

ANALYSIS OF THE PERFORMANCE AND DIVERSIFICATION BENEFITS OF THE SOUTH AFRICA COMMERCIAL REAL ESTATE MARKET

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ABSTRACT

The South Africa real estate market is an important African real estate market, having attracted considerable investor interest in recent years; particularly from domestic real estate investors. This paper highlights the risk-adjusted performance and portfolio diversification benefits of South Africa commercial real estate in a mixed-asset portfolio over a full period of 1996-2016 as well as in a post-GFC context. The risk-adjusted returns analysis demonstrates a clear distinction of the performance of South Africa commercial real estate, with both direct and listed real estate provided competitive risk-adjusted performance compared to stocks and bonds. Importantly, both direct and listed real estate contributed significantly in mixed-asset portfolios due to improved portfolio diversification benefits since the GFC. The strategic real estate investment implications are also highlighted.

INTRODUCTION

The real estate investment landscape in Africa has experienced considerable investment activities over the last decade, particularly amongst investors seeking real estate opportunities beyond the traditional developed markets, targeting higher return-risk spectrum and diversification opportunities in new real estate investment markets. With Africa being composed of predominantly developing real estate markets as well as being home to some of the significant improvers of real estate market transparency (e.g.: Botswana, Zambia, Ethiopia) (JLL, 2016), Africa is seen by investors as a unique alternative real estate investment opportunity. The region is also actively contributing to global real estate momentum, signifying the continuous improvement by various African jurisdictions in improving their real estate market competitiveness and attractiveness (e.g.: Nairobi) (JLL, 2017). The income-producing commercial real estate marketplace in Africa has seen substantial activity recently, with the total transaction volume for the full year of 2017 recorded at \$2.7 billion. This is a 93% increase on post-GFC 2010's total real estate transaction volume of \$1.4 billion. Over 200 commercial properties were transacted over 2017 versus only 42 commercial properties in 2010 (RCA, 2017). This also sees five Africa-focussed real estate funds having successfully raised a total of \$1.4 billion over 2013-2017 (see Exhibit 1), indicating the growing use of the non-listed real estate vehicle as a route to Africa real estate.

With the apartheid regime in the distant past and the economy undergoing significant transformation, South Africa is an instrumental powerhouse in the region due to its greater economic and political stability (CBRE, 2016). This allows South Africa to be the key conduit for significant commercial real estate investment in the region, otherwise largely inaccessible from other African countries. This sees South Africa being the source of major real estate investment activity in the African region. At \$2.2 billion, commercial real estate transactions in South Africa represents 81% of the total transaction volume in the region in 2017. Increases in the urbanisation rate (1.33% p.a.) (CIA, 2017) and industrialisation of the economy (PWC, 2015) will see continued demand for real estate products by local and international investors as well as higher private and public investment in real estate to accommodate this structural change.

Even though the South Africa real estate market in general has been the focal point in various research in recent years, published research on the performance and added value role of South Africa commercial real estate is scarce. This previous research has largely concentrated on the

following issues: investment decision making for South African investors (Akinsomi et al, 2015; Lowies et al, 2016), drivers of commercial real estate returns (Akinsomi et al, 2018), relationship between macroeconomic factors and house prices (Gupta et al, 2010; Das et al, 2011; Simo-Kengne et al, 2012; Aye et al, 2013; Simo-Kengne et al, 2015), listed real estate companies (Bardhan et al, 2008; Olaleye, 2011; Akinsomi et al, 2016) and South Africa REITs (Akinsomi et al, 2017; Ntuli and Akinsomi, 2017; Ijase et al, 2017). While the South African listed real estate market has attracted considerable interest recently, these studies did not provide a fuller coverage of both direct and listed commercial real estate investment opportunities, particularly concerning the added-value role and benefits of South Africa commercial real estate (both direct and listed real estate) in the perspective of a South African mixed-asset investment portfolio.

The purpose of this paper is to assess the significance, risk-adjusted performance and portfolio performance enhancement role of South Africa commercial real estate over 1996-2016. This sees three specific research questions (RQ) concerning South Africa commercial real estate as the primary empirical focus of this research:

RQ1: How does South Africa commercial real estate compare to major asset classes on a risk-adjusted basis?

RQ2: Does South Africa commercial real estate provide added-value and diversification benefits in a mixed-asset portfolio framework?

RQ3: Has South Africa commercial real estate enhanced its performance and added-value benefits in the post-GFC South Africa mixed-asset investment framework?

These three research questions enable considerable insights into the role of South Africa commercial real estate in a mixed-asset portfolio, and the ongoing strategic implications for South Africa commercial real estate as an effective real estate investment market; particularly for domestic real estate players and cross-border investors looking for optimistic risk-return real estate investment opportunities in an emerging market. The strategic real estate investment implications are also highlighted.

SIGNIFICANCE OF SOUTH AFRICA COMMERCIAL REAL ESTATE

South Africa profile

Located in the southern-most region of the African continent (see Exhibit 2), South Africa has been at the forefront of significant economic and investment activities in both domestic and regional perspectives in recent years. With a GDP size of \$362 billion and a real GDP growth for 2017 expected at 0.9%, South Africa is the second largest economy within the Sub-Saharan region (after Nigeria at \$461 billion). This also means South Africa could be regarded as one of the prosperous African countries, in terms of the size of its population (54.8 million) relative to its economy (CIA, 2017; IMF, 2017). South Africa also excels in many economic and institutional qualities, with South Africa (#61 globally) being the third most economically competitive African country, only exceeded by Mauritius (#45) and Rwanda (#58) (WEF, 2017). The stature of the South African economy is further reinforced with its conducive and business-friendly environment, ranking South Africa (#82 globally) in the fifth place amongst African countries after Mauritius (#25), Rwanda (#41), Kenya (#80) and Botswana (#81) (World Bank, 2017). Continuous institutional commitment at combating corruption sees South Africa improving its corruption perception ranking from 69th least corrupt country in 2012 (TI, 2012) to 64th least corrupt country in 2016 (TI, 2017). Exhibit 3 profiles the social, economic and real estate context of South Africa.

South Africa real estate profile

At \$76 billion, South Africa is one of the most vibrant investable commercial real estate markets in the African region, accounting for 11% of the Middle East and Africa (MEA) emerging market as well 1% of the global emerging market investable real estate universe (EPRA, 2017a). The significant commercial real estate investment opportunity has spurred the development of real estate investment vehicles in South Africa, with the Real Estate Investment Trust (REIT) investment regime being introduced in 2013. 29 South African REITs are available in the listed real estate investment space, enabling investors' access to a "purer" yield-oriented commercial real estate exposure in a liquid format (EPRA, 2017b). This includes Growthpoint, Redefine, Resilient and Hyprop. Also, some of these REITs have been a significant player in recent years as local investors in the South Africa commercial real estate investment landscape. Exhibit 4 profiles the property portfolio of South African REITs; particularly concerning their asset under management (AUM), property sectors and locations.

At \$32.1 billion, its listed real estate market (both REITs and listed real estate operating companies) is a significant component of the overall capital market, contributing 7.6% of the total South African stock market capitalisation.

The transparency status of the South African real estate market gives further credence to its real estate market significance (both in a regional and emerging real estate market context). South Africa (25th most transparent) is the only real estate market in the African region to achieve a transparent real estate market status and being in third place amongst the emerging real estate markets, after Poland (#13) and Czech Republic (#20) (JLL, 2016). The enhanced stature of South Africa real estate transparency is contributed to by the quality and depth of its real estate market data and reporting, as well as efficient legal and planning processes for its real estate. This is further complemented by the ongoing real estate anti-corruption initiative by the government (Boles, 2017) as well as the contribution of economic competitiveness towards real estate transparency (Newell, 2008), as evident in South Africa.

At \$16.6 billion, commercial real estate transaction activity over 2013-2017 in South Africa is significant; accounting for 93% of the regional transaction volume. The source of capital for this commercial real estate transactions has been from domestic investors (98% of total transaction volume). South African REIT companies are the largest contributors towards this capital inflow (62% of total transaction volume) to South Africa commercial real estate (see Exhibit 5). This sees major South African REITs dominate the top 5 players e.g.: Fortress (\$3.6 billion), Redefine (\$2.8 billion), Growthpoint (\$1.5 billion), Accelerate (\$0.7 billion) and Investec (\$0.6 billion) (see Exhibit 5). Traditional real estate sectors dominate the South Africa real estate acquisition landscape over 2013-2017, with the office sector (36% of total transaction volume) and retail sector (35%) being the preferred real estate sectors amongst investors.

Overall, the South Africa real estate market has seen increased significance in recent years (both in domestic and regional contexts), marked by stronger domestic real estate investor activity, innovation in real estate product and improved real estate market transparency. Having established the significant interest in, and increased importance of commercial real estate in South Africa, the following sections will analyse and highlight the risk-adjusted performance, portfolio diversification benefits and portfolio value-added role of South Africa commercial real estate.

DATA AND METHODOLOGY

Data

The MSCI annual South Africa real estate total return performance series was used over the 21-year period of 1995-2016. This long time-series data enables the coverage of a full real estate market cycle. However, since this MSCI South Africa real estate data series was constructed using the appraised value of individual real estate assets, a first-order auto-regressive (AR1) de-smoothing filter proposed by Geltner (1993) was applied to remove the appraisal-smoothing bias. A de-smoothing parameter of $\alpha = 0.50$ was chosen. This resulted in one year of the total return data being consumed in the construction of the de-smoothed MSCI South Africa real estate series. The time series used for analysis effectively covered 1996-2016. A sub-period post-GFC analysis was also conducted over 2010-2016 to assess the post-GFC recovery for South Africa commercial real estate.

The MSCI South Africa real estate index at 2016 comprised 1,450 properties from 13 fund portfolios valued at South African Rand (ZAR) 297 billion (US\$ 22 billion). The respective real estate sub-sectors used were office (548 properties at ZAR 80 billion (US\$ 6 billion)), retail (297 properties at ZAR 170 billion (US\$ 12 billion)) and industrial (483 properties at ZAR 32 billion (US\$2 billion)), with their respective contributions to the overall South Africa real estate index being office (27%), retail (57%) and industrial (10.7%) (MSCI, 2017). Three South Africa capital cities real estate market was also analysed: Johannesburg, Cape Town and Durban.

For the other mainstream asset classes, the MSCI South Africa described the stock market index, while the South Africa listed real estate index was derived from a Datastream-calculated index. South African 10-year governments bonds and 90-day treasury bills were used to represent the equivalent bonds and cash asset-class respectively. All analyses were done in ZAR.

Methodology

Performance analysis used were average annual returns and annual risk over 1996-2016. Risk-adjusted returns were assessed using the Sharpe ratio. Portfolio diversification benefits were assessed using correlation analysis to identify the potential mixed-asset portfolio benefits for South Africa commercial real estate. The mixed-asset portfolios were assessed using efficient

frontier and asset allocation diagrams across the risk spectrum. This was then extended to assess South Africa commercial real estate in the post-GFC context over 2010-2016.

RESULTS: FULL PERIOD: 1996-2016

This first section analyses the performance of South Africa commercial real estate over the full period of 1996-2016.

Risk-adjusted performance

Exhibit 6 displays the risk-adjusted performance of South Africa commercial real estate over 1996-2016. Listed real estate (20.58% p.a.) delivered the highest average returns over this period, with direct real estate (14.32% p.a.) outperforming both stocks (12.95% p.a.) and bonds (10.59% p.a.). Except for bonds (3.04%), direct real estate (10.35%) recorded a lower risk level than listed real estate (18.39%) and stocks (19.49%). The strong performance demonstrated by both listed (Sharpe ratio: 0.61; Sharpe ranking: #1) and direct (0.47; #2) real estate saw both of these real estate investment channels as the best and second-best performing assets on the Sharpe ratio risk-adjusted performance ranking.

By real estate sub-sector, retail real estate (0.60) was the best-performing sector, well ahead of both industrial (0.47) and office (0.25). Cape Town (0.47) delivered the highest risk-adjusted performance within the city sub-sector due to its superior average annual returns delivered at a competitive risk level compared to Johannesburg and Durban over 1996-2016.

Diversification benefits

The inter-asset correlation coefficients for South Africa commercial real estate over 1996-2016 are shown in Exhibit 7. The overall results indicate that both South Africa listed (correlation coefficient of $r = 0.55$) and direct ($r = 0.61$) real estate has limited diversification benefits with the stock market. Both commercial real estate vehicles are also substitutable in a mixed-asset portfolio ($r = 0.63$), indicating a mean-reverting attribute of real estate returns in a long-run investment horizon. Nevertheless, South Africa commercial real estate could provide investors with diversification benefits with fixed-income instrument since both listed ($r = 0.04$) and direct ($r = -0.15$) real estate were weakly correlated with the long-term government bonds.

While investment within the direct real estate sub-sectors would not provide enhanced diversification potential, several direct real estate sub-sectors were found to be a good portfolio diversifier with the stock markets, for instance industrial real estate ($r = 0.42$) as well as real estate assets located in Cape Town ($r = 0.36$).

Mixed-asset portfolios

Exhibit 8 presents the efficient frontier of various portfolio mix scenarios and the asset allocation diagram for South Africa commercial real estate over 1996-2016. A baseline portfolio (Portfolio 1) comprised financial assets only (stocks and bonds) was constructed to evaluate the performance enhancement of adding South Africa commercial real estate in mixed-asset portfolios. The inclusion of direct (Portfolio 2) and listed (Portfolio 3) real estate separately resulted in upward shifting of the efficient frontier curve compared to the baseline portfolio. However, the efficient frontier of Portfolio 2 composed of financial assets and direct real estate was over a limited risk-return band. The portfolio with financial assets and listed real estate provided a more significant coverage across the risk-return spectrum.

When the mixed-asset framework was enlarged to include all assets into the mix (Portfolio 4), the overall risk-return curve exhibited marginal improvement across the entire risk-return band; this 4-asset portfolio had the highest efficiency. Most importantly, the asset allocation diagram for Portfolio 4 shows the important role played by real estate, with a more prominent role by listed real estate. Stocks did not form any part of this optimal portfolio.

A constrained optimal asset allocation analysis was then performed, whereby the total allocation for direct and listed real estate was capped at 10%; reflecting a realistic real estate allocation in an investment portfolio. As shown in Exhibit 9, the majority of the 10% limit was allocated to listed real estate, while direct real estate was limited only in the conservative portfolio risk-return spectrum. This suggests that performance enhancement could be achieved more optimally through listed real estate's higher risk-return trade-off within the confines of the 10% allocation cap.

RESULTS: POST-GFC: 2010-2016

Risk-adjusted performance

The post-GFC risk-adjusted performance of South Africa real estate is shown in Exhibit 10. A slightly lower annual return performance was recorded in this post-GFC period compared to the full period by both direct (13.83% p.a. versus 14.32% p.a.) and listed (17.86% p.a. versus 20.58% p.a.) real estate. Nevertheless, a significant reduction in annual risk level is evident in both direct (4.39% versus 10.35%) and listed (11.62% versus 18.39%) real estate. This resulted in 257% and 26% improvement on the Sharpe ratio risk-adjusted basis by direct and listed real estate respectively. Consequently, both direct (#2) and listed (#3) real estate outperformed the stock market (#4), with bonds (#1) delivering the best risk-adjusted returns over this post-GFC period.

Diversification benefits

The South Africa commercial real estate post-GFC correlation analysis results are given in Exhibit 11. Overall, the impact on diversification benefits in the post-GFC timeframe was mixed. For example, a 19% (post-GFC: $r = 0.51$ vs full period: $r = 0.63$) diversification improvement suggests both direct and listed real estate would be able to complement each other in a mixed-asset framework in this post-GFC period. Further, a 63% more effective diversification was achieved between listed real estate and stocks ($r = 0.20$ versus $r = 0.55$). However, both direct and listed real estate exhibited lower diversification with bonds over the same period. Mixed results were also observed within the real estate sub-sectors and major cities.

Mixed-asset portfolios

Exhibit 12 shows various post-GFC efficient frontiers generated from ideal mixtures of bonds, stocks, direct and listed real estate. Efficient frontiers containing real estate assets (Portfolio 2 and 3) outperformed the financial assets-only portfolio (Portfolio 1) throughout the entire risk-return band. Both real estate channels presented their own unique role, in that the addition of direct real estate provided substantial upward shift of the efficient frontier, whilst listed real estate allowed for a wider risk-return spectrum. The results imply that commercial real estate is an important component of asset mixes for both risk-averse investors as well as investors seeking greater risk-return trade-off.

Exhibit 12 also presents the different asset weightings of Portfolio 4 scenario. The conservative optimal asset-mix (delivering the lowest level of portfolio return (8.27% p.a.) and risk (0.37%)), was monopolised by bonds. However, this changed where bonds were omitted entirely, which occurred when the portfolio return and risk reached the moderate levels of 15.1% p.a. and 7.0%. At this point, the percentages of direct and listed real estate increased to 62% and 38% respectively. From this point, both direct and listed real estate maintained their significant presence as important components of efficient portfolios, coexisting with each other until the highest point of the risk-return spectrum in this South Africa post-GFC mixed-asset framework.

Given the over-exposure of real estate in the post-GFC unconstrained portfolio analysis, the optimisation process adopted a constraint of 10% in total real estate, while stock and bond allocations were not constrained. The result of this scenario is presented in Exhibit 13. Real estate maintained its role at the 10% maximum allocation throughout the entire portfolio risk-return band except at the most conservative portfolio risk-return level. Listed real estate had a higher role in this post-GFC portfolio context than direct real estate, with the average allocation in listed real estate at 8% compared to 1% for direct real estate.

REAL ESTATE INVESTMENT IMPLICATIONS

The South Africa real estate market is an important platform to both local and international real estate investors seeking to access the African real estate markets. This sees South Africa as the most transparent real estate market and the hive for significant real estate transaction activities within the region. The introduction of the REIT investment structure in 2013 has been a major stimulus for domestic demand for quality commercial real estate assets, with South African REITs having been the major players in the commercial real estate marketplace by transaction volume over 2013-2017. This increased stature of South Africa commercial real estate investment space warrants an independent investigation of its investment attributes; this being the primary motivation of this paper.

Three key research questions have been addressed by this paper and the performance and added-value benefits of South Africa commercial real estate were empirically investigated. While past performance is no guarantee of future performance, the full period analysis over 1996-2016 using MSCI data has highlighted the competitive performance of South Africa commercial real estate compared to the other major South Africa asset classes. Notably, both direct and listed real estate improved their risk-adjusted performance in the 2010-2016 post-GFC period. This resulted in real estate being prominently featured in the optimal mixed-asset investment framework, be they in the full period or the post-GFC timeframe. Thus, commercial real estate is an essential element of investment portfolios irrespective of the investor's risk-return appetite.

Overall, the results link in strongly with the increased domestic investment activity in South Africa in recent years. More importantly, this paper presents a compelling case for the relevance for South Africa as a unique real estate investment opportunity in an emerging market context. The challenge going forward is the need for a higher level of involvement in real estate investment activity by major international real estate investors. This is crucial as South Africa continues to become the conduit for access to the regional real estate investment opportunities.

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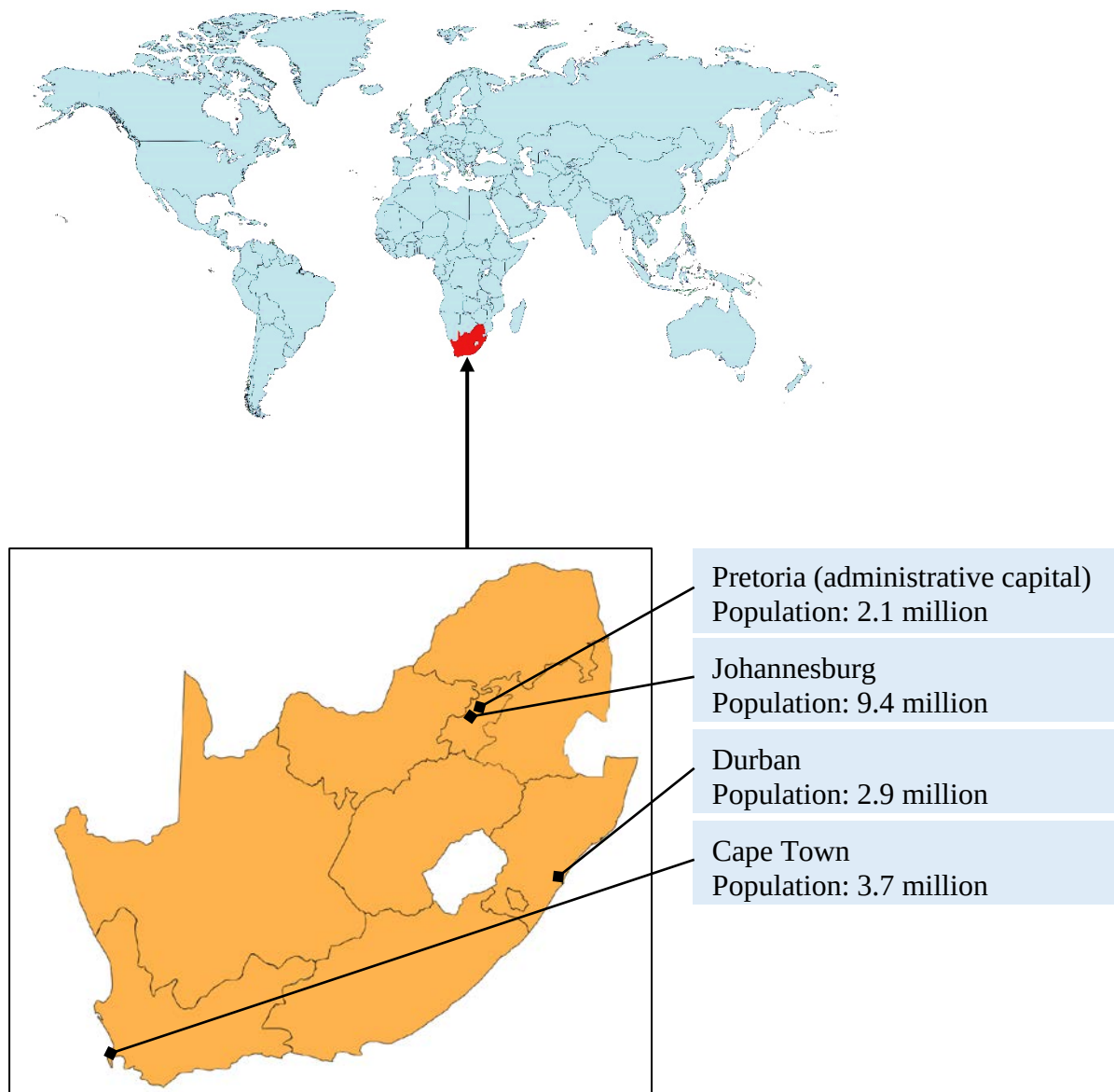
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Exhibit 1: Top Five Africa-Focussed Closed RE Funds: 2013-2017

Real estate fund	Fund manager	Size (\$M)	Geographic focus
Actis Africa RE Fund III	Actis	500	Sub-Saharan Africa
Novare Africa Property Fund II	Novare	351	Pan-Africa
RMB Westport RE Development Fund II	RMB Westport	272	Nigeria, Ghana, Angola, Ivory Coast
Momentum Africa RE Fund	Momentum/Eris	170	Mozambique, Zambia, Kenya, Nigeria, Ghana
Pan African Housing Fund	Phatisa	42	Kenya, Rwanda, Zambia

Source: I&P RE (2018), Linklaters (2018), Preqin (2018)

Exhibit 2: Map of South Africa



Source: Author's construction from MapChart, CIA (2017)

Exhibit 3: Social, economic and real estate profile of South Africa: 2017

Social:

Population: 54.8 million

Major cities: Pretoria (administrative capital), Johannesburg, Cape Town, Durban

Urban population: 66%

Rate of urbanisation: 1.3%

Government: Parliamentary republic

Economic:

GDP: \$362 billion

GDP growth: 0.9% real

GDP sectors: Services (67%), industrial (30%), agriculture (3%)

Labour force: 22.2 million (services (72%), industrial (23%), agriculture (5%))

Unemployment: 27.6%

Global competitiveness: #61 (out of 137 countries)

Corruption perception: 64th least corrupt (out of 176 countries)

Ease of doing business: #82 (out of 190 countries)

Stock exchange: Johannesburg (#17 globally; \$995 billion market cap)

Real estate:

Real estate transparency: transparent (#25 globally)

Size of commercial real estate market: \$76 billion

Listed real estate sector = 7.3% stock market

No. of REITs = 29

Sources: CIA (2017), IMF (2017), EPRA (2017), JLL (2016), Transparency International (2017), World Bank (2017), World Economic Forum (2017), World Federation of Exchanges (2017)

Exhibit 4: Property profile of South African REITs: 2017

South Africa REIT	AUM (ZAR billion)	No. of properties	Property sector	Location
Hammerson*	181.5	37	Retail	UK, Ireland, France
Intu*	180.3	20	Retail	UK, Spain
Growthpoint	105.6	559	Diversified	South Africa, Australia, Europe
Hyprop	28.3	20	Retail	South Africa, Sub-Saharan Africa, Macedonia
Fortress	28.2	300	Diversified	South Africa
Redefine	25.8	49	Diversified	UK, Germany, South Africa
Resilient	22.8	39	Retail, vacant land	South Africa, Nigeria, Portugal
Rebosis	18.7	49	Diversified	South Africa
Investec	17.4	119	Diversified	South Africa
Property Fund SA Corporate	16.8	196	Diversified	South Africa, Zambia
Capital and Regional	15.3	9	Retail	UK
Vukile	13.6	66	Retail	South Africa, Namibia
Emira	13.2	134	Diversified	South Africa
Arrowhead	13	305	Diversified	South Africa
Octodec	12.8	315	Diversified	South Africa
Accelerate	11.6	60	Diversified	South Africa, CEE
Liberty 2D	8.7	11	Office, retail	South Africa
Hospitality	8.2	24	Hospitality	South Africa
Investec Australia	7.5	24	Diversified	Australia
Dipula	6.9	174	Diversified	South Africa
Equites	6.2	52	Logistics	South Africa
Texton Property	5.5	54	Diversified	South Africa, UK
Tower	5.1	46	Diversified	South Africa, Croatia
Gemgrow	4.5	129	Retail, industrial	South Africa, Croatia
Stor-age	3	43	Self-storage	South Africa
Indluplace	2.9	125	Residential, student accomm.	South Africa
Safari	2.6	19	Retail, healthcare	South Africa, Namibia
Fairvest	2.2	41	Retail	South Africa
Delta	1.3	18	Diversified	South Africa

*: dual listing on London Stock Exchange and Johannesburg Stock Exchange

Source: Author's compilation from various South African REIT annual reports

Exhibit 5. Top 10 South Africa commercial property investors by acquisition volume: 2013-2017

Rank	Company	Acquisition volume by property sector (%)				Volume (\$ billion)	No. of property
		Office	Industrial	Retail	Hotel		
1	Fortress*	40%	4%	37%	7%	\$3.57 B	259
2	Redefine*	3%	8%	4%	11%	\$2.83 B	114
3	Growthpoint*	14%	0%	47%	9%	\$1.49 B	75
4	Accelerate*	25%	0%	1%	62%	\$0.69 B	44
5	Investec*	0%	0%	100%	0%	\$0.67 B	48
6	Tradehold	70%	15%	13%	1%	\$0.57 B	71
7	Octodec	13%	6%	71%	0%	\$0.51 B	87
8	Delta	0%	0%	100%	0%	\$0.50 B	52
9	Billion	54%	0%	46%	0%	\$0.47 B	33
10	Vukile*	71%	0%	29%	0%	\$0.36 B	20

*: South African REITs

Source: Authors' compilation from RCA database

Exhibit 6: South Africa commercial RE risk-adjusted performance analysis: 1996-2016

Asset	Average annual returns (%)	Annual risk (%)	Sharpe ratio
Real estate	14.32%	10.35%	0.47
Office	11.98%	10.46%	0.25
Retail	15.80%	10.62%	0.60
Industrial	15.10%	12.01%	0.47
Johannesburg	13.94%	11.14%	0.41
Cape Town	14.86%	11.53%	0.47
Durban	13.51%	14.45%	0.28
Stocks	12.95%	19.49%	0.18
Listed real estate	20.58%	18.39%	0.61
Bonds	10.59%	3.04%	0.39

Source: Author's analysis from MSCI and Datastream

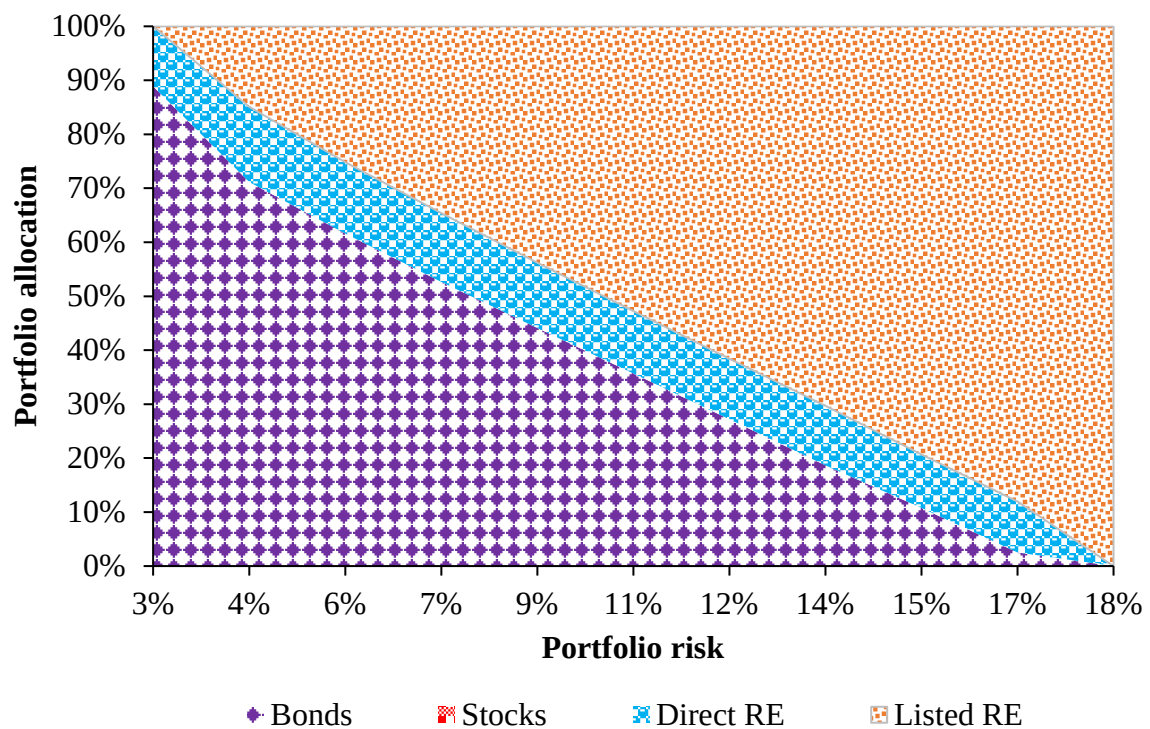
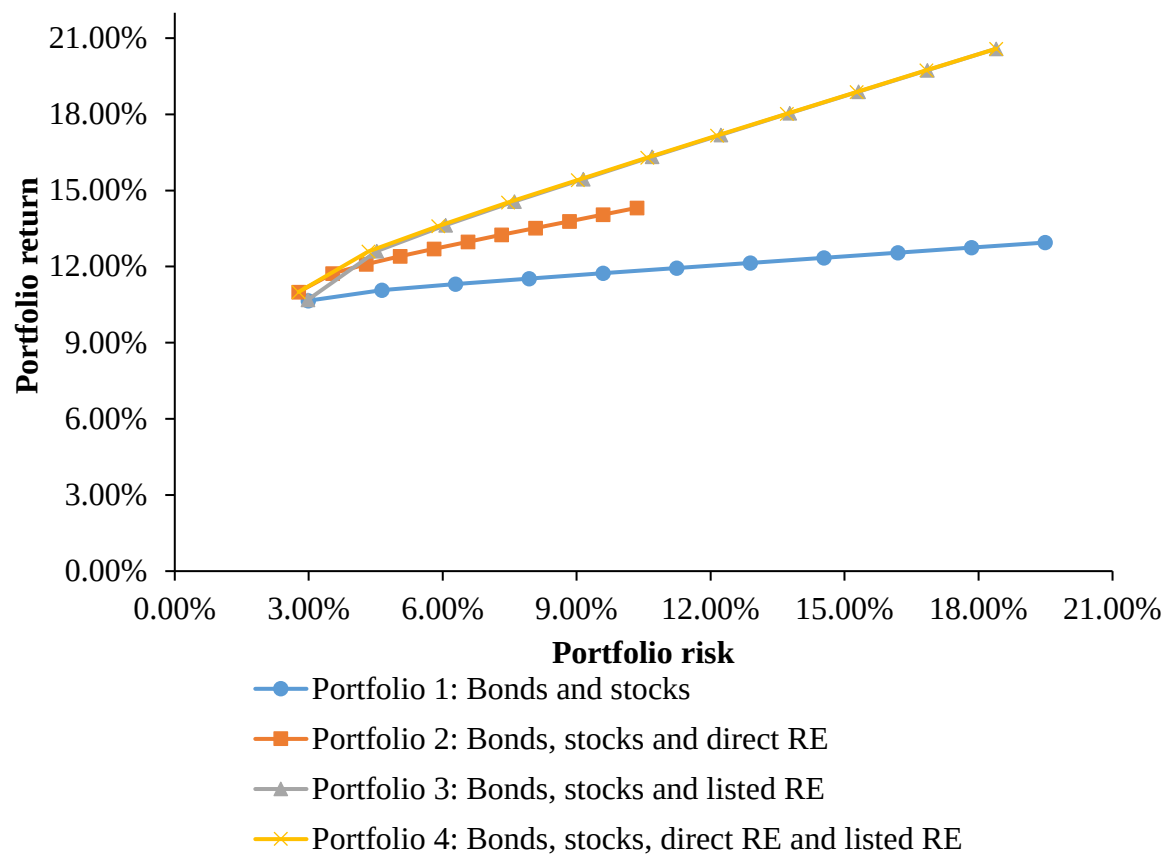
Exhibit 7: South Africa commercial RE correlation analysis: 1996-2016

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Real estate [1]	1.00									
Office [2]	0.92*	1.00								
Retail [3]	0.95*	0.78*	1.00							
Industrial [4]	0.91*	0.83*	0.83*	1.00						
Johannesburg [5]	0.97*	0.92*	0.88*	0.92*	1.00					
Cape Town [6]	0.87*	0.75*	0.88*	0.80*	0.80*	1.00				
Durban [7]	0.87*	0.74*	0.87*	0.77*	0.80*	0.71*	1.00			
Stocks [8]	0.61*	0.55*	0.65*	0.42	0.51*	0.36	0.62*	1.00		
Listed real estate [9]	0.63*	0.67*	0.54*	0.47*	0.59*	0.50*	0.54*	0.55*	1.00	
Bonds [10]	-0.15	-0.26	-0.01	-0.25	-0.13	-0.02	-0.24	-0.04	0.04	1.00

Source: Author's analysis from MSCI and Datastream

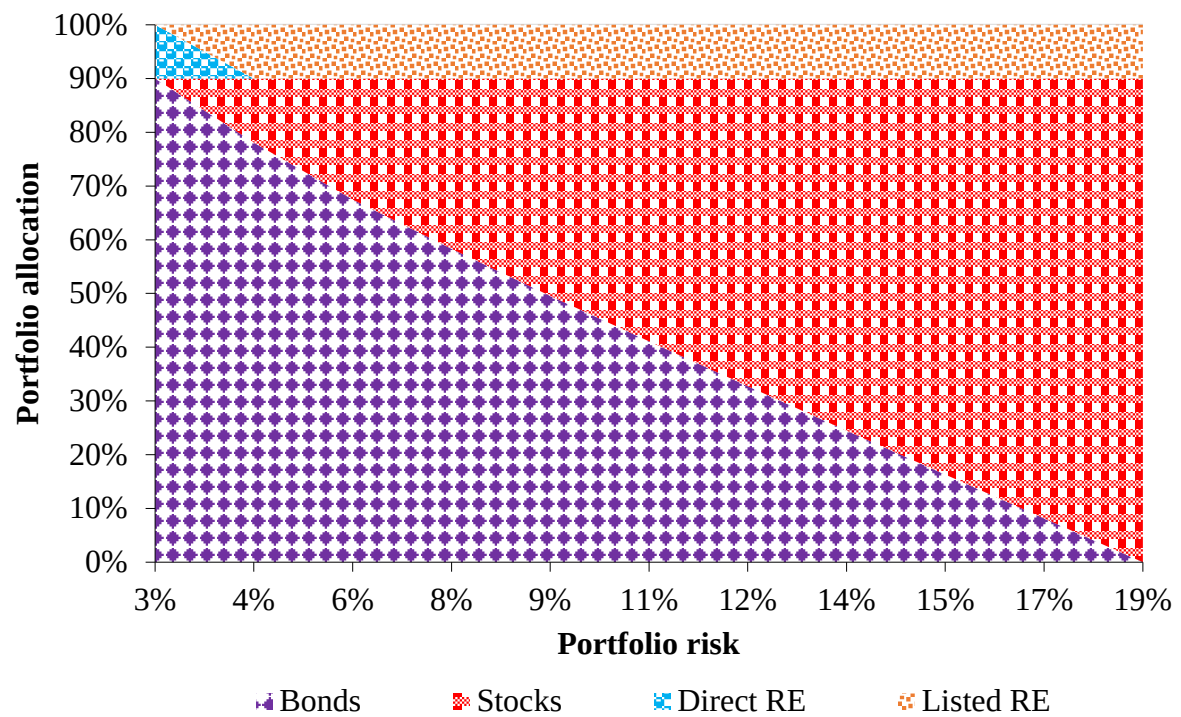
*: significant correlation <5%

Exhibit 8: South Africa commercial RE efficient frontiers and asset allocation diagram: 1996-2016



Source: Author's analysis from MSCI and Datastream

Exhibit 9: South Africa commercial RE constrained asset allocation diagram: 1996-2016



Source: Author's analysis from MSCI and Datastream

Exhibit 10: South Africa commercial RE post-GFC risk-adjusted performance analysis: 2010-2016

Asset	Average annual returns (%)	Annual risk (%)	Sharpe ratio
Real estate	13.83%	4.39%	1.68
Office	11.48%	5.07%	1.08
Retail	14.16%	4.77%	1.71
Industrial	14.82%	4.24%	2.08
Johannesburg	13.29%	4.36%	1.67
Cape Town	12.73%	5.88%	1.15
Durban	14.62%	11.39%	0.76
Stocks	12.23%	9.42%	0.66
Listed real estate	17.86%	11.62%	0.87
Bonds	8.27%	0.37%	6.15

Source: Author's analysis from MSCI and Datastream

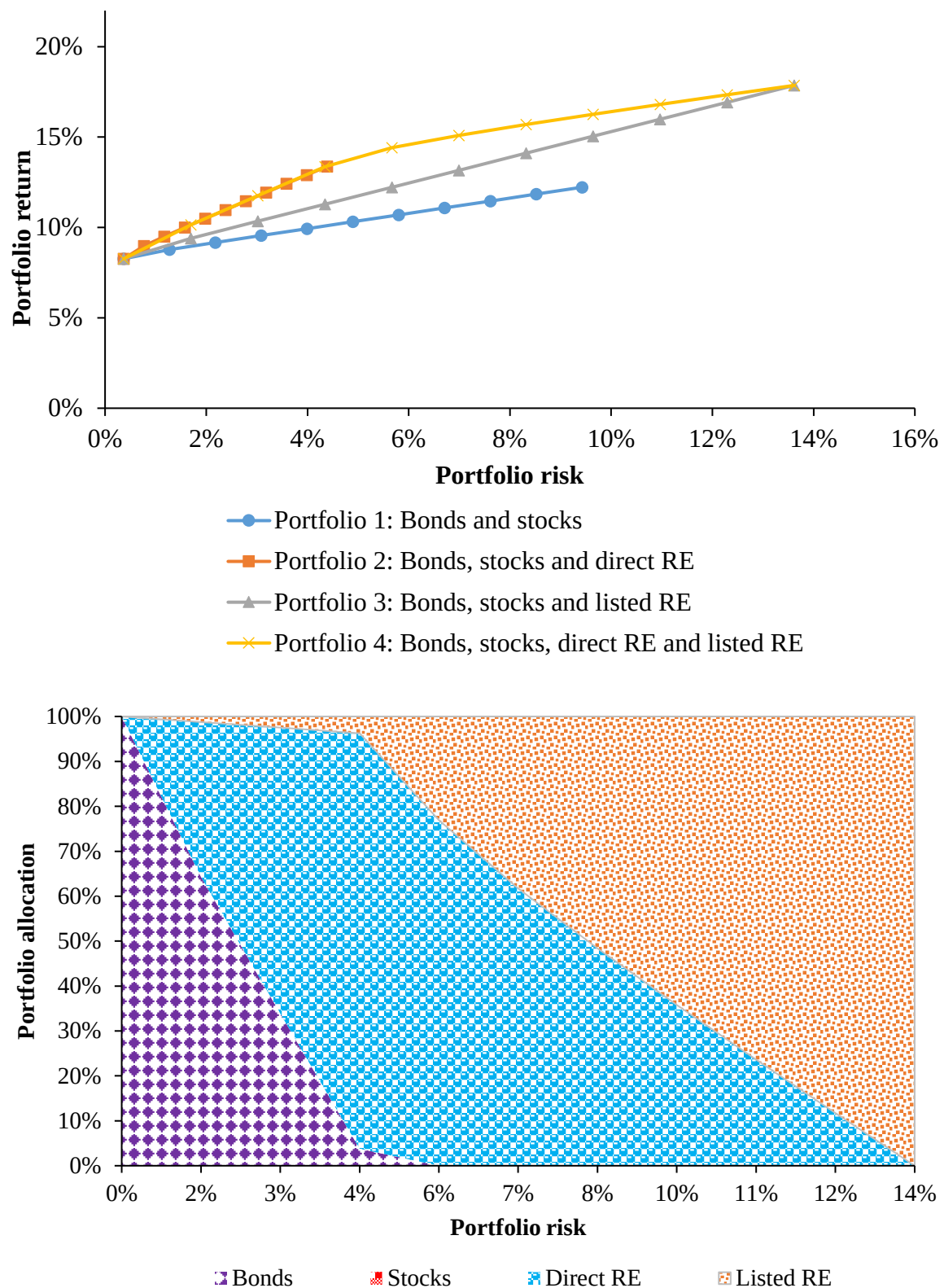
Exhibit 11: South Africa commercial RE post-GFC correlation analysis: 2010-2016

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Real estate [1]	1.00									
Office [2]	0.85*	1.00								
Retail [3]	0.95*	0.66	1.00							
Industrial [4]	0.94*	0.65	0.97*	1.00						
Johannesburg [5]	0.97*	0.84*	0.90*	0.93*	1.00					
Cape Town [6]	0.73	0.48	0.83*	0.75	0.63	1.00				
Durban [7]	0.72	0.41	0.79*	0.70	0.66	0.56	1.00			
Stocks [8]	0.73	0.80*	0.61	0.57	0.67	0.21	0.86*	1.00		
Listed real estate [9]	0.51	0.61	0.37	0.32	0.49	-0.07	0.05	0.20	1.00	
Bonds [10]	0.31	0.13	0.27	0.39	0.42	0.02	0.31	0.05	0.20	1.00

Source: Author's analysis from MSCI and Datastream

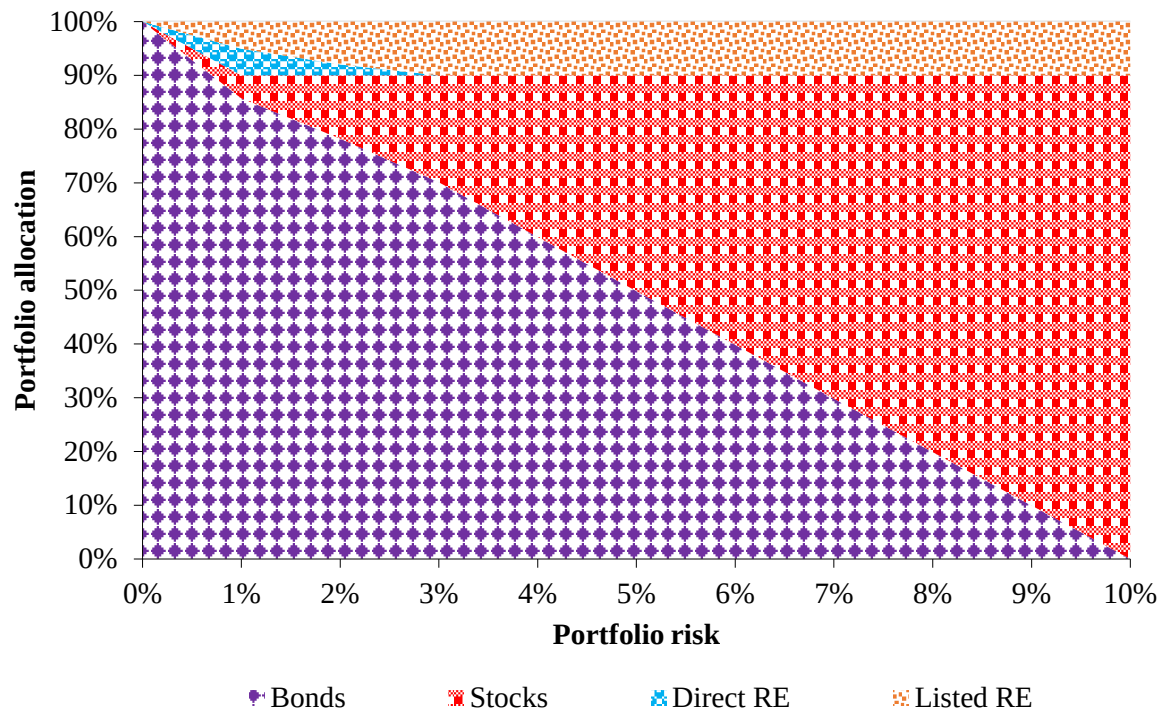
*: significant correlation <5%

Exhibit 12: South Africa commercial RE post-GFC efficient frontiers and asset allocation diagram: 2010-2016



Source: Author's analysis from MSCI and Datastream

Exhibit 13: South Africa commercial RE post-GFC constrained asset allocation diagram: 2010-2016



Source: Author's analysis from MSCI and Datastream