Offshore property investment and market performance of South African REITs: a regime-switching CAPM analysis

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Abstract

Purpose – The purpose of this study is to determine whether South African real estate investment trusts (REITs) with significant foreign real estate holdings produce better market performance metrics when compared to REITs with larger domestic holdings. The paper also provides a comprehensive overview of the market performance of South African REITs in the decade following the inception of the REIT regime in 2013.

Design/methodology/approach – The authors employ the capital asset pricing model (CAPM), using different estimation techniques to determine the stability of the estimated parameters over time. In addition to the CAPM framework, several basic and advanced portfolio performance metrics are computed to assess the performance of the various REIT portfolios.

Findings – The results show that REITs with significant offshore allocations produce superior market returns than their counterparts. Across most of the risk measures analysed, the foreign-biased REIT portfolios were found to be riskier. On the whole, foreign-biased REITs performed better on a risk-adjusted basis. The results were consistent across the different sample periods and the performance metrics analysed.

Practical implications – The results suggest that the decision to diversify internationally has implications for the pricing of REITs on stock markets. The differences in the performance metrics for the foreign- and home-biased REIT portfolios also imply an opportunity for investors to further diversify REIT portfolios by holding a mix of home-biased and foreign-biased REITs.

Originality/value – This paper is one of the few to consider the implications of international diversification on stock market performance rather than on more fundamental measures of REIT performance such as the net present value. This study also provides an emerging market (African) perspective to the literature.

Keywords Real estate investment trust, REITs, International diversification, Foreign bias, Home bias, Regime-switching CAPM, Portfolio performance, Downside risk, Tracking error, South Africa

Paper type Research paper

1. Introduction

Investors often invest in property as a way of diversifying their portfolios. Diversification within a property portfolio itself can be achieved by investing directly or indirectly in property. Diversification can also be achieved by investing in different property sectors or geographical areas. Geographical diversification can be achieved domestically or internationally (Adair

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et al., 1999). Studies such as Eichholtz *et al*. (2001), Wilson and Zurbruegg (2003) among others have found that, compared to the stock and bond markets, property markets exhibit a lower level of international correlation, making international property investment a good avenue for diversification.

South Africa formally adopted the REIT regime in 2013. From a value of under R50bn, the South African (SA) REIT market grew to R435billion before the market started to contract in 2017 (Pilusa *et al*., 2022). A key investment decision for South African REITs (SA REITs) over the past decade has been whether to diversify internationally or maintain a focus on SA direct properties. Offshore property investment among South African Property Companies has typically taken three forms: (1) Inward listing by non-South African property companies who continue to have significant investments outside the country, e.g. Investec Australia, Nepi Rockcastle; (2) Domestic South African REITs with significant investments outside the country, e.g. Vukile Property Fund, Growthpoint Properties, Fortress REIT Limited, Attacq Limited; (3) South African REITs with secondary listing outside the country, e.g. Growthpoint Properties Australia (Moja, 2019).

The average allocation to offshore property, which was nearly 0% at the inception of the REIT legislation grew to almost half of the portfolio of these REITs by 2018. Appendix 1 contains a Table provides a summary of the offshore allocation of SA Property companies based on a report by Moneyweb, based on data from Real Capital Analytics (Moneyweb, 2019). The Table shows that the majority of SA property offshore investments went to Central Europe (30%) and the remaining 1% went to the rest of Africa. In terms of sector exposure, 60% of the SA offshore property investments were invested in the Retail sector and the remaining was spread evenly between Office and Industrial property sectors. Appendix 2 is a list of SA REITs ranked according to their average foreign direct real estate allocations. Growthpoint Properties recorded the highest average offshore allocation of 35%. The highest allocation over the period was by Vukile Properties which invested as much as 56% offshore in a single year. We classified 14 out of the 26 REITs as foreign-biased at least once over the sample period, as they recorded an annual offshore allocation greater than the median for the individual years.

It is important to note that South African REITs are not subject to a limit on how much they can invest offshore. Like most global REITs, South African REITs must adhere to certain requirements. Key among these requirements is the requirement to derive at least 75% of their income from rental income or other unconsolidated REITs. They are also required to distribute at least 75% of their taxable income as dividends each year, and to maintain a maximum debt-to-asset ratio of 60% of the value of their gross assets (PricewaterhouseCoopers, 2021). The 2022 amendment to Regulation 28 of the Pensions Act (1956) specifies that not more than 45% of a retirement fund's assets can be invested offshore (National Treasury, 2022). This limit however doesn't affect REITs, even though retirement funds such as pension and provident funds are major investors in REITs.

In this study, we provide a comprehensive analysis of the performance of SAREITs, since the inception of the REIT regime in 2013. A key objective of this study is to analyse the impact that investment in direct property outside South Africa has on the market performance of SAREITs. We focus on market performance, rather than more fundamental measures such as return on assets/equity, net present values, etc. This approach enables us to capture investor sentiments about whether they believe that the international diversification strategy of these REITs is worthwhile. In an efficient market, superior performance of offshore property assets or portfolios would naturally translate into higher share prices, dividends, and eventually higher total returns. In this study, firms with offshore allocations falling above the median allocation for a particular year are classified as foreign-biased while those falling below this threshold are labelled home-biased. We collected ten years' worth of daily price and total return data as well as annual property allocations for our analysis.

There are a number of motivations for this study. South Africa introduced the REIT legislation about a decade ago (October 2013). This study uses daily data from the inception of the REIT regime to the end of 2022 to analyse the performance of SAREITs. This way, the study builds on Ntuli and Akinsomi (2017). Of particular interest to this study is the role that offshore/international diversification has played in the performance of these REITs. Gibilaro and Mattarocci (2016) noted a dearth of literature on the impact of the home-bias phenomenon outside the United States. They mention in particular that less developed REIT markets in Africa, Asia, and Europe have been particularly under-represented in the literature. Also, many of the US-based studies look at geographical diversification within the US rather than internationally.

Another imperative for this research is that, unlike other markets where a strong home bias has been found to exist, we have observed the opposite, with SAREITs investing more and more offshore. A report by Moneyweb (2019) described this as a form of "capital flight", with South African property companies, both listed and unlisted, continuing to invest billions offshore. Reasons attributed to this phenomenon include poor growth of the domestic South African economy, high taxes and municipal rates, political uncertainty, and security issues such as the invasion of construction sites by so-called "construction mafias". As of 2019, nearly half (47%) of South African property companies' holdings were held offshore – mostly in Central and Eastern Europe. This represents a huge jump as these property companies had virtually no allocation to foreign assets just ten years before.

Significant property deals by these companies have received a considerable amount of press coverage and public interest. For example, Robosis' decision to expand to the UK by acquiring a 62% stake in New Frontier Properties for R1.2bn received wide press coverage. The announcement led to a 15% share price growth (Muller, 2016). In 2019 the company announced that it was selling its stake for a mere R700. A circular issued to shareholders read in part: "The board of directors of Rebosis is of the opinion that the shareholding in New Frontier has been one of the reasons for a depressed Rebosis share price, due to the challenges New Frontier is facing being declining shopping mall valuations in the United Kingdom as a result of, amongst other matters, Brexit" (Rebosis Property Fund Limited, 2015). A BusinessLIVE Report quoted the Head of property funds at Stanlib as saying that the properties that Rebosis disposed of were some of its best retail assets, confirming the statement in the circular issued by the Board of Directors that its main concern was with the fall in the company's share prices which led to more than R100bn fall in the market value of the company between 2017 and 2019, in the wake of Brexit and the subsequent fall in value of UK properties (Anderson, 2019). With a focus on the Polish market, Redefine Property's offshore acquisitions appear to have had a lasting positive impact on the company's stock prices and market value. In November 2016, Redefine announced it had sealed a 1.2bn Euro deal for a Polish commercial property, making it the largest offshore property deal by a South African property company and also the largest single investment in investment property in Poland (Property24, 2016). In addition to several other strategic acquisitions, the company acquired a 51% stake in Stokado, Poland's second-largest self-storage operator in 2023. Later that year, the company acquired Top Box, a storage rental company (PropertyWheel, 2023). With these acquisitions, Redefine capitalised on a strong demand for storage space in Poland. Financial Mail reported that Redefine's stock price increased by nearly 30% within three months in 2024 (Muller, 2024). These events illustrate how the market prices of REIT stocks can be both positively and negatively impacted by their offshore property investment, irrespective of the performance of the underlying investment.

Given that this study is premised on comparing the return and risk performance of home-biased and foreign-biased REITs, theoretically, it is situated in the modern portfolio theory (MPT) of Markowitz (1952, 1959). The MPT formulated the problem portfolio formation or asset allocation as optimising the choice of mean (return) and variance (risk). Hence, his mean-variance portfolio theory proves that, fundamentally, the best result is obtained by holding variance constant and maximising expected return or holding expected return constant while minimising variance (Elton and Gruber, 1997). In this wise, we have applied the MPT by employing a battery of return and risk metrics to assess the performance of home-biased vis-à-vis foreign-biased in the SAREITs market. The ultimate goal is to reap the benefits of diversification (Hoesli and Lizieri, 2007) as the trade-off between risk and return by offshoring SAREITs.

Unlike previous studies, our study focuses on how offshore property investment indirectly influences stock prices through investor sentiment or the way in which investors perceive the offshore property deal. If investors believe that the timing and other circumstances surrounding a property deal or the future prospects of the properties held by a REIT are promising, they will respond by demanding the shares of that company, thereby placing upward pressure on the stock price. The reverse also holds true.

2. Literature review

Despite the well-known advantages of international diversification, the "home-bias" phenomenon where investors only invest in familiar environments and businesses that are visible to them, has been observed across many markets, both developed and developing (Coval and Moskowitz, 1999; Karlsson and Nordén, 2007; Ke *et al*., 2010). Coval and Moskowitz (1999) attributes the home bias phenomenon to the existence of national boundaries and a preference for geographical proximity. National boundaries refer to all the challenges or hurdles investors face as they move capital across political and monetary boundaries. These include exchange rate risk, regulatory controls, cultural differences, high transaction costs, taxation, and sovereign risk. Preference for geographic proximity refers to the tendency for investors and asset managers to be more comfortable with local firms and to have a desire to invest in their domestic economy.

Diversification within the real estate sector is the dispersion and spreading of available capital by investing in property in different geographical regions or sectors. As with other investments, diversification of property investments is aimed at reducing risk (Hoesli and Lizieri, 2007). Diversification allows investors to earn similar returns at a lower risk exposure (Ali, 2006). Several studies have investigated the drivers of international diversification. Lang and Stulz (1994) posit that investors in industries and economies with poor growth prospects tend to invest across other sectors, industries, or economies. In like manner, better growth prospects in foreign markets attract investments as the case is for many developing countries and their property markets (see Hamelink and Hoesli, 2004). In REITs, fierce domestic competition also drives asset allocation offshore, especially, in advanced markets such as the US (Mull and Soenen, 1997). International diversification is also a function of business strategy in terms of the blend between core and non-core investments. Doukas and Lang (2003) indicate that offshoring tends to bring more benefits and creates long-term shareholder value if it is a core business strategy than otherwise.

The relationship between diversification and the performance of real estate firms has also been the focus of a number of studies. Eichholtz *et al*. (2001) found that internationally diversified property companies underperformed their locally focused peers by about 2.7% per annum on a risk-adjusted basis. The underperformance was found to be due to informational disadvantages rather than transaction costs or foreign exchange risk. The study found that larger firms were able to reduce underperformance over time and with an increase in the scale of their investment offshore. Boer *et al*. (2005) also found that international diversification results in a loss of focus and negatively affects the performance of property companies.

Home bias in property investment has been noted by several studies. REIT portfolios, especially, have been found to be dominated by domestic properties with very little held offshore. Turnbull and Sirmans (1993) attribute this home bias among REITs to market imperfections which result in increased cost of information about potential property investments, especially for outside investors. Being a highly heterogeneous asset, the decision to invest in property depends on the ability to gather information to evaluate new opportunities. An increase in this cost results in lower returns than expected. McAllister (1999) identified the high cost of diversification, high research and transaction costs, liquidity challenges, and the day-to-day management required for properties, as challenges that hinder the ability of small property funds especially, from diversifying internationally. Ambrose *et al*. (2000) assert that geographical concentration leads to greater operational efficiency due to economies of scale.

The growth of unlisted real estate funds, indirect real estate vehicles, and third-party real estate service providers have helped to reduce the challenges associated with international real estate investment. De Wit (1997) suggests that investors seeking to invest outside their home countries should employ indirect property funds or listed property securities. Similarly, Steinert and Crowe (2001) recommend investment in more liquid and transparent real estate assets for the purposes of international diversification. Eichholtz *et al*. (2001) also advised that investors seeking to invest internationally do so through investing in foreign property funds or companies. They should only consider investing directly when they are able to invest as efficiently as local property companies.

3. Data and methodology

We collected daily price and total returns data on all REITs on the Johannesburg Stock Exchange (JSE) from the Eikon Database (Formerly Thomson Reuters DataStream). We also collected data on the asset allocation of these REITs, specifically on the geographical split of their assets both within and outside South Africa. The asset allocation data was sourced directly from the individual REITs. For the analysis in this paper, we only include the REITs for which we have asset allocation data over the entire 2013–2022 sample period. In total, we had data for 26 REITs.

In categorising firms for the purposes of portfolio construction, it is important to define what makes a firm “home-biased” or “foreign-biased”. One approach is to establish a threshold ab initio. Yen Keng (2004) for example classified Australian firms with foreign stock allocations greater than 20% as “international” while Moja (2019) used a threshold of 25% to classify South African firms as “foreign-biased”. Other studies use a more dynamic approach, with firms falling below or above the median, quartile or decile score being classified as “home-biased” (Gibilaro and Mattarocci, 2016, 2021). This approach is also used by industry practitioners and researchers when applying factor models which require the categorisation of firms into Small/Large or High/Low Market capitalisation firms (Fama and French, 2020; Gibilaro and Mattarocci, 2021; Kubota and Takehara, 2018).

In this study, REIT firms with offshore (foreign or non-South African) allocations above the allocation for all REITs in a particular year are classified as “foreign-biased”. The remaining REITs, those with offshore allocations below the median allocation, are classified as “home-biased”. Since the asset allocation data is only compiled once a year, we maintain the classification for the whole year, even for indices that have a frequency of less than a year (i.e. daily, weekly, monthly, etc.).

The foreign exposure of the individual REITs for each year is calculated based on the geographical split of assets of the various REITs using the following formula:

$$Foreign\,Bias = \frac{Value\ of\ Foreign\,Asset\,Holding}{Overall\,Portfolio\,Value} \tag{1}$$

Following Markowitz (1952), we calculate the return on a portfolio p at time t as the weight of the asset in a portfolio, multiplied by the return for that period. For a value-weighted portfolio, the weight for a particular asset is the market capitalisation at the end of the year divided by the combined market capitalisation of all the REITs classified as foreign-biased for that period. The same process is employed in the calculation of the returns of home-biased REIT portfolios.

$$R_{pt} = \sum W_{it} \times R_{it} \tag{2}$$

The daily return for each REIT is calculated using the following formula:

$$R_{it} = \frac{P_{it}}{P_{it\text{-}1}} - 1, \tag{3}$$

where P_{it} is the price of a REIT on a particular day, t and $P_{it\text{-}1}$ is the price of a REIT on a previous day, t−1.

The variance of a portfolio, according to Markowitz (1952) is calculated by summing up the weighted covariance matrix. Mathematically, this can be expressed as follows:

$$\sigma_{\mathrm{p}}^2 = \sum_{\mathrm{i}=1}^{\mathrm{n}} \sum_{\mathrm{j}=1}^{\mathrm{n}} \mathrm{w_i w_j Cov}(\mathrm{r_i}, \mathrm{r_j}), \tag{4}$$

where w_i is weight of the *ith* asset; w_j is weight of the *jth* asset, and $Cov(r_i, r_j)$ denotes the covariance between the *ith* and *jth* asset. In terms of the returns, we use both the price returns and total returns and, therefore, have a price index and a total return index for the home-biased as well as the foreign-biased REITs.

We use the Capital Asset Pricing Model (CAPM) to directly determine whether foreign-biased REITs perform better than their home-biased counterparts. The model was developed independently by Sharpe (1964), Treynor (1965, 1961), Lintner (1965), and Mossin (1966) to determine how the systematic (undiversifiable) risk of an investment drives its expected return (Perold, 2004). This model is the most prominent model in asset pricing with several formulations of the model in use. The excess return formulation of the CAPM which we use in this study is presented as

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + \epsilon \tag{5}$$

Based on the CAPM model, Jensen (1968) developed the Jensen's Alpha and proceeded to use it to analyse the performance of US mutual funds between 1945 and 1964. Jensen's Alpha has since become one of the most widely used measures among active investment managers as an industry standard for determining managers' ability to predict security prices well enough to be able to outperform the market.

$$Jensen's\,Alpha = R_{pt} - [R_{ft} + \beta(R_{mt} - R_{ft})] \tag{6}$$

Several studies have shown that the CAPM market beta alone does not explain unexpected excess returns on stocks. To make up for this deficiency, a number of multi-factor models have been developed. The most popular of these models include the Arbitrage Pricing Theory of Ross (1976), the three-factor model of Fama and French (1996), the four-factor models of (Carhart, 1997; Pástor and Stambaugh, 2003; Ross, 1976) formulated the Arbitrage Pricing Theory and proceeded to propose a multi-factor model in which the return of a security is explained by an unspecified number of macroeconomic variables. The identification of the specific variables is not straightforward, with different researchers and investment practitioners employing approaches such as principal component analysis and maximum likelihood estimation to identify the relevant macroeconomic factors (Trifan, 2009).

Fama and French (1996) extended the CAPM model by adding two additional factors – a market value factor (HML) and a size factor (SMB). Along with the market risk premium which is the sole factor in the CAPM model, the Fama-French model expresses the expected return of a security as a function of the return earned on the asset relative to the excess return earned on a well-diversified market portfolio, the additional return generated by small-cap stocks relative to large-cap stocks and the risk-premium earned on undervalued stocks relative to overvalued stocks. The two other factors in the Fama and French (1996) model were based on the works of (Basu, 1983; Banz, 1981). Carhart (1997) added a momentum factor (WML) to the Fama-French model. This factor was based on the study of (Jegadeesh and Titman, 1993) who found a tendency for the good or bad performance of a stock to persist over several months. The WML factor is often computed as the difference between the top 30% of firms on a market and those of firms in the bottom 30th percentile (Carhart, 1997; Chen and Fang, 2009; Rehnby, 2016). Pástor and Stambaugh (2003) on the other hand added the a liquidity variable (LIQ) to the (Fama and French, 1996) model. The variable LIQ captures the extra return that investors require for illiquid shares with illiquidity being defined as the chance that the shares cannot be sold without high implicit and explicit transaction costs.

Tests of the Capital Asset Pricing Model have often been based on the assumption that the measure of systematic risk, beta, is stable over time (Huang, 2000). Several empirical studies have, however, shown that this is not the case (Blume, 1971; Chen, 1982; Fabozzi and Francis, 1977; Levy, 1971). The time-varying nature of beta has been attributed to the influences of micro- and macro-economic factors on asset returns (Wijethunga and Dayaratne, 2015). To account for changes in the CAPM parameter estimates over time, a number of approaches have been suggested and used in empirical studies: Rolling correlations (Škrinjarić, 2014), recursive regression (Škrinjarić, 2014); Kalman filter (Mergner and Bulla, 2008; Moonis and Shah, 2003); state space models (Lettau and Ludvigson, 2010), regression analysis with structural breaks (Aluko and Abogun, 2018; Huang and Wu, 2005), and regime switching regression (Abdymomunov and Morley, 2011; Huang, 2000; Škrinjarić, 2014; Tansuchat *et al.*, 2018).

Despite the limitations of the CAPM as discussed in the preceding paragraphs, the model, along with the many risk, return and risk-adjusted return metrics such as Jensen’s Alpha, Treynor ratio, etc. that have been developed based on the model, has remained the most popular asset pricing model and has provided a toolkit for investment practitioners over the past four decades in the estimation of the cost of equity for portfolio management, performance measurement and capital budgeting decisions (Graham *et al.*, 2005; Nel, 2011; PricewaterhouseCoopers, 2016; Rehnby, 2016; The South African Institute of Chartered Accountants, 2019). The CAPM’s popularity has been attributed to its simplicity as well as a natural resistance of the investment management community to adopt new approaches (Bartholdy and Peare, 2005). Moreover, many empirical studies that have compared the CAPM to a wide variety of multifactor models have not shown that these models significantly outperform the CAPM model (Bartholdy and Peare, 2005; Kabir *et al.*, 2023; Sadiq *et al.*, 2024). More recent studies such as Aulerich (2004) and Jain and Wu (2000) argue that the problem with the CAPM model has to do with implementation issues rather than with a deficiency in the model *per se*. The practical issues that have been highlighted include the use of inappropriate benchmarks, the timeframe and data frequency used in the estimates.

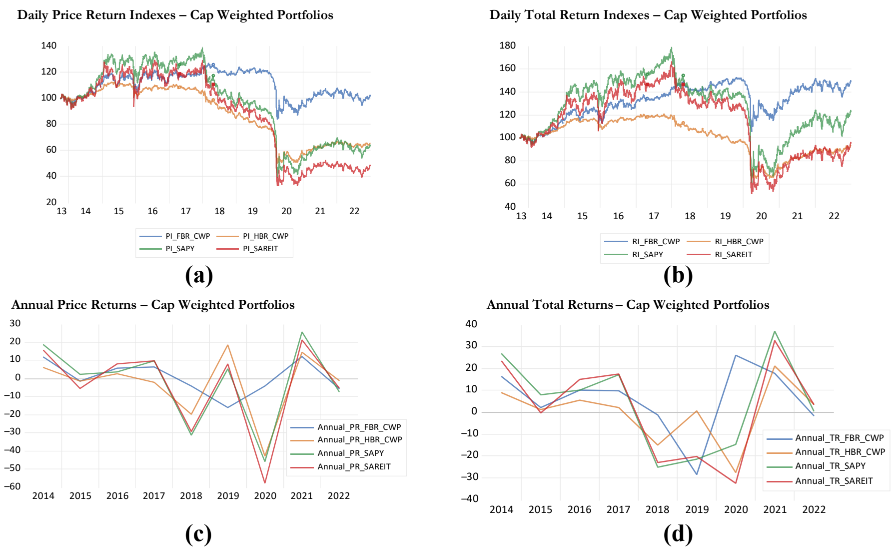
In this study, we first estimate the standard Capital Asset Pricing Model using the returns of the various home-biased and foreign-biased REITs as the independent variables and the FTSE/JSE SAREIT Index (J805) as the benchmark returns. Our approach is in line with Bartholdy and Peare (2005) who suggested the use of an appropriate sector index rather than a broad market index such as the FTSE/JSE All Share Index. Two alternative property indexes, the SAPY and ALPI, contain both REITs and Real Estate Operating Companies, i.e. Real Estate Investment and Services (FTSE/JSE, n.d.). Given that REITs have a unique structure, the inclusion of other types of listed real estate companies in the SAPY and ALPI indexes makes these indexes less than ideal for the CAPM estimation. We however include the SAPY Index in the calculation of the other return, risk and risk-adjusted return metrics.

In addition to the standard Ordinary Least Square estimation of the CAPM model, we also use the rolling and recursive estimation to visualise the evolution of the alpha and beta estimates over time. In addition to showing evidence of changes in the CAPM parameters over time, this analysis also enables us to determine which of the portfolios produced the better alphas over time and the ones that exhibited higher systematic risk (beta). We also employ the newly developed structural break test of Ditzen *et al.* (2021) to determine if there are any structural breaks in our data that need to be accounted for. Based on this, we break our data into the pre- and post-structural break dates and re-estimate the CAPM parameters. Finally, we use the regime-switching regression analysis to re-estimate the CAPM parameters to see how the parameters change over different regimes or states of the market.

4. Results

4.1 Evolution of the South African REIT market

Figure 1 contains four sets of graphs comparing the returns of foreign-biased REITs to the price and total return indices of home-biased REITs as well as the SA listed property benchmarks;



Note(s): PI_SAREIT: Price index, South African real estate investment trust portfolio; PI_SAPY: Price index, South African listed property portfolio; PI_FBR_CWP: Price index, Foreign-Biased REIT portfolio (Cap-weighted); PI_HBR_CWP: Price index, Home-Biased REIT portfolio (Cap-weighted); RI_SAREIT: Total return index, South African real estate investment trust portfolio; RI_SAPY: Total return index, South African listed property portfolio; RI_FBR_CWP: Total return index, Foreign-Biased REIT portfolio (Cap-weighted); RI_HBR_CWP: Total return index, Home-Biased REIT portfolio (Cap-weighted); TR_SAREIT: Total returns, South African real estate trust portfolio; TR_SAPY: Total returns, South African listed property portfolio; TR_FBR_CWP: Total returns, Foreign-Biased REIT portfolio (Cap-weighted); TR_HBR_CWP: Total returns, Home-Biased REIT portfolio (Cap-weighted); PR_SAREIT: Price returns, South African Real estate trust portfolio; PR_SAREIT: Price returns, South African real estate trust portfolio; PR_SAPY: Total returns, South African property portfolio; PR_FBR_CWP: Total returns, Foreign-Biased REIT portfolio (Cap-weighted); PR_HBR_CWP: Total returns, Home-Biased REIT Portfolio (Cap-weighted)

Source(s): Authors' own work

Figure 1. Index growth

the SAPY and SAREIT indices. The Figure contains four quadrants representing the two sets of price indexes and two sets of total return indices.

Figure 1a and 1b track how an investment of R100m would have grown over the period 2013–2022. While Figure 1a shows the portfolio growth based purely on stock price changes (capital gains), Figure 1b accounts for dividend payments and hence gives an idea of how much the portfolio would contain over time. The two Figures (1a and 1b) show that an investment in the foreign-biased portfolio would produce a higher terminal value by the end of 2022. An investment of R100m in the capitalisation-weighted foreign-biased REIT would have grown to R148.60m based on total returns. The same amount invested in the capitalisation-weighted home-biased portfolio would have dropped in value to R93.51m at the end of 2022. The SAREIT index and SAPY indices would have terminal values of R95.07m and R122.69m, respectively. We see that, although the REIT market underperformed the overall property market, as measured by the return on the SAPY index when we isolate the REIT firms with significant foreign allocations, we see that they actually outperform the SAPY index. This ranking also holds when we examine the growth in the value of the portfolio based purely on market price changes (capital gains). Another interesting observation we make is that the price indices of home-based REITs were more in line with the SAPY index, rather than the SAREIT index. However, when dividends are considered, we see that home-biased REITs begin to align more with the local SAREIT benchmark, especially post-2020.

We also see from the various return indices that the SAREIT market has undergone significant ups and downs since the introduction of the REIT regime in 2013. As noted by Pilusa *et al*. (2022), the listed property market in South Africa grew significantly in market value following the adoption of the REIT regime in 2013, until a combination of factors led to the contraction of the market. In the following section, we discuss the evolution of the SAREIT market along with the returns of the various property portfolios.

Figure 1 shows how the returns of the SAREIT, SAPY, and the two indices we created have evolved over time. The price index graph is particularly useful in understanding how a market responds to different events as prices change more quickly with new information than total returns (Hawkings, 2023; Mauboussin and Callahan, 2023). In the year that the REIT legislation was introduced (i.e. 2013), South Africa hosted the BRICS summit following its admission into this diplomatic-political group. This placed South Africa on the radar of global investors, especially those with an interest in the listed property market. This surge in interest translated into strong market performance as can be seen in the upward trend in the price and total return. In 2014, just a year after the passing of the REIT legislation, the SAREIT market emerged as one of the best-performing in the world. The market outperformed the domestic aggregate stock and bond markets as well as the Asian, European, and UK REITs markets (Ntuli and Akinsomi, 2017). Our analysis shows that an investment of R100m in the SAREIT index would have grown to R124m by the end of 2014. This represents an annualised holding period yield of 19%. After this initial period of strong performance, however, the SAREIT market was bedevilled by a number of market, macroeconomic, and political challenges. The impact of these factors on all the index series can be seen more clearly in Figure 1a and 1b.

One of the earliest shocks in the South African market experienced following the introduction of the REIT regime was a political turmoil in December which left the country with three different Finance Ministers in a space of just one week. The JSE All-Share index lost R169bn in just two days and the Rand fell sharply against the major trading currencies. The credit rating agency, Fitch, downgraded the country's credit rating to just one notch above junk status (Motsoeneng and Toyana, 2015).

A similar occurrence in 2017 had a more debilitating effect on the South African stock market and the general economy. Following another shock removal of the finance minister, Pravin Gordhan, both Standard and Poors and Fitch downgraded South Africa's sovereign debt rating to junk status (BB and BB+). The Rand fell by 15% against the major trading currencies in a space of two weeks and the JSE All Share index dropped by as much as 7% in a single day in the weeks following the announcement (Campbell, 2017; Macharia and Toyana, 2017; Times, 2017).

In early 2018, a number of analyst reports emerged about alleged price manipulation by the Resilient Group of Companies, made up of Resilient REIT, Fortress REIT, and NEPI Rockcastle (formerly Greenbay Properties). The reports alleged that the high valuations of companies within the group were due largely to intra-group trading and other market irregularities. The publication of these reports led to a sharp decline in the share prices of the companies within the group, the property sector, and the whole JSE stock market. The share prices in the group fell by between 15 and 63%, wiping out R137bn of the combined value of these companies (Mail and Guardian, 2018; Thompson, 2018). Although the group was eventually cleared in 2020 following a prolonged investigation by the Financial Sector Conduct Authority, these allegations nevertheless had a severe negative impact on all listed property companies and the South African property market as a whole (Financial Sector Conduct Authority, 2019; Mahlaka *et al*., 2019).

Another factor that dampened the growth of the SAREIT market was the struggling South African economy. Between 2018 and 2020, South Africa experienced two technical recessions, one in the second quarter of 2018 and another in the fourth quarter of 2019, making these two of three recessions the country had suffered since the first democratic election in 1994. The effects of these recessions were further compounded by the COVID-19 pandemic beginning at the end of 2019. In an attempt to contain the spread of the virus, the country went into lockdown for 21 days from the 26th of March to the 16th of April 2020. The lockdown measures remained in place till June 2022 when all the COVID-19 guidelines were relaxed (Department of Statistics South Africa, 2019; Sibeko, 2021).

Figure 1a and 1c show the trend in the values of the various portfolios over time, based solely on price changes and total returns, respectively. As mentioned earlier, the movement in the price index is a better indicator of how investors respond to various events in real-time and so is a better indicator of market price changes. The total return index contains dividends which may mask the actual price movements, especially when significant dividends are paid by the firms. This is especially true for REITs which are mandated to pay 75% of their taxable income annually as dividends in South Africa (Marshall *et al*., 2006). We found that, by the end of 2014, an investment of R100m in the SAREIT index would have grown to R115m based on market price changes alone, while an investment in the SAPY index would have grown to R118m. An investment in the capitalisation-weighted foreign-biased REIT portfolio would have grown to R112m while an investment in home-biased REITs would have become R107m.

We witness a sharp drop in the portfolio values towards the end of 2015. The lowest values occurred on the 11th of December which falls within the same week that the Finance Minister was removed from office. After the reappointment of the Finance Minister, the market quickly recovered and continued to grow consistently till early 2017 when all the portfolios hit their lowest point of the year, specifically on the 10th of April, 2017. The SAREIT index, for example, fell from R118.55m on the 3rd of January 2017 to R113.79m on the 10th of April. The SAPY index dropped from 126.68m to 122.03m over the same period. The cap-weighted foreign-biased REIT portfolio's value dropped from 116m to 114.91 while the home-biased portfolio fell from R108.70m to R103.10m. These falls came on the back of another unceremonious dismissal of the Finance Minister along with 9 other Cabinet Ministers at the end of March 2017. Few of these portfolios recovered their values before the Resilient Group scandal and the technical recessions of 2018. As can be seen from Figure 1, almost all of the portfolios started to trend downward from 2018 through to the end of 2020. The lowest point for the indices occurred on the 24th of March 2020, with a few occurring on the 25th of March. It is interesting to note that, this sharp fall in the index came just after the announcement of the 21-day lockdown on the 23rd of March, 2020 but before the actual lockdown which started on the 27th of March. The SAREIT index lost 60% of its January value to end at R32.59m while the SAPY index lost 56% to end at R39.12m. The capitalisation-weighted foreign-biased REIT portfolio lost 30.27% to become R83.42m while the home-biased portfolio had an ending value of R53.31m (down by 35% year-to-date).

Post-COVID, we begin to see an upward trend in the portfolio values based on the changes in their prices. By the end of 2022, most of the REIT portfolios had recovered all or a significant part of their portfolio values. The SAREIT price index was up 47% relative to its lowest value of R32.59m to end 2022 at R47.98m. The SAREIT went up to a value of R63.37m. The capitalisation-weighted foreign-biased REIT portfolio ended 2022 with a portfolio value of 101.30, up by 21% relative to its 2020 low of R83.42m while the home-biased REIT ended the year 2022 with a terminal value of R65.46m up 31% with respect to its March 2020 level.

An interesting observation in Figure 1a and 1b is that, from 2017, when all the other price return indices started trending downward, we see that the foreign-biased REIT price index maintained its value for a considerable time. This is an indication that these REITs did not experience the same price declines suffered by the local property benchmarks (SAREIT and SAPY) and the home-biased REITs. This may be because investors may have held the belief that REITs with significant foreign asset holdings are not as prone to the local market downturns and so may have held on to their shares in these REITs, resulting in the stability in their prices and index values.

Although our discussion so far has focused mainly on the price indices in Figure 1a, we see that Figure 1b which tracks total returns also broadly follows the same trend. Given that REITs are required to pay a significant amount of dividends (75% of their taxable income in South Africa), some of the losses arising from the decline in prices are obviously made up for by these dividend payments. For example, Figure 1b and Table 2 show that an investment of R100m in 2013 in the capitalisation-weighted foreign-biased REITs would have produced the highest terminal value of R148.60m by the end of 2022, compared to the SAREIT index portfolio which would have produced a terminal value of 95.07m. The SAPY index would have produced a portfolio value of R122.69m over the same period.

The significant differences observed between the price and total index values further underscore the benefits of REIT investments. Even though stock price declines would have significantly impacted the portfolio value of all investors on the JSE over the sample period, REIT investors were to some extent protected as their dividend payments are more certain than investors in other sectors.

4.2 Portfolio return, risk, and risk-adjusted returns

Aside from tracking the value of the various portfolios based on price changes and total returns, we also computed several portfolio performance metrics as follows: four (4) measures of portfolio returns, three (3) measures of total risk, two (2) measures of downside risk and four (4) measures of risk-adjusted returns. Table 1 contains a list of formulas used for the calculation of the various return, risk and risk-adjusted return metrics. Given that real estate returns are not normally distributed, we propose that these alternative measures are adopted and used alongside the more conventional measures of risk and return to give investors a more complete view of the performance of their real estate investment portfolios.

4.2.1 Portfolio return measures. We first calculate the arithmetic average returns of all the portfolios and benchmarks. The results show that the foreign-biased REITs produce better average total returns than home-biased REITs. Over the entire sample period (2013–2022), an investment in the capitalisation-weighted foreign-biased REIT portfolio would have produced an average annual total return of 5.67% compared to only 0.03% if invested in a home-biased REIT portfolio. An investment in the SAREIT and SAPY index portfolios, which are also capitalisation-weighted, would have yielded annual returns of 1.79 and 4.19%, respectively. When evaluated on a daily frequency, the home-biased REITs did not yield positive arithmetic average total returns in any of the sample periods analysed. The foreign-biased REIT portfolio recorded the highest arithmetic mean total return, followed by the SAPY index. As an

Table 1. Portfolio performance metrics – formulas

Performance measure	Formula/Model	Definition of terms
Arithmetic average return	$\overline{R}_{pt} = \frac{\sum R_{pt}}{n}$	R_{pt} = Portfolio return at time t n = number of observations
Geometric average return	$\mathrm{GM} = [\prod_{i=1}^{n} HPR]^{1/n} - 1$	$HPR = 1 + R_{pt}$ n = number of observations
Average excess return wrt risk-free rate	$ER_{rf} = E(R_{pt}\text{-}R_{ft})$	R_{pt} = Portfolio return at time t R_{ft} = Risk-free rate of return
Average excess return wrt SAREIT benchmark	$ER_b = E(R_{pt}\text{-}R_{bt})$	R_{pt} = Portfolio return at time t R_{bt} = Benchmark Return (return on SAREIT index)
Tracking error wrt risk-free rate	$TE_{rf} = \sigma(R_{pt}\text{-}R_{ft})$	R_{pt} = Portfolio return at time t R_{ft} = Risk-free rate of return
Tracking error wrt risk-free rate	$TE_b = \sigma(R_{pt}\text{-}R_{bt})$	R_{pt} = Portfolio return at time t R_{bt} = Benchmark Return (return on SAREIT index)
Sharpe ratio	$SR = \frac{E(R_{pt}-R_{ft})}{\sigma(R_{pt}-R_{ft})}$	R_{pt} = Portfolio return at time t R_{ft} = Risk-free rate of return
Information ratio	$IR = \frac{E(R_{pt}-R_{bt})}{\sigma(R_{pt}-R_{bt})}$	R_{pt} = Portfolio return at time t R_{bt} = Benchmark Return (return on SAREIT index)
Portfolio beta	$\beta = \frac{cov(R_{pt}, R_{mt})}{\sigma^2(R_{pt})}$	$cov(R_{it}, R_{mt})$ = Covariance between portfolio return and benchmark return $\sigma^2(R_{it})$ = Portfolio variance
Treynor ratio	$TR = \frac{E(R_{pt}-R_{ft})}{\beta}$	R_{pt} = Portfolio return at time t R_{ft} = Risk-free rate of return β = Portfolio Beta
Maximum drawdown	$\mathrm{MaxDD} = \mathrm{Max}\left[\frac{\mathrm{M(t)}-\mathrm{p(t)}}{\mathrm{M(t)}}\right]$	$\mathrm{M(t)}$ = Peak Value $\mathrm{p(t)}$ = Trough Value
Calmer ratio	$\mathrm{Calmer\ Ratio} = \frac{\mathrm{E(R_{pt}-R_{ft})}}{\mathrm{MaxDD}}$	R_{pt} = Portfolio return at time t R_{ft} = Risk-free rate of return MaxDD = Maximum Drawdown
Semi-deviation	$\mathrm{SemiDev} = \sqrt{\frac{\sum_{t=1}^{n} [\min(R_{pt}-\mathrm{R_{bt}}, 0)]^2}{\mathrm{n-1}}}$	R_{pt} = Portfolio return at time t R_{bt} = Benchmark Return (return on SAREIT index) N = Number of periods
Sortino ratio	$\mathrm{Sortino} = \frac{\mathrm{E(R_{pt}-R_{bt})}}{\mathrm{SemiDev}}$	R_{pt} = Portfolio return at time t R_{bt} = Benchmark Return (return on SAREIT index) SemiDev = Semi-deviation

Note(s): RI_SAREIT: Total return index, South African real estate trust index; RI_SAPY: Total return index, South African property index; RI_FBR_CWP: Total return index, Foreign-Biased REIT portfolio (Cap-weighted); RI_HBR_CWP: Total return index, Home-Biased REIT portfolio (Cap-weighted)
Source(s): Authors' own work

alternative to the arithmetic average return, we also calculated the geometric mean return for the various portfolios. It has been shown that in the absence of low or zero volatility, the geometric and arithmetic means should equal each other. The more volatile the returns are, the greater the difference between the two metrics, with the arithmetic mean being greater by approximately half the variance of returns (Bouzouita *et al.*, 2009; Markowitz, 2012). The geometric mean return represents the actual returns that accumulate to buy-and-hold investors. Compounding the arithmetic mean does not yield the ending portfolio values unless the returns for all the periods are equal. The arithmetic mean has however been shown to produce more consistent and unbiased estimates of future returns than the whereas the geometric mean is often biased downwards (Blume, 1974). Most statistical and portfolio metrics and techniques such as the Sharpe Ratio, CAPM Alphas, least squares regressions, etc. are also based on the arithmetic mean (Bessembinder, 2024; Lausberg and Brandt, 2024; McCulloch, 2003). The relative performance based on the geometric mean returns is consistent with the arithmetic mean results. The foreign-biased REIT portfolio produced and the SAPY index produced positive average returns over both sample periods. Again, the home-biased REIT portfolio produced daily average losses over both sample periods while the SAREIT index portfolio recorded positive returns only over the 2013–2019 sample period.

The average excess returns (relative to both T-bill rates and the SAREIT benchmark returns) follow the same pattern described in the preceding paragraph. Only the capitalisation-weighted foreign-biased REIT portfolio consistently produced positive average excess returns across the various sample periods and relative to the chosen benchmarks. A look at the annual return and rolling total return graphs in Figure 1 as well as Appendix 4 shows that foreign-biased REITs performed best between mid-2017 and mid-2020. As explained earlier, this may be because REITs with significant foreign allocations were viewed as "safe haven" investments during periods when the local SA stock market and general economy were facing challenges.

4.2.2 Risk measures. In analysing the risk of the various portfolios, we calculated three measures of total volatility: standard deviation, mean absolute deviation, and tracking error. The standard deviation and mean-absolute deviation are two of the most common measures of total risk, with the standard deviation being the more widely used measure of investment risk (CFA Institute, 2020; Georgieva *et al*., 2009; Gorard, 2005). The use of the standard deviation as a measure of investment risk dates back to Markowitz (1952) who used it as a measure of risk in his portfolio optimisation framework. The standard deviation is, however, premised on the assumption that returns are normally distributed. As far back as the early 20th Century, there was a raging debate about the appropriateness of the standard deviation as a measure of dispersion given that most data series have been found to not be normally distributed (Eddington, 1914; Fisher, 1920). The choice back then was between the standard deviation and the mean absolute deviation. Fisher (1920), for example, argued in favour of the standard deviation, indicating that the standard deviation was more efficient than the Mean Absolute Deviation when returns are normally distributed. This fact was confirmed by several subsequent studies (Aldrich, 1997; MacKenzie, 1981). Eddington (1914), on the other hand, proved that the mean absolute deviation was more efficient in realistic situations where returns are not normally distributed and where there are outliers due to extreme events, measurement errors, among others. He, therefore, suggested the use of the Mean Absolute Deviation as a measure of dispersion among astronomers and meteorologists whose work involves the weather and regularly encounter outliers. Our analysis shows that commensurate with their higher returns, foreign-biased REIT portfolios were more volatile, based on the results of both the standard deviations and mean absolute deviations.

The non-normality of returns, especially in emerging markets, has been established by several studies. For example, van Heerden (2020) found that the returns of companies on the Johannesburg Stock Exchange (JSE) are not normally distributed. They proceeded to recommend several measures of risk and risk-adjusted returns that can be employed to properly account for the risk and returns of different investments. They further found that the use of these alternative risk measures enhanced the ability of portfolios to outperform a buy-and-hold strategy. The risk measures van Heerden (2020) recommended include tracking error, maximum drawdown and semi-deviation.

The tracking error replaces the historical mean with the return on a benchmark or target return, making it a better measure of risk for active investors who may be tracking an index (Harlow, 1991; Lhabitant, 2009). Using the tracking error as a measure of risk to evaluate the various portfolios, we find that the foreign-biased REITs which recorded the higher standard deviation and mean absolute deviation values rather recorded lower tracking errors in most of the sample periods we analysed. This anomaly can be explained by Equation (7) which links the tracking error of an asset to the standard deviation of the asset and benchmark as well as the correlation between the asset and its benchmark (Ahmadzade and Gao, 2020; Ametefe *et al*., 2018):

Table 2. Portfolio performance metrics – estimates based on total returns

	RI_ SAREIT	RI_ SAPY	RI_FBR_ CWP	RI_HBR_ CWP
Portfolio metrics based on annual total returns (2013–2022)				
Average returns (%)	1.7926	4.1906	5.6726	0.0306
Maximum (%)	32.8581	36.9362	25.9328	21.1013
Minimum (%)	−32.5197	−25.2621	−28.6182	−27.5029
Standard deviation (%)	22.6962	21.5137	15.7560	13.9488
Correlation wrt SAREIT (%)	1.0000	0.9505	0.3302	0.8916
Portfolio metrics based on annual total returns (2013–2019)				
Average returns	2.0422	2.5246	1.4666	0.5238
Maximum	23.2937	26.6442	16.1229	8.8494
Minimum	−22.8582	−25.2621	−28.6182	−15.0882
Standard deviation	19.8752	21.1527	15.9663	8.2554
Correlation with SAREIT index	1.0000	0.9757	0.8095	0.7947
Portfolio metrics based on daily total returns (2013–2022)				
Index growth (Base value R100m)	95.0711	122.6857	148.5981	93.5081
Arithmetic average return (%)	0.0111	0.0183	0.0202	−0.0008
Geometric mean returns	−0.0022	0.0088	0.0171	−0.0029
Average excess returns wrt T-bill returns (%)	−0.0051	0.0021	0.0041	−0.0170
Average excess returns wrt SAREIT (%)	0.0000	0.0072	0.0091	−0.0119
Correlation wrt SAREIT	1.0000	0.9638	0.9445	0.6678
Standard deviation (%)	1.6208	1.3631	0.7819	0.6397
Mean absolute deviation (%)	1.0073	0.8269	0.4875	0.3897
Tracking error wrt SAREIT returns (%)	0.0000	0.4759	0.9188	1.0767
Maximum drawdown	69.4044	65.8587	31.0462	47.1154
Semi-deviation wrt SAREIT index (%)	0.0000	0.3396	0.6351	0.7657
Sharpe ratio	−0.0031	0.0016	0.0052	−0.0265
Information ratio wrt SAREIT	–	0.0151	0.0099	−0.0111
Calmer ratio	−0.0001	0.0000	0.0001	−0.0004
Sortino ratio wrt SAREIT index	–	0.0212	0.0144	−0.0156
Portfolio metrics based on daily total returns (2013–2019)				
Index growth (Base value R100m)	125.1767	136.0896	150.4292	96.5429
Arithmetic average return (%)	0.0207	0.0241	0.0280	−0.0014
Geometric mean returns	0.0144	0.0198	0.0262	−0.0023
Average excess returns wrt T-bill returns (%)	0.0026	0.0061	0.0099	−0.0195
Average excess returns wrt SAREIT (%)	0.0000	0.0035	0.0073	−0.0221
Correlation wrt SAREIT	1.0000	0.9533	0.9305	0.8335
Standard deviation (%)	1.1196	0.9340	0.5975	0.4122
Mean absolute deviation (%)	0.7928	0.6563	0.4078	0.2877
Tracking error wrt T-bill returns (%)	1.1196	0.9341	0.5975	0.4122
Maximum drawdown	26.1501	26.6936	15.1402	21.2513
Semi-deviation wrt SAREIT index (%)	0.0000	0.2613	0.4210	0.5887
Tracking error wrt SAREIT returns (%)	0.0000	0.3634	0.6045	0.8087
Sharpe ratio	0.0023	0.0065	0.0166	−0.0473
Information ratio wrt SAREIT	–	0.0095	0.0121	−0.0273
Calmer ratio	0.0001	0.0002	0.0007	−0.0009
Sortino ratio wrt SAREIT index	–	0.0132	0.0173	−0.0375

Note(s): RI_SAREIT: Total return index, South African real estate trust index; RI_SAPY: Total return index, South African property index; RI_FBR_CWP: Total return index, Foreign-Biased REIT portfolio (Cap-weighted); RI_HBR_CWP: Total return index, Home-Biased REIT portfolio (Cap-weighted)
Source(s): Authors' own work

$$TE_p = \left(\sigma_p^2 + \sigma_b^2 - 2\rho\sigma_p\sigma_b\right)^{0.5} \tag{7}$$

From Equation (6), we can deduce that other things being equal, a portfolio or asset with a higher standard deviation would need to be more highly correlated with the benchmark to produce a lower tracking error. This implies that foreign-based REITs were more correlated with the SAREIT benchmark than their counterparts – a fact that can be verified from the correlation values in Table 2. For the analysis based on annual returns covering the periods 2013–2022, we found that the foreign-biased REIT portfolio had a correlation coefficient of 0.3302 with the SAREIT benchmark. Over the same period, the home-biased REIT portfolio had a correlation of 0.8916 with the benchmark SAREIT index. For the 2013–2019 sub-sample period however, the correlation was much closer, with the foreign-biased and home-biased REIT portfolios recording correlations of 0.81 and 0.79 respectively. The correlation coefficients based on the annual price returns are very similar to the total returns (see Appendix 3). When evaluated over a daily frequency, however, we find that the correlation between the SAREIT index and the foreign-biased REIT portfolio was much higher than that of the home-biased REITs. An explanation for this is that the returns of the SAREIT index portfolio over those periods were largely driven by the foreign-biased REITs included in the benchmark portfolio.

Another criticism of the standard deviation as a measure of risk is that it measures the dispersion of return around the historical mean and thus penalises both downside and upside deviations. A number of downside risk measures have, therefore, been proposed in the literature to capture only the downside volatility of investment portfolios as opposed to total volatility. One of the most common of these measures is the semi-variance and semi-deviation. In his later work, Markowitz (1959) acknowledged the inefficiencies of the mean-variance framework and recommended the use of the semi-variance in place of the standard deviation. Several studies have found the semi-variance to be more intuitive as investors generally interpret risk to mean the possibility of making a "loss". The measure has also been found to perform well in the presence of non-normal return distributions (Beach, 2011; Salah *et al.*, 2018). Another popular downside risk measure is the maximum drawdown. It measures the greatest loss that investors could suffer if they purchase a stock at its highest price and sell at its lowest point. In other words, it is the largest drop in the price of an asset, from peak to trough, at a stretch (de Melo Mendes and Lavrado, 2017). We found that the foreign-biased REIT portfolio produced the lowest semi-deviation, meaning that this portfolio produces lower downside risk for investors than its counterparts. This confirms the observation we made earlier about the ability of foreign-biased REIT portfolios to maintain their value over time. The foreign-biased REIT portfolio recorded the lowest drawdown values across both sample periods. Over the 2013–2019 sample period, the largest value the foreign-biased REIT portfolio would lose at a stretch is R15.14m, compared to the home-biased REIT portfolio which would have lost 21.25m. Both the SAREIT and SAPY indices would have lost over R26m each. Over the full sample period, 2013–2022 sample period, the foreign-biased portfolio would still have produced the lowest drawdown value of R31.04m compared to the home-biased portfolio which would have lost R47.11m. The SAREIT and SAPY portfolios would have made higher drawdowns, losing up to R69.40m and R65.86m, respectively.

4.2.3 Risk-adjusted returns. In the preceding sub-sections, we have independently examined different measures of return and risk of the foreign-biased and home-biased REIT portfolios. We find that although foreign-biased REITs produced higher returns, they also exhibited higher volatility. However, when we switched to the downside risk framework, we found that foreign-biased REITs were less risky. Modigliani and Modigliani (1997) found that there was a lot of focus on return measures by investment managers and little focus on risk. They recommended the use of risk-adjusted returns which appropriately adjust portfolio return for risk as well as allow for the measurement of the performance of managed portfolios against relevant market portfolios or benchmarks. The oldest risk-adjusted performance was introduced by Treynor (1965) shortly after the Capital Asset Pricing Model was developed. The Treynor ratio converts total returns into excess returns by subtracting a risk-free rate and dividing this by the beta coefficient derived from the CAPM model, a measure of systematic risk. In response to criticisms that the beta coefficient only accounts for systematic risk to the neglect of portfolio-specific risk, Sharpe (1966) replaced the beta coefficient by the standard deviation to produce a risk-adjusted metric known as the Sharpe ratio. The Sharpe ratio has become arguably the most widely used risk-adjusted metric in the investment management industry. Several variants of the Sharpe and ratios have been developed over the years, the most common being the Information, Sortino, and Calmer ratios (Agarwal and Lorig, 2020; Greef *et al*., 2004; Modigliani and Modigliani, 1997; Steinki and Mohammad, 2015). The Information Ratio is a variant of the Sharpe Ratio which replaces the risk-free rate with the return on a chosen benchmark in deriving the excess return. The measure of risk is also the tracking error, rather than the standard deviation (Goodwin, 1998; Israelsen, 2005). The Sortino Ratio (Sortino and Van Der Meer, 1991) is a risk-adjusted metric that utilises the semi-deviation as the measure of risk. Like the Information Ratio, it uses a benchmark return rather than a risk-free rate in deriving excess returns. The Calmar Ratio, introduced by Young (1991), adopts the Maximum Drawdown as its denominator and excess returns relative to a risk-free rate.

We found that the foreign-biased REIT portfolio recorded positive risk-adjusted returns across all four metrics, whereas the home-biased REIT portfolio consistently recorded negative risk-adjusted returns. This was the case irrespective of the time period over which we estimated these measures, pointing to the superior performance of the REITs that make up the foreign-biased REIT portfolio. In most cases, the foreign-biased REIT portfolio also outperformed the two local property benchmarks, SAPY and SAREIT in terms of risk-adjusted returns, especially over the 2013–2019 sample period (See Table 2 and Figure 4).

4.3 Standard capital asset pricing model estimates

In addition to the portfolio metrics discussed in the preceding sections, we employ the Capital Asset Pricing Model. Table 3 shows the results of the regression analysis as estimated from the CAPM model. We see that the beta coefficients for the portfolios we created were all less than 1 and statistically significant. We can, therefore, infer that these portfolios were less volatile than the SAREIT market portfolio as constructed by the Financial Times Stock Exchange (FTSE)/Russell. A significant observation we make is that the capitalisation-weighted foreign-biased portfolios had higher beta coefficients (0.453) than the capitalisation-weighted

Table 3. Standard CAPM analysis (2013–2022)

	ER_PI_FBR_CWP	ER_PI_HBR_CWP	ER_RI_FBR_CWP	ER_RI_HBR_CWP
ER_PI_SAREIT	0.451***	0.356***		
	(0.003)	(0.004)		
ER_RI_SAREIT			0.453***	0.357***
			(0.003)	(0.003)
_cons	0.006	−0.017***	0.009*	−0.013**
	(0.006)	(0.006)	(0.005)	(0.006)
Observations	2,311	2,311	2,311	2,311
R-squared	0.885	0.811	0.893	0.821

Note(s): ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT portfolio (Cap-weighted); ER_PI_SAREIT: Excess price returns of the South African REIT index; ER_RI_SAREIT: ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT portfolio (Cap-weighted); ER_RI_SAREIT: Excess total returns of the South African REIT index
Source(s): Authors' own work

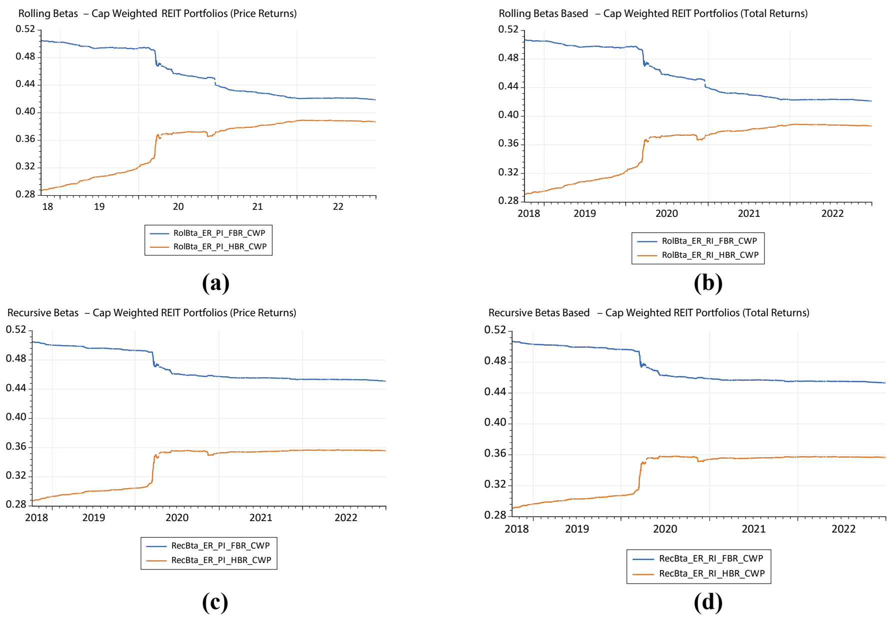
home-biased portfolios (0.357). The results obtained using both price and total returns were very similar as can be seen from Table 3.

Based on the intercept (Alpha) estimates which indicate outperformance, we found that the foreign-biased REIT portfolio generated a positive Alpha of 0.006 and 0.009 based on price return and total returns, respectively. We note that only the analysis using total returns was statistically significant.

The capitalisation-weighted home-biased REIT portfolio, however, recorded a negative Alpha coefficient of −0.017 when estimated using price returns and −0.013 when estimated using total returns. Both estimates were statistically significant. This result implies that the home-biased REIT portfolio did not generate the returns required to cover its systematic risk level.

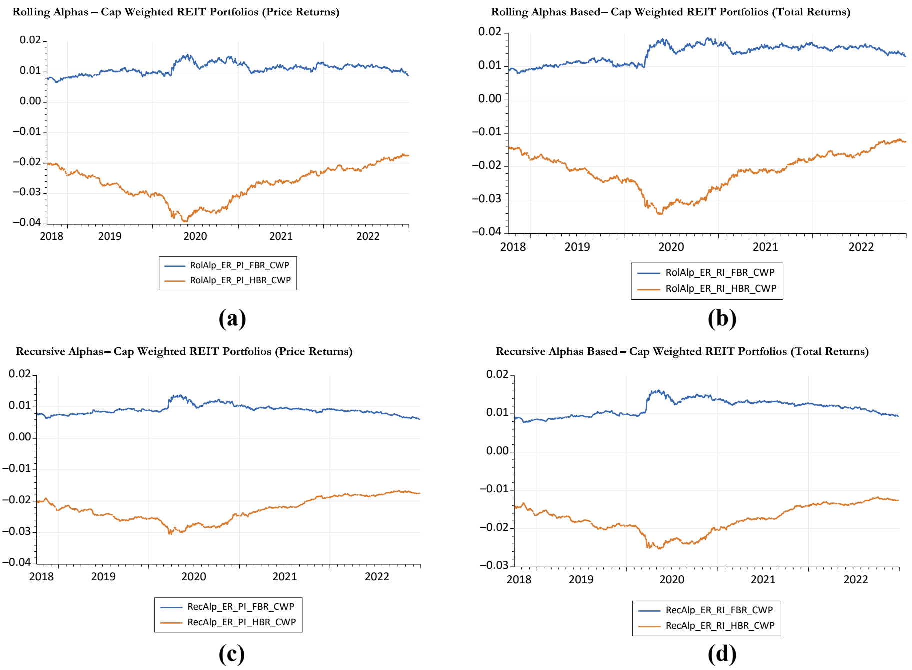
4.4 Rolling and recursive CAPM analysis

As in Wijethunga and Dayaratne (2015), we re-estimate the CAPM parameters using both the rolling window and recursive regression techniques to determine if the parameters estimated in Section 4.3 are stable over time. For the rolling regression analysis, we use a fixed window of 250 days, corresponding to the number of trading days in a year. For the recursive analysis, we increase the window length from an initial 250 days by one day at a time till all 2,311 observations are included in the estimation. We find that the same pattern is evident when we graphed the Beta and Alpha estimates based on the different windows. We base our discussion in this Section on the 5-year window which is typically the length of time that CAPM models are estimated (Brooks, 2019, p. 742).



Note(s): RecBta: Recursive Beta Coefficients; ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT Portfolio (Cap-Weighted); ER_RI_SAREIT: ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT Portfolio (Cap-Weighted)
Source(s): Authors' own work

Figure 2. 5-Year Rolling and Recursive Betas wrt South African REIT Index (SAREIT) Benchmark



Note(s): RecAlp: Recursive Alpha Estimates; ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT Portfolio (Cap-Weighted); ER_PI_SAREIT: Excess price returns of the South African REIT Index; ER_RI_SAREIT: ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT Portfolio (Cap-Weighted); ER_RI_SAREIT: Excess total returns of the South African REIT Index

Source(s): Authors' own work

Figure 3. 5-Year Rolling and Recursive Alphas wrt South African REIT Index (SAREIT) Benchmark

Figure 2 shows that the beta estimates of the foreign-biased REIT portfolio over time were consistently higher than the beta estimates of their counterpart home-biased REITs. Commensurate with their higher beta levels, the foreign-biased REIT portfolios also produced consistently higher and positive Alphas (Figure 3). Interestingly, the graph shows an apparent inverse relationship between the Alphas of the two portfolios with foreign-biased REIT Alphas increasing when the Alpha of their counterpart home-biased REITs were decreasing, and vice versa. Over the sample period, however, the Alphas for the capitalisation-weighted home-biased REITs were always negative. From 2020, we note that the Alpha values for the home-biased REITs are on an upward trajectory.

When we estimated the CAPM parameters recursively, we found a similar pattern as with the rolling window estimation. The foreign-biased REITs produced beta coefficients that were consistently higher than the beta estimates of their home-biased counterparts. Interestingly, the graph of the two recursive beta estimates in Figure 3 appear to be symmetrical, with the beta estimates of the capitalisation-weighted foreign-biased REIT portfolio decreasing progressively while the home-biased REIT portfolio's beta increased progressively up till around 2020 when they stabilised (Figure 4).

Note(s): ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT Portfolio (Cap-Weighted); ER_PI_SAREIT: Excess price returns of the South African REIT Index; ER_RI_SAREIT: ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT Portfolio (Cap-Weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT Portfolio (Cap-Weighted); ER_RI_SAREIT: Excess total returns of the South African REIT Index
Source(s): Authors' own work

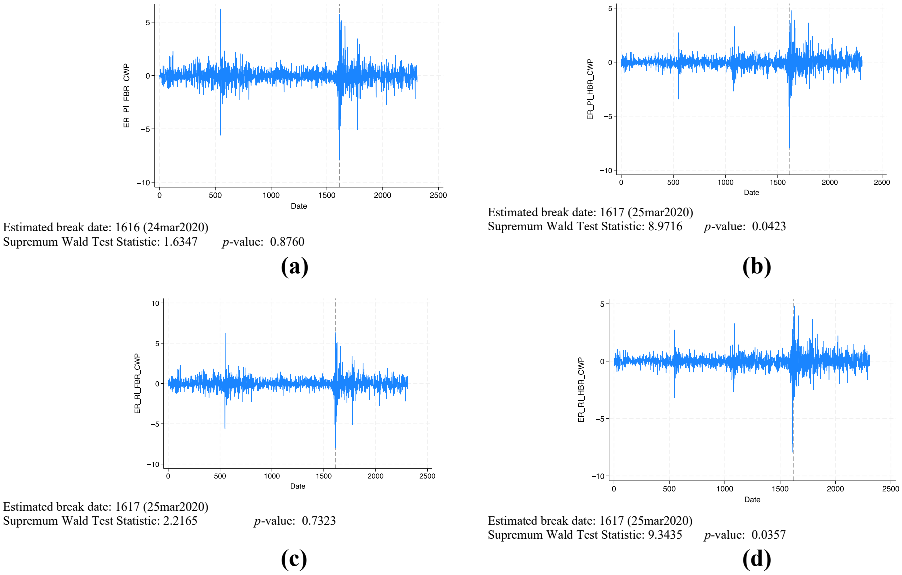
Figure 4. 5-Year Rolling and Recursive Treynor wrt South African REIT Index (SAREIT) Benchmark

The Alpha estimates of the foreign-biased portfolios were also consistently higher than the beta of the home-biased REITs. Here too, we notice that all the recursive Alpha estimates for the foreign-biased REITs were consistently positive while those of the home-biased REITs were consistently below zero. This again shows that foreign-biased REITs produce superior returns, relative to the local benchmark.

4.5 CAPM analysis with structural break

To identify possible structural breaks in our data, we use the Ditzen *et al.* (2021) test which captures multiple structural breaks in a time series. The test has been found to be asymptotically valid in identifying the structural breaks, the break dates, and the confidence interval (Hewag *et al.*, 2023). The test identified a structural break date of 24th of March for the price returns of the foreign-biased portfolio and 25th of March, 2020 for the other three series. As noted earlier, these dates coincide with South African President, Cyril Ramaphosa's announcement on the 23rd March 2020 that the country would go into a 21-day nationwide lockdown in an attempt to contain the spread of the COVID-19 virus and also the period when most of the REITs portfolio values hit rock-bottom before beginning to rise again.

Figure 5 shows the excess returns of the various portfolios with the estimated structural break point represented by the broken vertical line. We see that the volatility of the series



Note(s): ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT portfolio (Cap-weighted); ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT portfolio (Cap-weighted)

Source(s): Authors' own work

Figure 5. Test for a structural break – Unknown Break Date (Ditzen *et al.*, 2021)

increased significantly following the break-point date. Given the results of the Ditzen *et al.* (2021) test, we split our sample period into two clusters – a pre-structural break and a post-structural break period and re-estimate the CAPM model using the two sets of data. The results are presented in Table 4.

We find that, during the pre-structural break period, both the foreign-biased and home-biased portfolios produced significant Alpha estimates. Like the estimates based on the pre-structural break returns, we find that the home-biased REITs produced negative betas while their foreign-biased counterparts produced positive betas.

4.6 Regime switching CAPM analysis

Another way of accounting for the time-varying nature of the CAPM estimates is to account for the different regimes that may be present in the data. Following Huang (2000), we apply the Markov-switching model of Shen (1994) which uses a two-state Markov Switching model. In this model, Beta is thought to switch according to a first-order Markov chain. The results of the Markov switching regime switching CAPM regression are reported in Table 5. For the beta estimates, we found that as we moved from State 1 to State 2, the beta for the foreign-biased REITs increased significantly while the beta for home-biased REITs reduced by nearly half.

Again, the Alpha for home-biased REITs was statistically significant in State 1. These Alphas were again negative, pointing to the fact that these REITs failed to generate returns commensurate with their systematic risk levels, as required by the CAPM. Although the Alphas for the foreign-biased REITs were positive as before, they were not found to be statistically significant. Also, none of the portfolios produced a significant Alpha in State 2.

Table 4. CAPM regression with structural break

		ER_PI_FBR_CWP[1]	ER_PI_HBR_CWP[2]	ER_RI_FBR_CWP[5]	ER_RI_HBR_CWP[6]
Entire sample period	ER_PI_SAREIT[9]	0.451***	0.356***		
		(0.003)	(0.004)		
	ER_RI_SAREIT[10]			0.453***	0.357***
				(0.003)	(0.003)
	_cons	0.006	−0.017***	0.009*	−0.013**
		(0.006)	(0.006)	(0.005)	(0.006)
	Observations	2,311	2,311	2,311	2,311
	R-squared	0.885	0.811	0.893	0.821
Pre-structural break date	ER_PI_SAREIT	0.471***	0.348***		
		(0.004)	(0.004)		
	ER_RI_SAREIT			0.476***	0.348***
				(0.004)	(0.004)
	_cons	0.012**	−0.03***	0.014**	−0.025***
		(0.006)	(0.006)	(0.006)	(0.006)
	Observations	1,618	1,619	1,619	1,619
	R-squared	0.884	0.788	0.895	0.799
Post-structural break date	ER_PI_SAREIT	0.43***	0.365***		
		(0.006)	(0.006)		
	ER_RI_SAREIT			0.426***	0.366***
				(0.006)	(0.006)
	_cons	−0.003	0.01	0.003	0.014
		(0.012)	(0.012)	(0.011)	(0.012)
	Observations	693	692	692	692
	R-squared	0.891	0.838	0.896	0.848

Note(s): Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; ER_PI_SAREIT: Excess price returns of the South African REIT Index; ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT portfolio (Cap-weighted); ER_PI_SAREIT: Excess price returns of the South African REIT index; ER_RI_SAREIT: Excess total returns of the South African REIT index; ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT portfolio (Cap-weighted); ER_RI_SAREIT: Excess total returns of the South African REIT index
Source(s): Authors' own work

In terms of performance, foreign-biased REITs have done better than home-biased REITs using the battery of return and risk metrics. This observation is corroborated by a number of studies in the literature. For instance, Liu and Mei (1998) find that international real estate investments offer progressive diversification benefits over other financial assets such as common stocks. Gibilaro and Mattarocci (2016) also find that there is no guarantee for home-biasedness to yield higher returns. Case (2017), further found that listed equity REITs in the US have provided better risk-adjusted returns than those diversified across other developed countries. Nonetheless, some other studies diverge from the findings of this study. For example, Eichholtz *et al*. (2001) indicate that international properties underperform domestic companies owing to idiosyncratic characteristics rather than external factors such as transaction costs, leverage, and currency. Gibilaro and Mattarocci (2014) divulge that Asian REITs with home-biased portfolio concentration maximise average returns and further has a probability of positive and abnormal performances as compared to internationally diversified REITs. Further, home-biased REITs offer the opportunity to optimise risk-return strategy by

Table 5. Markov regime switching CAPM regression

		Coefficient	Std. err	z	P > |z|	[95% conf. interval]	
A. Analysis using total returns – State 1							
ER_RI_FBR_CWP	ER_RI_SAREIT	0.4135	0.0034	122.8400	0.0000	0.4069	0.4201
	_cons	*0.0080*	0.0054	1.4600	0.1430	−0.0027	0.0186
ER_RI_HBR_CWP	ER_RI_SAREIT	0.3913	0.0037	105.4200	0.0000	0.3840	0.3986
	_cons	−0.0134	0.0064	−2.1000	0.0360	−0.0260	−0.0009
B. Analysis using total returns – State 2							
ER_RI_FBR_CWP	ER_RI_SAREIT	0.6004	0.0066	90.9300	0.0000	0.5874	0.6133
	_cons	*0.0005*	0.0094	0.0600	0.9540	−0.0179	0.0190
ER_RI_HBR_CWP	ER_RI_SAREIT	0.2132	0.0077	27.5700	0.0000	0.1980	0.2283
	_cons	0.0010	0.0088	0.1100	0.9130	−0.0163	0.0183
C. Analysis using price returns – State 1							
ER_PI_FBR_CWP	ER_PI_SAREIT	0.4141	0.0034	122.1000	0.0000	0.4075	0.4208
	_cons	*0.0054*	0.0057	0.9500	0.3410	−0.0057	0.0166
ER_PI_HBR_CWP	ER_PI_SAREIT	0.3937	0.0037	105.9700	0.0000	0.3864	0.4010
	_cons	−0.0206	0.0067	−3.0900	0.0020	−0.0337	−0.0075
D. Analysis using price returns – State 2							
ER_PI_FBR_CWP	ER_PI_SAREIT	0.6040	0.0070	85.7800	0.0000	0.5902	0.6178
	_cons	*0.0017*	0.0099	0.1700	0.8670	−0.0178	0.0212
ER_PI_HBR_CWP	ER_PI_SAREIT	0.2070	0.0077	26.9000	0.0000	0.1920	0.2221
	_cons	−0.0036	0.0088	−0.4100	0.6800	−0.0210	0.0137

Note(s): ER_PI_SAREIT: Excess price returns of the South African REIT Index; ER_PI_FBR_CWP: Excess price returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_PI_HBR_CWP: Excess price returns of Home-Biased REIT portfolio (Cap-weighted); ER_PI_SAREIT: Excess price returns of the South African REIT Index; ER_RI_SAREIT: Excess total returns of the South African REIT Index; ER_RI_FBR_CWP: Excess total returns of Foreign-Biased REIT portfolio (Cap-weighted); ER_RI_HBR_CWP: Excess total returns of Home-Biased REIT portfolio (Cap-weighted); ER_RI_SAREIT: Excess total returns of the South African REIT Index
Source(s): Authors' own work

institutional investors which feeds on higher quality information and reduced costs (Gibilaro and Mattarocci, 2016). The observed differences in performance are typical of real estate diversification strategies which vary from country to country and from investor to investor. This also confirms the finding of Wilson and Zurbruegg (2003) that there is no consensus on the extent of benefits from global diversification in the real estate market. Despite risk and return preferences, investment strategies, offshore growth opportunities, among others, the proliferation of real estate investment platforms is increasingly eroding the home-bias phenomenon (Aussant *et al.*, 2014).

5. Summary, conclusion, and recommendations

In this study, we collected the prices and asset allocation data of SAREITs over the period 2013–2022. We used the property allocations to categorise these REITs as either foreign-biased or home-biased for each year. REITs with foreign property allocations that exceed the median allocation for a particular year are categorised as foreign-biased while those with allocations below the median allocation are classified as home-biased. Based on this classification, we created capitalisation-weighted price and total return indexes that track the performance of these two portfolios.

Using the returns of the portfolios constructed, we calculated several measures of portfolio return, risk and risk-adjusted return. This analysis shows that the foreign-biased REITs generally produced higher returns than the home-biased REITs. In terms of risk, however, we find that foreign-based REITs exhibited higher risk when the measure of risk took into account total volatility, e.g. the standard deviation and mean-absolute deviation. The story was, however, different when we calculated downside risk measures such as semi-variance and maximum drawdown. Foreign-biased REITs provided better downside protection as they appeared to be less affected by domestic market conditions. On the whole, we find that foreign-biased REITs generated better risk-adjusted returns irrespective of the risk measure. The results from this stage of our analysis show that investment decisions are likely to be different depending on the measure of return, risk or risk-adjusted return that an investor employs. It is, therefore, important for investors to have access to a wide array of measures to aid better decision-making. Regulators and investment platforms such as Easy Equity, Robinhood, TradeStation, etc. should consider issuing guidelines that require the various funds they host on their platforms to provide at least the most popular measures of return, total risk, downside risk and risk-adjusted returns. A survey of these sites shows that the factsheets provided by the various funds contain measures of risk and return of their own choosing. This could obviously lead to "cherry-picking" and "window dressing" by the funds, to the detriment of the investing public.

We proceeded to work within the framework of the Capital Asset Pricing Model (CAPM). We first estimated the standard CAPM model for the entire sample period, i.e. 2013–2022. The results of the standard CAPM model showed that the foreign-biased REIT portfolio mostly produced positive and significant Alphas while the home-biased REIT portfolios generated negative and statistically significant Alpha coefficients. Foreign-biased REITs also produced higher beta coefficients than their home-biased counterparts.

To test the stability of the estimated coefficients of the standard CAPM model, we first employed rolling and recursive regression analysis to show how the coefficients change or evolve over the sample period. The results show that the coefficients do change over time, an indication of different market cycles or regimes. This analysis further demonstrated that foreign-biased REITs generated positive Jensen's Alphas that were consistently higher than those generated by home-biased REITs. The higher Alphas however came with higher betas, implying that these portfolios were more volatile relative to the local SAREIT benchmark portfolio. The Treynor Ratio, a risk-adjusted return measure based on the CAPM model confirmed that the Alphas produced by the foreign-biased REIT portfolios were worth the higher betas that these portfolios recorded over the sample period. These results also highlight the fact that foreign-biased and home-biased REITs respond differently to systematic risk factors. This suggests that there is an opportunity to further diversify a listed South African property portfolio by holding a combination of foreign-biased and home-biased REITs.

Both the CAPM regression with structural break and regime switching CAPM regression showed that there are times or regimes when none of the portfolios are able to produce statistically significant Alphas. The CAPM regression with structural break showed that none of the portfolios produced statistically significant Jensen's Alphas in the period following the structural break, i.e. the period following the COVID-19 lockdown. Similarly, the regime-switching CAPM regression did not return significant Alphas for any of the portfolios in State 2. This result shows that the ability of the various portfolios to generate outperformance relative to the capital asset pricing model's predicted returns does not hold always. Investors therefore need to be mindful of how they interpret the CAPM outputs that they obtain when they analyse their portfolios and ensure that they test their models out-of-sample before making investment decisions.

The practical implication of these results is that investors can earn better market returns from investing in stocks of REITs with significant foreign asset holdings. From a diversification perspective, investors can protect themselves from local market downturns by holding the stocks of foreign-biased REITs.

Although this study provides evidence of the superior returns, downside risk protection and diversification benefits of holding foreign-biased REITs, this study does not determine an optimal mix of foreign property holdings or the countries or regions that are most associated with these benefits. This is an area that future studies can explore.

Also, we feel that the lack of industry acceptance of multifactor models highlighted in the literature could be because many of the measures or concepts of risk and risk-adjusted returns that are very popular in the investment management industry (e.g. Alpha, Beta, Treynor ratio) are based on the CAPM's single-factor beta. It remains unclear how the multiple betas generated by multi-asset models could be incorporated and how the results can be interpreted. For example, a particular asset may have a low beta relative to Factor 1 but a high relative to Factor 2. There is a need for further studies to develop a similar suit of risk-adjusted metrics, especially within the real estate industry.

A limitation of this study is that we do not employ optimisation techniques in the creation of the various portfolios. We used the market capitalisations in the determination of the weight of the various REITs in the various portfolios. Future studies can explore the use of optimisation techniques to determine the optimal combination of home-biased and foreign-biased that should be held by an investor. An equally-weighted methodology could also be explored. For such an analysis to be meaningful, the benchmark used should also be equally weighted. Although there are a few JSE indices that are equally weighted (e.g. the FTSE/JSE Equally Weighted Index), there is none that specifically focuses on listed South African property companies.

Bearing in mind that the estimates of multifactor models such as the Fama-French and Carhart models as applied by previous studies could still be time-varying, future studies could apply multifactor models in a time-varying fashion to determine whether the benefits of international diversification hold across the selected systematic risk factors. The factors that drive REITs to invest offshore and also determine the success of these investments can also be explored by future studies.

Most importantly, this study has demonstrated that investors actively monitor the macroeconomic, political and other factors which could impact the current performance and future prospects of the properties that REITs invest in, especially offshore. REITs therefore need to put in more efforts to carry investors along by providing them with adequate information to boost their confidence. The facts surrounding planned acquisitions need to be shared with investors timeously to let them understand what the real prospects and challenges are.

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Appendix 1

Table A1. Summary of offshore direct property allocations by SA property firms

Total invested offshore	US$4.9billion (%)
Regional breakdown	
Central Europe	63
Western Europe	15
Australia	17
UK	4
Rest of Africa	2
Sector breakdown	
Retail	60
Office	20
Industrial	20

Source(s): Table created by authors Based on Moneyweb (2019)

Appendix 2

Table A2. Summary statistics – foreign allocation (in percentages) and foreign bias frequency

Rank	REIT name	Frequency[1]	Average	Maximum	Minimum
1	Growthpoint Properties	10	35.07	49.93	21.91
2	Fortress REIT Limited	9	38.07	52.00	27.04
3	Resilient REIT	6	26.33	39.86	13.23
4	Texton Property Fund	6	22.85	38.90	0.00
5	Vukile Property Fund	6	28.54	55.79	5.33
6	Equites Property Fund	5	20.91	46.09	0.00
7	Stor-age REIT	5	17.90	45.57	0.00
8	Tower Property Fund	4	17.55	37.04	0.00
9	Attacq Limited	3	14.14	20.41	0.00
10	Investec Property Fund	3	15.80	45.00	0.00
11	Redefine Properties	3	15.67	22.77	4.85
12	Hyprop Investments Limited	3	20.21	41.00	1.04
13	Rebosis Property Fund	2	5.81	21.02	0.00
14	Emira Property Fund	1	9.21	17.23	5.40
15	Accelerate Property Fund	0	7.16	13.30	0.00
16	Arrowhead Properties	0	0.00	0.00	0.00
17	Delta Property Fund	0	1.98	3.66	0.00
18	Dipula Income Fund	0	0.00	0.00	0.00
19	Fairvest Property Holdings	0	0.74	6.62	0.00
20	Heriot REIT	0	0.00	0.00	0.00
21	Indluplace Properties	0	0.00	0.00	0.00
22	Liberty Two Degrees	0	0.00	0.00	0.00
23	Octodec Investments Limited	0	0.00	0.00	0.00
24	SA Corporate Real Estate	0	2.82	5.88	0.00
25	Spear REIT Limited	0	0.00	0.00	0.00
26	Transcend Residential Property Fund	0	0.00	0.00	0.00

Note(s): Frequency: Number of times a firm is ranked as foreign-biased over the sample period
Source(s): Authors' own work

Appendix 3

Table A3. Portfolio Performance Metrics – Price Returns

	PI_ SAREIT	PI_SAPY	PI_FBR_ CWP	PI_HBR_ CWP
A. Annual price returns (2013–2022)				
Average returns (%)	−3.8916	−2.0636	0.5369	−2.7739
Maximum (%)	21.2931	25.6466	12.1255	18.5855
Minimum (%)	−57.7827	−45.7609	−15.9309	−42.7458
Standard deviation	25.0936	22.9951	9.1865	18.5619
Correlation	1.0000	0.9776	0.4476	0.9454
Annual price returns (2013–2019)				
Average returns	1.0797	1.4728	0.3586	0.7231
Maximum	15.4848	18.5881	11.8439	18.5855
Minimum	−29.3013	−31.1659	−15.9309	−19.7132
Standard deviation	16.4285	17.0322	9.8412	12.4990
Correlation	1.0000	0.9639	0.3566	0.8075
B. Daily price returns and other portfolio metrics (2013–2022)				
Index growth (Base value R100m)	47.9757	63.3709	101.2994	65.4592
Arithmetic average return (%)	−0.0184	−0.0099	0.0036	−0.0162
Geometric mean returns	−0.0318	−0.0197	0.0006	−0.0183
Average excess returns wrt Tbill returns (%)	−0.0345	−0.0261	−0.0125	−0.0324
Average excess returns wrt SAREIT (%)	0.0000	0.0085	0.0221	0.0022
Correlation wrt SAREIT	1.0000	0.9334	0.9405	0.8992
Standard deviation (%)	1.6274	1.3926	0.7847	0.6449
Mean absolute deviation (%)	1.0165	0.8314	0.4929	0.3927
Tracking error wrt SAREIT returns (%)	0.0000	0.5973	0.9284	1.0848
Maximum Drawdown	74.7805	71.7420	34.2135	55.5002
Semi-deviation wrt SAREIT index (%)	0.0000	0.4276	0.6348	0.7622
Sharpe ratio	−0.0212	−0.0187	−0.0159	−0.0502
Information ratio wrt SAREIT	–	0.0142	0.0238	0.0020
Calmer ratio	−0.0005	−0.0004	−0.0004	−0.0006
Sortino ratio wrt SAREIT index	–	0.0198	0.0347	0.0028
C. Daily price returns and other portfolio metrics (2013–2019)				
Index growth (Base value R100m)	80.5525	88.6201	119.2256	76.5399
Arithmetic average return (%)	−0.0075	−0.0033	0.0131	−0.0163
Geometric mean returns	−0.0139	−0.0077	0.0113	−0.0171
Average excess returns wrt Tbill returns (%)	−0.0256	−0.0214	−0.0050	−0.0344
Average excess returns wrt SAREIT (%)	0.0000	0.0041	0.0206	−0.0088
Correlation wrt SAREIT	1.0000	0.9523	0.9260	0.8230
Standard deviation (%)	1.1302	0.9377	0.6019	0.4174
Mean absolute deviation (%)	0.8030	0.6589	0.4133	0.2895
Tracking error wrt SAREIT returns (%)	0.0000	0.3718	0.6162	0.8216
Maximum drawdown	38.1721	36.3439	16.3547	32.2823
Semi-deviation wrt SAREIT index (%)	0.0000	0.2647	0.4198	0.5898
Sharpe ratio	−0.0226	−0.0228	−0.0083	−0.0823
Information ratio wrt SAREIT	#DIV/0!	0.0111	0.0334	−0.0107
Calmer ratio	−0.0007	−0.0006	−0.0003	−0.0011
Sortino ratio wrt SAREIT index	#DIV/0!	0.0156	0.0490	−0.0149

Source(s): Authors' own work

Appendix 4

Source(s): Authors' own work

Figure A1. Rolling average returns (one year)

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