(0.001)
lnmarc	0.014***	(0.003)	0.014***	(0.003)
inf	-0.002	(0.002)	-0.002	(0.002)
rgdp	0.002	(0.002)	0.002	(0.002)
intp	-0.003	(0.003)	-0.003	(0.003)
precr	0.011	(0.013)	0.011	(0.013)
cris	0.029***	(0.010)	0.029**	(0.014)
Constant	-0.253***	(0.065)	-0.253***	(0.069)
Observations	433		433	
Number of REITs	55		55	
Prob > F	0.000		0.000	
R2 within	0.1410		0.1410	
R2 between	0.2539		0.2539	
R2 overall	0.1495		0.1495	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.3.2. Treynor Index

The Treynor ratio presented weak evidence that the period during the financial crisis significantly affected the returns of SA REITs and the performance was higher than the other market phases. This indicates that SA REITs produce significant returns even under periods of low growth in the economy.

Table 14: Regression results - Model 3 - Treynor Ratio

$$TR_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \psi_c E_{cit} + \mu_{it}$$

VARIABLES	C RE	se	D RE Het	se
da	-0.063	(0.865)	-0.063	(0.445)
btm	-0.023	(0.461)	-0.023	(0.207)

pai	-0.618	(0.569)	-0.618**	(0.309)
divy	-0.020	(0.054)	-0.020	(0.059)
lnmarc	0.039	(0.127)	0.039	(0.079)
inf	-0.242*	(0.147)	-0.242	(0.163)
rgdp	0.143	(0.140)	0.143	(0.110)
intp	-0.118	(0.214)	-0.118	(0.181)
precr	0.598	(1.010)	0.598	(0.558)
cris	1.151	(0.838)	1.151*	(0.674)
Constant	1.454	(3.352)	1.454	(1.466)
Observations	432		432	
Number of REITs	55		55	
Prob > F	0.000		0.000	
R2 adjusted	,		,	
R2 within	0.0111		0.0111	
R2 between	0.0761		0.0761	
R2 overall	0.0136		0.0136	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

4.2.3.3. Jensen's Alpha

Jensen's alpha indicates that the performances across the different cycles were not significantly different. The results further indicate that the market phases are positively correlated to the Jensen's Alpha.

Table 15: Regression results - Model 3 - Jensen's Alpha

$$JA_{it} = \varphi_i + \beta_n X_{nit} + \gamma_k M_{kit} + \psi_c E_{cit} + \mu_{it}$$

VARIABLES	E RE	se	F RE Het	se
da	0.001	(0.051)	0.001	(0.087)
btm	-0.086***	(0.025)	-0.086**	(0.040)
pai	0.072**	(0.034)	0.072	(0.075)
divy	0.006**	(0.003)	0.006	(0.005)
lnmarc	0.053***	(0.010)	0.053***	(0.011)
inf	-0.004	(0.006)	-0.004	(0.009)
rgdp	0.011*	(0.006)	0.011	(0.007)
intp	-0.004	(0.009)	-0.004	(0.013)
precr	0.031	(0.045)	0.031	(0.047)
cris	0.022	(0.037)	0.022	(0.054)

Constant	-1.069***	(0.235)	-1.069***	(0.281)
Observations	433		433	
Number of id	55		55	
Prob > F	0.000		0.000	
R2 within	0.1019		0.1019	
R2 between	0.2216		0.2216	
R2 overall	0.1420		0.1420	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects model; FE = heteroscedasticity-controlled fixed effects model; RE = random effects model; RE Het = heteroscedasticity-controlled random effects model; se = standard error

In summary, the evidence in model 3 is in support of model 1; in the sense that the evidence shows that size and book-to-market have a significant influence on the performance of SA REITs. The Sharpe ratio presents overwhelming evidence that size and the book-to-market ratio significantly influence the risk-adjusted returns and the same can be said of the Jensen's alpha. Property asset intensity results varied from weak evidence to strong evidence with the Sharpe ratio, Treynor ratio and Jensen's alpha respectively and the Jensen's alpha presented strong evidence that dividend yield significantly influences returns. The evidence also suggests that risk-adjusted returns were higher during the financial crisis than returns generated during the other periods of crisis. This is surprising as we expect REITs to perform better during periods where the market is positive or recovering from a state of crisis.

Chapter 5

5. Conclusion

This research analysed how different REITs performed against one another on a risk-adjusted basis and how South African REITs performed during different periods of the global financial crisis. The study further identified determinants of the performance of JSE-listed and delisted SA REITs. The purpose of the study was to isolate the performance of South African REITs, in order to compare the returns of REIT segments over a period of time and to identify REIT performance drivers. The study employed panel regression models to provide evidence that intended to enable investors to make more informed decisions in terms of which REITs would maximize their wealth and to help portfolio managers in developing REIT investment strategies. This study will add to the body of South African REIT research.

The empirical results are summarized in the table below and discussed thereafter.

Table 16: Summary of findings

Variable	**Model 1 Determinants**			**Model 2 Sector performance**			**Model 3 Market Conditions**		
	Sharpe Ratio (SR)	*Treynor's Index (TI)*	*Jensen's Alpha (JA)*	*SR*	*TI*	*JA*	*SR*	*TI*	*JA*
Intercept	Negative		Negative	Negative	Negative	Negative	Negative	Positive	Negative
Mtb	Proportional		Proportional	Proportional		Proportional	Proportional		Proportional
lnMarc	Proportional		Proportional	Proportional		Proportional	Proportional		Proportional
Divy			Proportional						
Pai		Inversely proportional			Inversely proportional			Inversely proportional	
rgdp			Proportional			Proportional			
Hotels & Resorts				Underperform (1)		Underperform (1)			
Retail				Under (2)	Underperform (3)	Under (2)			
Residential				Under (3)	Under (1)				
Office					Under (2)				
Industrial					Under (4)				
Diversified					Under (5)				
Crisis							Proportional		

The empirical evidence indicated that size, book-to-market, property asset intensity, dividend yield and real GDP growth influence the performance of South African real estate investment trusts. The results further revealed that South African REITs are not influenced by macroeconomic factors and the debt asset ratio, with the exception of real GDP growth.

The results further showed that South African REITs generated negative returns during 2000 – 2017. The different REIT segments do indeed have different and significant risk-adjusted performance and the Hotel and Resort REIT segment produced poorer risk-adjusted returns during the whole period of the study, as per the Sharpe and Jensen's Alpha. The Sharpe and Jensen's Alpha measures indicated that the different REIT segments produced negative returns and underperformed the market during the period of study. However, the Treynor Index produced evidence that indicate that only Hotel and Resort REITs produced positive returns and outperformed its peers. More reliance should be placed on the Sharpe and Jensen's Alpha measures as the Treynor ratio presented a very high standard deviation [20.43] which deviated away from the mean [1.28] (refer to Table 5 above).

Lastly, the evidence suggested that the period during the crisis significantly affected the risk-adjusted returns of SA REITs and REITs performed well during the crisis, but pre-crisis and post-crisis performance were not significantly different from each other. The results suggested that SA REITs perform well under difficult financial conditions and based on their high dividends and low gearing the REITs present great investing opportunities for investors.

The research has identified the key factors which investors should pay attention to and actively manage, in order to enhance returns and portfolio managers can develop REIT investment strategies. The findings will add to the existing body of REIT literature in South Africa and enable investors to make more informed decisions when investing in SA REITs.

Areas for further research

Further research can be done on the performance of South African REITs during different economic cycles and the comparison of the performance REITs in developing markets.

6. References

Abdul-Rasheed, A., Bioye Tajudeen, A., Muhammad Bashar, N., & Muibi Olufemi, S. (2008). Real estate security and other investment assets: A comparison of investment characteristics in the Nigerian stock markets. *Journal of Property Investment & Finance, 26*(2), 151-161.

Abdul-Rasheed, A., & Tajudeen, A. (2006). Performance analysis of listed construction and real estate companies in Nigeria. *Journal of Real Estate Portfolio Management, 12*(9), 177-186.

Abraham, T. (2016). The Comprehensive Guide to Stock Price Calculation. Retrieved from https://blog.quandl.com/guide-to-stock-price-calculation

Alcock, J., Baum, A., Colley, N., & Steiner, E. (2013). The role of financial leverage in the performance of private equity real estate funds. *The Journal of Private Equity*, 80-91.

Alpha, S. (Producer). (2018, 27 June 2018). Office REITs: Time To Focus On Secondary Markets. Retrieved from https://seekingalpha-com.cdn.ampproject.org/c/s/seekingalpha.com/amp/article/4183523-office-reits-time-focus-secondary-markets

Bhuyan, R., Kuhle, J. L., Al-Deehani, T. M., & Mahmood, M. (2015). Portfolio Diversification Benefits Using Real Estate Investment Trusts-An Experiment with US Common Stocks, Equity Real Estate Investment Trusts, and Mortgage Real Estate Investment Trusts. *International Journal of Economics and Financial Issues, 5*(4).

Brounen, D., & de Koning, S. (2013). 50 years of real estate investment trusts: an international examination of the rise and performance of REITs. *Journal of Real Estate Literature, 20*(2), 197-223.

Brueggeman, W. B., Chen, A. H., & Thibodeau, T. G. (1984). Real estate investment funds: Performance and portfolio considerations. *Real Estate Economics, 12*(3), 333-354.

Chan, K. C., Hendershott, P. H., & Sanders, A. B. (1990). Risk and return on real estate: evidence from equity REITs. *Real Estate Economics, 18*(4), 431-452.

Chan, S. H., Erickson, J., & Wang, K. (2003). *Real estate investment trusts: Structure, performance, and investment opportunities*: Oxford University Press on Demand.

Chen, K., & Tzang, D. (1988). Interest-rate sensitivity of real estate investment trusts. *Journal of Real Estate Research, 3*(3), 13-22.

Chen, S.J., Hsieh, C., Vines, T., & Chiou, S.-N. (1998). Macroeconomic variables, firm-specific variables and returns to REITs. *Journal of Real Estate Research, 16*(3), 269-278.

Chui, A. C., Titman, S., & Wei, K. J. (2003). The cross section of expected REIT returns. *Real Estate Economics, 31*(3), 451-479.

Devaney, M. (2001). Time varying risk premia for real estate investment trusts: A GARCH-M model. *The Quarterly Review of Economics and Finance, 41*(3), 335-346.

Emele, C. R., & Umeh, O. L. (2013). A fresh look at the performance and diversification benefits of real estate equities in Nigeria: Case study of real estate equity and some selected common stocks. *International Journal of Development and Sustainability, 2*(2), 1300-1311.

Estate, M. R. (Producer). (2017, 20 May 2018). Savills World Research: How Much Is The World Worth? Retrieved from http://www.mcguire.com/blog/2017/04/savills-world-worth/

Ewing, B. T., & Payne, J. E. (2005). The response of real estate investment trust returns to macroeconomic shocks. *Journal of Business Research, 58*(3), 293-300.

Fama, E. F., & French, K. R. (1992). The cross‐section of expected stock returns. *the Journal of Finance, 47*(2), 427-465.

Fisher, J., & Goetzmann, W. (2005). The performance of real estate portfolios: A simulation approach.

Georgiev, G., Gupta, B., & Kunkel, T. (2003). Benefits of real estate investment. *Journal of Portfolio Management, 29*, 28-34.

Goebel, P., & Kim, K. (1989). Performance evaluation of finite-life real estate investment trusts. *Journal of Real Estate Research, 4*(2), 57-69.

Gordon, J., Canter, T., & Webb, J. (1998). The effect of international real estate securities on portfolio diversification. *Journal of Real Estate Portfolio Management, 4*(2), 83-91.

Graeme, N. (2009). The impact of the global financial crisis on A-REITs. *Pacific Rim Property Research Journal, Vol 15*(No 4), 17.

Graeme, N., & James, W. (1996). Assessing risk for international real estate investments. *Journal of Real Estate Research, 11*(2), 103-115.

Gu, Z., & Kim, H. (2003). An examination of the determinants of hotel REITs' unsystematic risk. *Journal of Hospitality & Tourism Research, 27*(2), 166-184.

Gyourko, J., & Keim, D. B. (1993). Risk and return in real estate: evidence from a real estate stock index. *Financial Analysts Journal, 49*(5), 39-46.

Hamzah, A. H., Rozali, M. B., & Tahir, I. M. (2010). Empirical investigation on the performance of the Malaysian real estate investment trusts in pre-crisis, during crisis and post-crisis period. *International Journal of Economics and Finance, 2*(2), 62.

Hidayat, S. E., & Abduh, M. (2012). Does financial crisis give impacts on Bahrain Islamic banking performance? A panel regression analysis. *International Journal of Economics and Finance, 4*(7), 79.

Jensen, M. C. (1968). The performance of mutual funds in the period 1945–1964. *The Journal of finance, 23*(2), 389-416.

Jong L.H, a. T. L. B. (2015). Portfolio performance of M-REITs before, during and after the global financial crisis. *21st Annual Pacific-Rim Real Estate Society Conference Kuala Lumpur, Malaysia*.

JSE (Producer). (2018, 07 June 2018). Real Estate Investment Trusts (REITs). Retrieved from https://www.jse.co.za/content/JSEPresentationItems/REITs.pdf

Kantilal, H. (2016). *An analysis of the Real Estate Investment Trust tax regime on the South African property sector.* North-West University (South Africa), Potchefstroom Campus.

Kilian, A. (Producer). (2017, 20 May 2018). South African REITs make their mark among South Africa's top listed companies. Retrieved from: http://www.engineeringnews.co.za/login.php?url=/article/south-african-reits-

make-their-mark-among-south-africas-top-listed-companies-2017-11-20&functionality=1

Kim J, J. S. (2012). Comparative analyses of hotel REITs: Examining risk-return and performance characteristics. *International Journal of Comtemporary Hospitality Management, 24*(4), 594 - 613.

Kola, K., & Kodongo, O. (2017). Macroeconomic risks and REITs returns: A comparative analysis. *Research in International Business and Finance, 42*, 1228-1243.

Kryzanowski, L., & Tcherednitchenko, M. (2007). Performance of Canadian E-REITs. *International Real Estate Review, 10*(2), 1-22.

Kuhle, J. (1987). Portfolio diversification and return benefits—common stock vs. real estate investment trusts (REITs). *Journal of Real Estate Research, 2*(2), 1-9.

Kuhle, J., Walther, C., & Wurtzebach, C. (1986). The financial performance of real estate investment trusts. *Journal of Real Estate Research, 1*(1), 67-75.

Ledoit, O., & Wolf, M. (2008). Robust performance hypothesis testing with the Sharpe ratio. *Journal of Empirical Finance, 15*(5), 850-859.

Ling, D. C., & Naranjo, A. (2002). Commercial real estate return performance: a cross-country analysis. *The Journal of Real Estate Finance and Economics, 24*(1-2), 119-142.

Moskowitz, D. (Producer). (2018, 12 June 2018). What are Risks of Real Estate Investment Trusts (REITs)? . Retrieved from: https://www.investopedia.com/articles/investing/031915/what-are-risks-reits.asp#ixzz5JWRFCivD

Mull, S. R., & Soenen, L. A. (1997). US REITs as an asset class in international investment portfolios. *Financial Analysts Journal, 53*(2), 55-61.

Newell, G., & Osmadi, A. (2009). The development and preliminary performance analysis of Islamic REITs in Malaysia. *Journal of Property Research, 26*(4), 329-347.

News, A. P. (2017). South African property market worth $403-billion, *African Property News*. Retrieved from http://www.africapropertynews.com/southern-africa/3239-south-african-property-market-worth-403-billion.html

News, A. P. (Producer). (2019, 15 March 2019). SA REITs corporate governance under spotlight. Retrieved from www.africapropertynews.com/southern-africa/3366-sa-reits-corporate-governance-under-spotlight.html

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.

Olanrele, O. O., Said, R., & Daud, M. N. (2015). Comparison of REIT Dividend Performance in Nigeria and Malaysia. *African Journal of Business Management, 9*(16), 608-614.

Olanrele, O. O., Said, R., Daud, M. N., & Ab, R. (2015). *N-REIT Performance in the Face of Index Computation and Risk Adjusted Return.* Paper presented at the Pacific-Rim Real Estate Society Conference.

Ooi, J., & Liow, K.-H. (2004). Risk-adjusted performance of real estate stocks: Evidence from developing markets. *Journal of Real Estate Research, 26*(4), 371-396.

Osiris. (2018). Osiris Databases. Available from Osiris Retrieved 20 June 2018 https://0-osiris-bvdinfo-com.innopac.wits.ac.za/version-201875

Paul, A., Robert, K., & Carl, M. (1991). The risk-return attributes of international real estate equities. *Journal of Real Estate Research, 6*(2), 143-151.

SAREIT (Producer). (2016, 03 June 2018). Who should invest? Retrieved from http://www.sareit.com/101_WhoShouldInvest.php

Sharpe, W. F. (1966). Mutual fund performance. *The Journal of business, 39*(1), 119-138.

Stevenson, S., & Dimovski, B. (2014). The Long-Term Performance of Australian Reit IPOs. *Journal of Real Estate Literature, 20*(3), 151-165.

Titman, S., & Warga, A. (1986). Risk and the performance of real estate investment trusts: A multiple index approach. *Real Estate Economics, 14*(3), 414-431.

Van der Wijst, N., & Thurik, R. (1993). Determinants of small firm debt ratios: An analysis of retail panel data. *Small Business Economics, 5*(1), 55-65.

Zietz, E., Sirmans, S., & Friday, S. (2003). The environment and performance of real estate investment trusts. *Journal of Real Estate Portfolio Management, 9*(2), 127-165.

7. Appendix

7.1. List of REITs

No.	South African REITs	Date of delisting (if applicable)
1	Accelerate Prop Fund Ltd	N/A
2	Acucap Properties Ltd	2015/04/30
3	Annuity Properties Ltd	2014/06/30
4	Arrowhead Properties B	2016/02/29
5	Arrowhead Properties Ltd	N/A
6	Ascension Prop Ltd A	2017/04/30
7	Ascension Prop Ltd B	2015/08/31
8	Capital & Regional Plc	N/A
9	Capital Property Fund	2014/07/31
10	Capital Property Fund Lt	2015/11/30
11	Delta Property Fund Ltd	N/A
12	Dipula Income Fund A	N/A
13	Dipula Income Fund B	N/A
14	Emira Property Fund Ltd	N/A
15	Equites Prop Fund Ltd	N/A
16	Fairvest Property Hldgs	N/A
17	Fortress Reit Ltd A	N/A
18	Fortress Reit Ltd B	N/A
19	Fountainhead Prop Trust	2015/08/31
20	Gemgrow Properties Ltd A	N/A

21	Gemgrow Properties Ltd B	N/A
22	Growthpoint Prop Ltd	N/A
23	Hammerson Plc	N/A
24	Heriot Reit Limited	N/A
25	Hospitality Prop Fund A	2016/10/31
26	Hospitality Prop Fund B	N/A
27	Hyprop Inv Ltd	N/A
28	Indluplace Properties Lt	N/A
29	Intu Properties Plc	N/A
30	Investec Australia Prop	N/A
31	Investec Property Fund L	N/A
32	Liberty Two Degrees Ltd	N/A
33	Lodestone Reit Limited	2017/01/31
34	Newpark Reit Ltd	N/A
35	Oasis Crescent Prop Fund	N/A
36	Octodec Invest Ltd	N/A
37	Orion Real Estate Ltd	N/A
38	Premium Properties Ltd	2014/09/30
39	Rdi Reit P.L.C	N/A
40	Rebosis Property Fund Lt	N/A
41	Rebosis Property Fund Lt A	N/A
42	Redefine Properties Ltd	N/A
43	Resilient Reit Limited	N/A
44	Sa Corp Real Estate Ltd	N/A

45	Safari Investments Rsa L	N/A
46	Schroder Eur Reit Plc	N/A
47	Spear Reit Limited	N/A
48	Stenprop Limited	N/A
49	Stor-Age Prop Reit Ltd	N/A
50	Sycom Property Fund	2016/04/30
51	Texton Property Fund Ltd	N/A
52	Tower Property Fund Ltd	N/A
53	Transcend Res Prop Fd Ld	N/A
54	Vividend Income Fund Ltd	2014/08/31
55	Vukile Property Fund Ltd	N/A

7.2 VIF tests

7.2.1 Model 1

Sharpe Ratio, Treynor Index and Jensen's Alpha

Variable	VIF	1/VIF
intp	1.80	0.555280
da	1.70	0.589910
divy	1.56	0.642868
btm	1.53	0.652693
inf	1.52	0.655955
rgdp	1.30	0.767277
lnmarc	1.18	0.846967
pai	1.17	0.852407
Mean VIF	1.47	

7.2.2 Model 2

Sharpe Ratio and Jensen's Alpha

Variable	VIF	1/VIF
divr	53.61	0.018654
retr	42.20	0.023696
hores	11.82	0.084582
offr	10.80	0.092630
resr	8.86	0.112850
indr	3.02	0.331632
intp	1.90	0.527215
da	1.95	0.511853
divy	1.60	0.626583
btm	1.58	0.631474
inf	1.55	0.646853
rgdp	1.31	0.760515
lnmarc	1.37	0.729878
pai	1.20	0.832401
Mean VIF	10.20	

Treynor Index

Variable	VIF	1/VIF
divr	53.42	0.018720
retr	42.17	0.023713
hores	11.82	0.084586

offr	10.32	0.096864
resr	8.86	0.112860
indr	3.02	0.331636
intp	1.90	0.526667
da	1.95	0.512436
divy	1.61	0.622564
btm	1.58	0.631879
inf	1.55	0.645798
rgdp	1.32	0.760376
lnmarc	1.37	0.729964
pai	1.20	0.831951
Mean VIF	10.15	

7.2.3 Model 3

Sharpe Ratio and Jensen's Alpha

Variable	**VIF**	**1/VIF**
precr	4.91	0.203858
intp	4.49	0.222735
inf	2.55	0.392050
cris	2.29	0.436977
divy	1.74	0.574539
da	1.70	0.589346
btm	1.57	0.636095
rgdp	1.55	0.644170
lnmarc	1.22	0.820885
pai	1.19	0.838673
Mean VIF	2.32	

Treynor Index

Variable	**VIF**	**1/VIF**
postcr	6.50	0.153912
intp	4.49	0.222912
inf	2.55	0.391660
cris	2.49	0.401317
divy	1.75	0.572853
da	1.69	0.590217
btm	1.57	0.636553
rgdp	1.55	0.644062
lnmarc	1.22	0.820782
pai	1.19	0.838759

Mean VIF	2.50	