Designing a market capitalisation-weighted benchmark for domestic equity investors

By MH Randall and D Corubolo

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ABSTRACT

An appropriate index is an essential component of an effective capital market, particularly for benchmarking investment performance for general equity portfolios. The paper will review the properties of an ideal benchmark. In the South African asset management industry, active equity investors tend to use the same, or similar, indices as their performance benchmarks. These indices influence stock allocation, performance fees and a range of listed and unlisted instruments, not to mention the public discourse.

Traditionally, market capitalisation has been used by market participants as the appropriate weighting mechanism for broad market indices. The paper will address challenges in constructing South African market indices, including debates over the definition of market capitalisation, questions around the inclusion of dual listed and foreign companies, and the consideration for non-resident participants that can significantly alter the benchmark composition. Furthermore, capital markets in developing economies are prone to concentration risk, and this raises the question of applying weighting caps to dominant index constituents.

This paper considers the construction options for vanilla market capitalisation weighted benchmarks for local equity investors. The authors consider the existing FTSE/JSE All Share Index variants, and present three alternative constructs:

1. Global weighting approach

2. SA Register approach
3. SA Resident approach

Analysis of these alternatives include various capping scenarios to deal with single stock concentration.

KEYWORDS

Benchmark, investable universe, FTSE/JSE All Share Index, FTSE/JSE SWIX All Share Index, Strate, dual listed

CONTACT DETAILS

Mr Mark Randall, JSE Ltd, Johannesburg, mark@therandalls.co.za
Mr Davy Corubolo, Stellenbosch University, Stellenbosch, davy@sun.ac.za

1. INTRODUCTION

1.1 Background

1.1.1 The Johannesburg Stock Exchange (JSE) is the largest exchange in South Africa in terms of the number of listed companies, size of listed market capitalisation and total value traded in the secondary market. It can therefore be considered as the primary (if not the only) market representing the investable universe of South African shares for domestic equity investors.

1.1.2 FTSE/JSE provides a series of indices that enables investors to, inter alia, invest in the market on a passive basis, and to benchmark the investment performance of active fund managers. The two most widely used broad market equity benchmarks are the FTSE/JSE All Share Index and the FTSE/JSE SWIX All Share Index, or their capped variants. Due to changing economic, political and market circumstances, these indices have required their design to be adjusted over time. Some of the most significant adjustments have related to dual listed and foreign companies, and the treatment of foreign market participants. This has resulted in indices that have not remained consistent over time, and rules that do not treat all companies consistently today.

1.1.3 This paper suggests three broad market equity benchmarks that enable investors in the South African equity market to select an alternative benchmark that is more appropriate to their circumstances and requirements, and a benchmark that may be more robust and consistent over time. One of these is the existing SWIX All Share Index with the historical anomalies removed, and the other two methodologies do not exist today. The three benchmarks are collectively called the alternative market benchmarks. Furthermore, the alternative methodologies should be sufficiently differentiated to allow a clearly articulated weighting principle for each one.

1.2 Problem statement and aim

1.2.1 The aim of this paper is to:

— Review the uses and properties of a "good" benchmark;
— Define and describe the investable universe for domestic equity fund managers;
— Summarise the design of current broad market equity benchmarks, including their limitations;
— Suggest alternative broad market equity benchmarks based on various definitions of market capitalisation that are relevant to the domestic investor; and
— Present the modelling results comparing current to alternative benchmarks.

2. BENCHMARKS

2.1 Types of benchmarks

2.1.1 The *Cambridge English Dictionary* defines a benchmark (noun) as "a level of quality that can be used as a standard when comparing other things." The terms "benchmark" and "market index" are sometimes used interchangeably, however they may not necessarily be the same – a market index may serve as a benchmark, however the latter need not be a market index.

2.1.2 Investment benchmarks could be broadly categorised as either standard or customised (Bai-Marrow & Radia, 2017). Standard benchmarks are usually indices representing specific assets and whose value and composition is determined by pre-defined rules. These indices are often designed, compiled, and maintained by index providers that also offer products and services linked to those indices.

2.1.3 Benchmarks based on inflation indices, in particular consumer price inflation, are an important type of standard benchmark that are commonly used by investors.

2.1.4 Customised benchmarks, on the other hand, are designed to be appropriate for the specific goals and risk/return profile for an investor. Customised benchmarks are often a combination of appropriate standard benchmarks, however they might also be standard benchmarks that have been customised in some way, such as for ESG factors (Bai-Marrow & Radia, 2017).

2.1.5 Conover et al. (2013) and Bai-Marrow and Radia (2017) consider a similar broader set of benchmark types:

— Absolute return benchmark, where the benchmark is of an absolute return type, such as three-month money market interest rates.
— Manager universes, where the benchmark refers to a selection of managers or the median manager for a particular approach or investment style.
— Broad market indices, which are constructed based on the market capitalisation of constituents and are the most common type of benchmark. They are described as "are closest to meeting the criteria for a valid benchmark" (Bai-Marrow & Radia, 2017). Conover et al. (2013) consider market indices to include those indices that

have been more narrowly defined to "represent investment styles within asset classes, resulting in style indexes."

— Customised, or goals-based, benchmarks, which are constructed to reflect the objectives of the asset owner or ultimate beneficiaries.

— Alternative market indices, which use different weighting structures compared to traditional broad market cap weighted indices and could include factor-model and return-based benchmarks.

2.2 Uses of benchmarks

2.2.1 Siegel (2003) describes key uses of benchmarks as:

— Gauge of sentiment

— Performance standard for actively managed funds

— Portfolio for passive exposure

— Proxy for asset classes

2.2.2 Historically broad market indices have been a useful indicator of sentiment. Siegel (2003) notes that "reducing the prices of diverse securities in a market to a single statistic is useful because it reveals the net effect of all factors at work in a market" and he further adds that "the use of an index as a sentiment indicator is particularly notable in times of stress."

2.2.3 Investment benchmarks are widely used as a standard against which the performance of an actively managed portfolio of assets can be evaluated. Many active investors use the composition of an index as their starting point and deviate from index weights based on their degree of conviction that a particular stock is more or less attractive than the market as a whole (Siegel, 2003). This evaluation allows investors to assess how well the portfolio is achieving its specified objectives, and it highlights the value added, and active risks taken, by the asset managers. In addition, such evaluation is necessary to determine performance-based fees for asset managers.

2.2.4 Increasingly benchmarks serve as the basis for creating portfolios for investors seeking passive exposure to specific markets. For benchmarks to be used in this way, it must be possible for an asset manager to replicate the benchmark portfolio. Siegel (2003) notes that benchmarks based on the geometric mean returns of constituents, and equal-weighted benchmarks, are not practical, while market capitalisation-weighted benchmarks "are excellent bases for index funds".

2.2.5 Benchmarks provide a useful history of returns and other characteristics of the asset classes they represent, and thus provide a useful proxy for understanding the behaviour of those asset classes. "A benchmark constructed on a consistent basis across time allows you to calculate long-run rates of return and to compare market levels at points widely separated in time." (Siegel, 2003). Benchmarks can also be used to measure risk and correlations between asset classes over time.

2.3 Properties of a good benchmark

2.3.1 Bailey (1992) argues that good benchmarks "increase the proficiency of performance evaluation, highlighting the contributions of active managers, and enhance plan sponsors' ability to control risk. Bad benchmarks obscure the contributions of managers and can lead to inefficient allocations of plan assets." Bailey (1992) provides an initial framework for evaluating the appropriateness of a benchmark.

2.3.2 Bailey and Tierney (1998) provide a list of characteristics that should be exhibited by valid benchmarks:

- **Unambiguous**. The identities and weights of securities or factor exposures constituting the benchmark are clearly defined.
- **Investable**. It must be possible to replicate and hold the benchmark and earn its return before expenses.
- **Measurable**. The benchmark return is readily calculable on a reasonably frequent basis.
- **Appropriate**. The benchmark being used for assessing the performance of a manager is consistent with the manager's investment style or area of expertise.
- **Reflective of current investment opinions**. The manager should be familiar with the securities that constitute the benchmark and their factor exposures.
- **Specified in advance**. The benchmark is specified prior to the start of an evaluation period and its calculation methodology is known to all interested parties.
- **Accountable**. The investment manager should be aware of the strengths and weaknesses of any benchmark they are asked to replicate or be judged against, and they must accept accountability for a client's portfolio performance against that benchmark.

2.3.3 Siegel (2003) argues that "for an index to serve as a useful benchmark, it must have certain characteristics, the most important of which is market-cap weighting." Siegel (2003) lists additional characteristics for a good benchmark. He maintains that there are several vitally important reasons for market-cap weighting being the central organising principle of good index construction. The reasons he provides include:

- **Macro consistency:** If everyone held a market-cap weighted index fund and there were no active investors, all stocks would be held with none left over. With other weighting schemes, it is mathematically impossible for all investors to hold the index.
- **Consistency with a buy-and-hold strategy:** Market-cap weighting is the only weighting scheme consistent with a buy-and-hold strategy. Indices that are not market-cap weighted require constant rebalancing due to ordinary changes in stock prices.
- According to the capital asset pricing model (CAPM), the cap-weighted market index is the only portfolio of risky assets that is mean-variance efficient.

2.3.4 In addition to the properties listed above, the process of designing and implementing a benchmark should be free from error and potential abuse. The International Organization of Securities Commissions (IOSCO) published a set of principles that are "intended to promote the reliability of Benchmark determinations, and address Benchmark governance, quality and accounting mechanisms" (IOSCO, 2013).

3. INVESTABLE UNIVERSE FOR DOMESTIC EQUITY INVESTORS

3.1 Introduction

3.1.1 This paper uses the term 'investable universe' to denote the pool of securities that are available for domestic equity managers for purchase and sale. This pool of securities is the opportunity set from which domestic equity investors can make asset selection, in line with their investment process. Any equity portfolio established by a domestic equity manager will therefore be a subset of this investable universe, together with a cash component, and potentially some level of derivative exposure to the same underlying universe.

3.1.2 Since the investable universe forms the opportunity set for domestic equity investors, it should also form the opportunity set for a suitable market benchmark design. In the same way that an investment process will determine asset selection decisions at the individual portfolio level, a benchmark design process will determine the benchmark methodology for a notional portfolio approach. This paper defines the investable universe as all equity shares listed on the JSE Main Board.

3.2 Background

3.2.1 The JSE is a South African company that was established in November 1887. It is one of several entities in South Africa that has been granted a licence to conduct the business of an exchange in terms of section 7(4) of the Financial Markets Act 19 of 2012. One of the aims of the Financial Markets Act is to license and regulate exchanges, central securities depositories, clearing houses and trade repositories.[1]

3.2.2 The Financial Sector Conduct Authority (FSCA) is responsible for the regulation and supervision of securities exchanges and is the regulator that awards licences in this regard. There are currently four licensed exchanges in South Africa,[2] namely:

— JSE,
— A2X (licence granted April 2017),
— Cape Town Stock Exchange (licence granted August 2016 as 4AX), and
— Equity Express Securities Exchange (licence granted September 2017).

1 https://www.gov.za/documents/financial-markets-act
2 https://www.fsca.co.za/Regulated%20Entities/Pages/Licenses.aspx

3.2.3 The JSE is the largest exchange in South Africa, measured by number of listed companies, size of listed market capitalisation and total value traded in the secondary market. This paper only considers equities that are listed on the JSE, in line with its definition of the investable universe.

3.2.4 A2X is the second largest exchange in South Africa. A2X is permitted to secondary list shares, exchange-traded funds (ETFs) and exchange-traded notes (ETNs) as well as to inward list shares with a foreign primary listing. A2X does not regulate the primary listing of any South African companies, and as a result there are no domestic equities listed on the A2X not also listed on the JSE. Excluding A2X from the investable universe does not have any impact on the number or market capitalisation of equities in the investable universe. When considering benchmark design and construction it is therefore not necessary to incorporate A2X data for listings or market capitalisation. All A2X domestic listings are also listed on the JSE. Furthermore, market benchmark design does not require any assumption to be made on where secondary market trading is executed.

3.2.5 The Cape Town Stock Exchange has thirteen listed issuers represented, including two with a total market capitalisation more than R1 billion. Equity Express Securities Exchange has ten listed issuers represented, with one primary listing with a market capitalisation more than R1 billion. In comparison, all listed companies included in the existing FTSE/JSE All Share Index have a market capitalisation larger than R1 billion. The JSE has, at the time of writing [10 July 2023], 268 equity instruments listed on the Main Board, and 196 have a market capitalisation larger than R1 billion. Equities listed on the Cape Town Stock Exchange and Equity Express Securities Exchange may well form part of the opportunity set for domestic equity investors. However their contribution to the market benchmark is unlikely to be material given their significantly smaller number of companies and total market capitalisation. As such, they have not been considered for inclusion in the investable universe.

3.3 JSE markets

3.3.1 The JSE operates several markets such as the equity market, the debt market and four derivatives markets. The equity market is a platform for the listing and trading of various financial instruments. Admission to the equity market is governed by the JSE Listings Requirements.[3] The Listings Requirements make allowance for various categories of listed instruments in the equity market, as well as requirements for different market segments.

3.3.2 All instruments listed on the equity market are available for trade by the trading members of the exchange. However, not all of these listed instruments are considered equity shares and therefore not every instrument listed on the equity market is appropriate for inclusion in the investable universe for domestic equity investors.

3 https://www.jse.co.za/regulation/companies-issuer-regulation

3.4 Categories of listed instruments

3.4.1 A cash security, equity, or share is a financial instrument that represents partial ownership in a company. Equity shares afford the equity shareholder two rights that differentiate them from other forms of tradable instruments, namely:

— The right to vote in the company's decisions, and
— The right to participate in the profits and growth of the company.

3.4.2 The JSE Listings Requirements make allowance for multiple types of tradable instrument that can be listed on the exchange. However, not all of these instruments meet the requirements to be classified as equity since they may not afford voting rights or rights to share in profits. The JSE uses a categorisation called *Instrument Type* for its market statistics reporting.

3.4.3 Table 1 shows the total number of instruments and aggregate market capitalisation per instrument type on the JSE Equity Market on 30 June 2023.

Table 1 Instruments listed on the JSE Equity Market on 30 June 2023

Instrument type	Number of instruments	Market capitalisation (R billions)
Index warrant	524	767.63
Ordinary share	278	14 592.86
Vanilla warrant	141	7.53
Basket warrant	122	344.28
Securities	111	21.12
Exchange traded funds	100	142.97
Preference shares	32	15.44
Compound warrant	22	36.33
A ordinary share	7	1 694.28
N ordinary	6	4 244.36
B ordinary share	4	13.61
Barrier warrant	4	5.75
Debentures	3	4.93
Options	1	26.76
Participatory interest	1	1.3

Source: JSE data

3.4.4 Warrants are a type of equity option, or derivative contract, which are listed and traded on the JSE Equity Market. They are issued by a company, typically a bank, on an underlying asset such as a share, index, commodity, or currency. They do not meet the definition of equity shares since, as a derivative product, they do not provide partial ownership of the underlying asset.

3.4.5 Additional instrument types in Table 1 that do not meet the definition of equity shares include:

— **Securities:** instruments such as exchange traded notes (ETNs) which are structured products with a payoff profile that references a different underlying asset.
— **Exchange traded funds (ETFs):** listed collective investment funds that either track an index or a physical commodity.
— **Preference shares:** do not include voting rights.
— **Debentures:** more closely related to a debt instrument.

3.4.6 Two historical instrument types that do represent equity shares are linked units and depository receipts. Both meet the definition of equity shares but did not have any corresponding instruments listed on the JSE on 30 June 2023, although there were historical listings of these instruments in the modelling period.

3.4.7 Figure 1 presents the number of instruments listed on the JSE Main Board that matches the seven JSE instruments type classified as equity shares. The majority of instruments comprises Ordinary Shares.

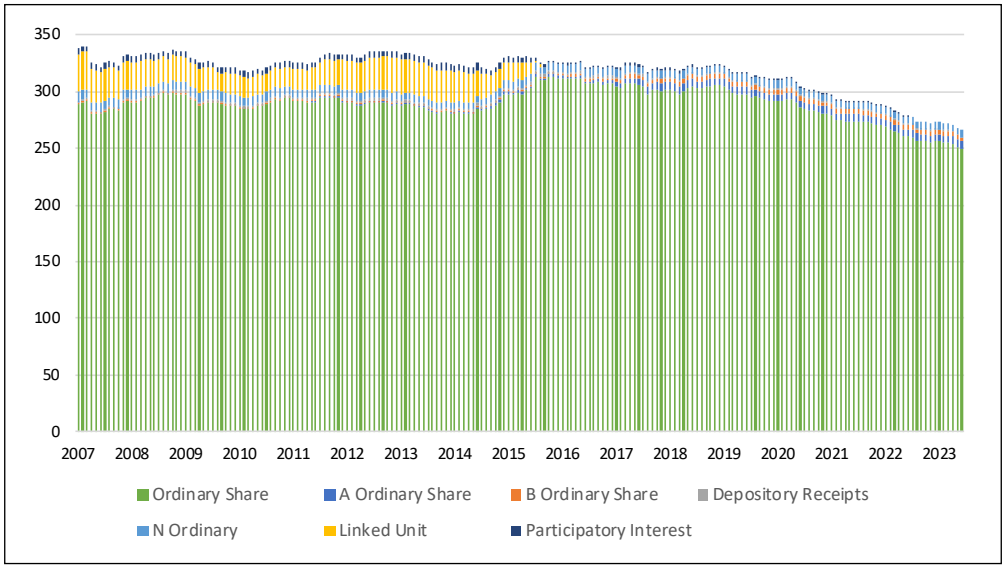

FIGURE 1 Number of equity instruments listed on the JSE Main Board (Source: JSE data)

3.4.8 This paper considers seven of the instrument types used for JSE market statistics that meet the definition of equity shares, and only includes these instrument types in the formation of the investable universe:

— Ordinary share
— A Ordinary share
— B Ordinary share

— N Ordinary
— Depository receipts
— Linked unit
— Participatory interest

3.5 Equity market segments

3.5.1 Most equity shares listed in the JSE equity market are listed on the Main Board, which is intended for well-established companies. The Listings Requirements provide for other segments such as the AltX, which is a market for small to medium companies that are in a growth phase. The JSE also historically offered a Venture Capital Board, Development Capital Board and BEE Board. The requirements for listing on these boards are generally less onerous than those required to list on the Main Board and are proportional to the size and nature of companies that list on these segments.

3.5.2 Companies that are listed on the AltX may have fewer conditions to obtain listing approval, and fewer continuing obligations around governance and disclosure requirements. The less onerous nature of their regulatory listing framework means that they are subject to lighter governance requirements when compared to established companies listed on the Main Board. Equity investors may therefore take less comfort in the governance frameworks applied to approving these listings and may potentially exclude them from their domestic equity mandates as a result.

3.5.3 Figure 2 shows the proportion of the number of instruments that are listed on the Main Board of the JSE against all other market segments such as AltX. This proportion has trended between 78% and 90% over the past 15 years when considering

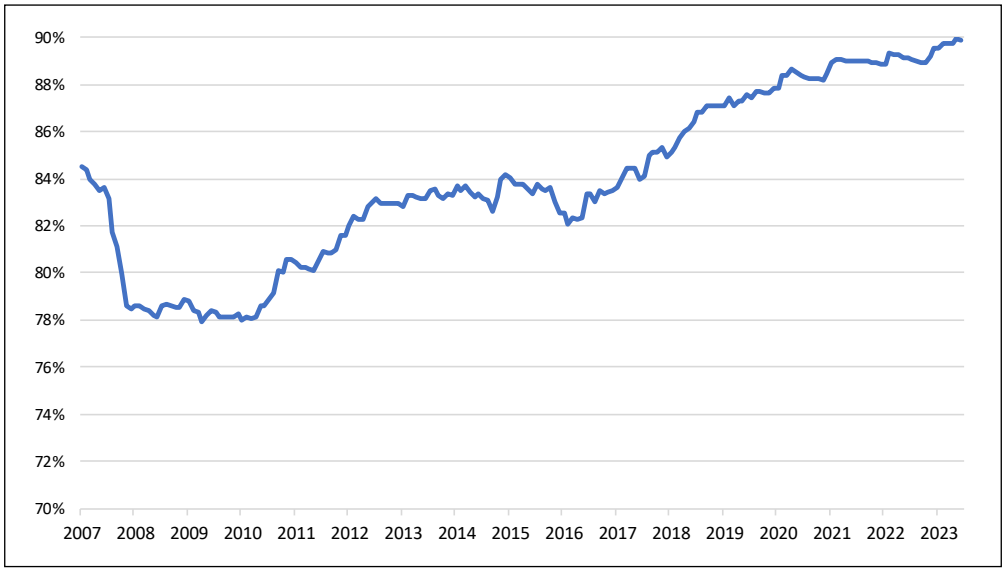

Figure 2 Proportion of JSE listed equity shares listed on the Main Board (Source: JSE data)

the seven instrument types that included in the investable universe for domestic equity, tracking at the top end of this range over the past three years.

3.5.4 When considering the relative proportion of total market capitalisation rather than number of listed instruments, the proportion attributable to Main Board companies has tracked between 99.4% and 99.9% over the same period. Excluding AltX companies from the investable universe would therefore remove a much smaller proportion of the opportunity set than is implied by the number of companies listed on AltX.

3.5.5 This paper restricts the investable universe to equity instruments that are listed on the Main Board of the JSE and does not consider AltX listings. This is because of the less onerous listings requirements, significantly smaller company size and fewer listed companies on AltX versus the Main Board.

3.6 Suspended companies

From time to time, a company listed on the JSE may be suspended or halt trading. This could be for a number of reasons such as the failure of the company to comply with the Listings Requirements, complexities relating to a corporate action, or even liquidation. While a suspension may precede a delisting, suspended companies do regularly resume normal trading once the reason for the suspension has lapsed. Shares in suspended companies cannot be bought or sold on the JSE, although held in equity portfolios across the market at the time of suspension, and it may therefore be appropriate that they remain in the market benchmark subject to certain conditions for a period in this event. As such, this paper includes suspended companies in the definition of the investable universe.

3.7 Derivative exposure

3.7.1 Investors can use derivative contracts to manage their exposure to the investable universe. This can take the form of warrants, futures, options, or swaps and can be executed through either exchanged listed or over-the-counter products. Such derivative contracts provide opportunities for investors to modify their overall exposure quickly or cheaply to the underlying set of equity shares, but they do not create fundamentally new investment opportunities in their own right. In the same way, an investor may gain exposure to domestic equities through collective investment schemes or structured products rather than purchasing individual equities.

3.7.2 The particular investment instrument that an investor utilises to gain exposure to domestic equities does not alter the fundamental underlying universe of equity shares. As such, derivatives, funds, or wrapper products are not included in the investable universe.

3.8 Investable universe

3.8.1 This paper defines the universe of shares that are available to domestic equity investors as equity shares that are listed on the JSE Main Board and can be traded

in South African Rand. This includes companies that are temporarily suspended from trading on the exchange.

3.8.2 This definition excludes:

— Companies that are listed on the Cape Town Stock Exchange or the Equity Express Securities Exchange but not listed on the JSE.
— Companies that are listed on the JSE AltX or segments other than the Main Board.
— Companies that have been terminated and are no longer listed.
— South African domiciled companies that are listed on an offshore exchange but not on the JSE.

3.8.3 This definition only includes various classes of ordinary shares, as well as linked units, depository receipts and participatory interests, and excludes instrument types that are not considered equity shares.

4. ANALYSIS OF INVESTABLE UNIVERSE

4.1 Introduction

4.1.1 This section provides an analysis of the investable universe over the fifteen-year period from 1 January 2008 to 30 June 2023. Equity characteristics important for benchmark design are discussed, and a corresponding descriptive analysis of the investable universe is provided.

4.1.2 Benchmark design may only include a subset of the investable universe as a result of certain equity characteristics. The characteristics discussed below will be referred to later when modelling various market benchmark designs.

4.2 Market capitalisation

4.2.1 The market capitalisation of a listed company is the prevailing market price valuation of the entire company. It is calculated as the product of the number of shares in issue and the price per share and is measured in South African Rand. It is a point in time valuation of how much it would cost to purchase the entire issued share capital of a listed company.

4.2.2 Conversely, it also represents the aggregate asset value of all investors who hold shares in the listed company. Through this lens, it measures the total assets owned by all shareholders who invest in the company, which is relevant when considering Siegel's (2003) macro-consistency argument for benchmark design.

4.2.3 The number of shares in issue is tracked by the JSE and this information is published daily for each listed company. This can change from time to time because of corporate finance activity undertaken by the listed company, called corporate actions or corporate events. Some types of corporate actions that can change the shares in issue include the issue of new shares, rights offers, withdrawal of shares, consolidations, share splits or conversions.

4.2.4 The prevailing price per share is obtained by observing secondary market transactions on the exchange. Exchanges offer a central order book market where anonymous bids and offers are matched to create an executed trade. The execution details of these trades are published in real time, including the matched price and quantity (number of shares). Since these trades are arm's length transactions between a willing buyer and a willing seller, they are seen as a point-in-time fair value of the share and therefore the prevailing share price.

4.2.5 While intraday pricing is useful for trading and investment decisions, market participants typically rely on end of day pricing for fund valuations and performance benchmarking. The JSE publishes a closing price for all equity shares, utilising the following pricing waterfall approach:

— The uncrossing price from the end of day closing auction trading session, if available.
— Otherwise, the last executed on-book trade during the trading day, if available.
— Otherwise, the previous closing price.

4.2.6 In addition to the shares in issue and closing price numbers, the JSE publishes a daily market capitalisation for all listed instruments. This is the product of the shares in issue and the closing price, measured in Rand. Figure 3 shows the total market capitalisation of the investable universe over the modelling period in Rand trillions. While there is some volatility, there is a clear upward trend over time, with the modelling period reflecting an increase of 10.4% per annum in total market capitalisation.

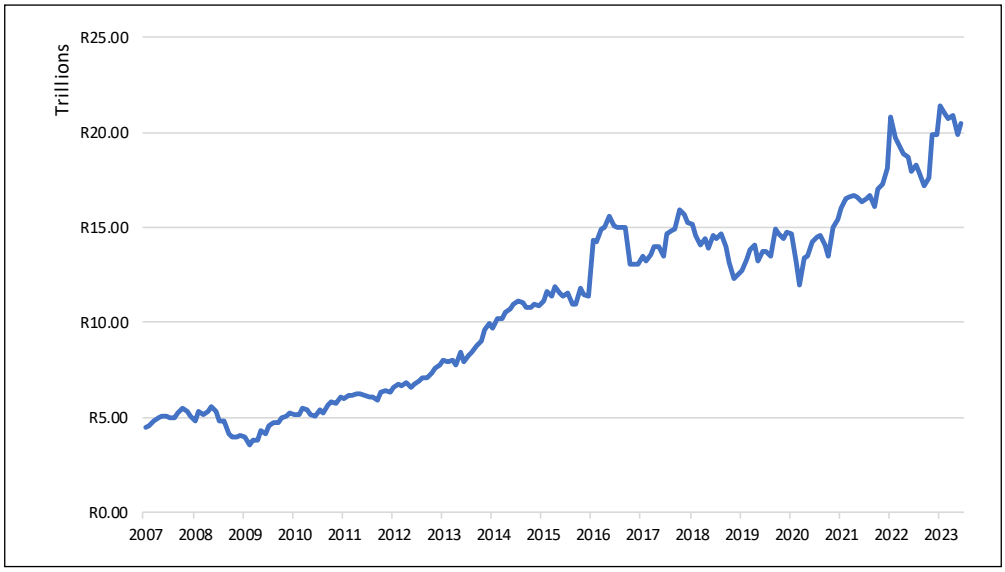

Figure 3 Aggregate market capitalisation of the investable universe (Source: JSE data)

4.2.7 Changes in overall market capitalisation can be caused by only three drivers:

— Listings and delistings impact the number of instruments listed on the exchange.
— Individual companies change their number of shares in issue through corporate actions.
— Market forces set the share price for individual companies.

4.2.8 Figure 4 shows the year-end coefficient of skewness of the distribution of market capitalisation of listed companies in the investable universe on the last trading day of each period. Raubenheimer (2010) notes that "South Africa's equity market provides a large (in terms of volume) but concentrated investment environment." Raubenheimer (2010) shows that "the concentration of an index or benchmark can materially constrain investment decisions and the portfolio construction processes, particularly when each investment is constrained to be held long." The equity market remains concentrated as the market capitalisation distribution of listed instruments shows a positive coefficient of skewness, although current skewness is at the lower end of the long-term trend:

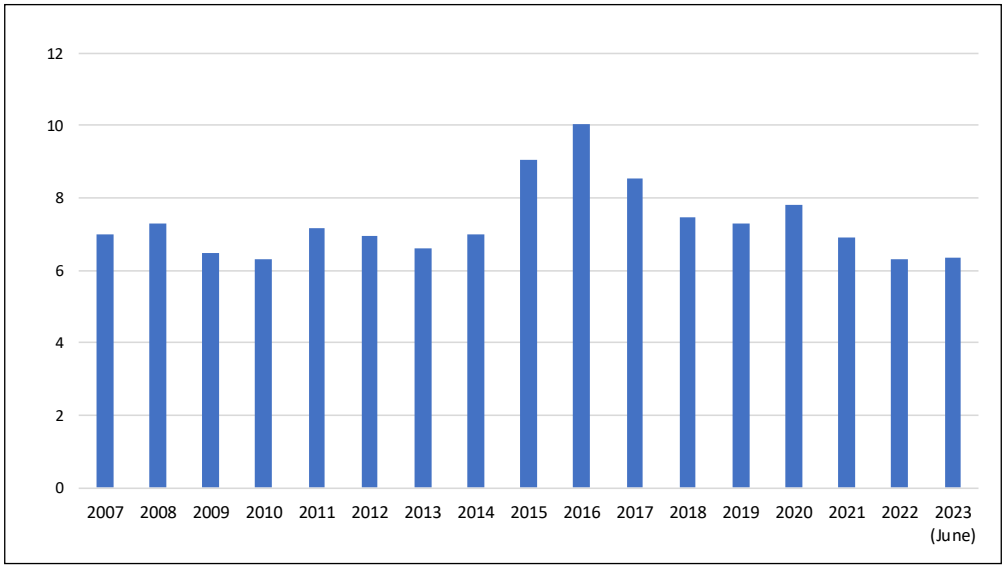

FIGURE 4 Coefficient of skewness of the market capitalisation distribution of the investable universe (Source: JSE data)

4.2.9 Despite the recent decrease in the coefficient of skewness, the ratio of the average market capitalisation to the median instrument market capitalisation is near an all-time high at nearly 20x. This is further highlighted by the cumulative market capitalisation distribution which shows the contribution of the five largest listed instruments is between 34% and 56% of aggregate market capitalisation. Figure 5 charts this proportion of the five

largest listed instruments relative to the overall investable universe market capitalisation over the modelling period.

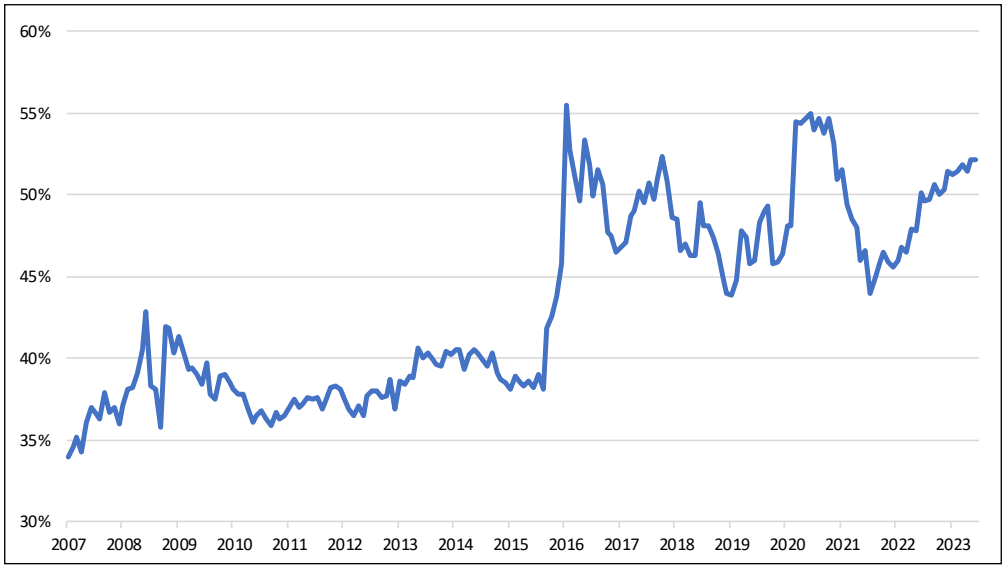

FIGURE 5 Market capitalisation of the five largest instruments relative to the total investable universe (Source: JSE data)

4.3 Number of instruments

4.3.1 The number of tradable instruments in the investable universe can only change as a result of listings or delistings. A new listing occurs when a company lists its shares for the first time, creates a new class of listed share, or applies for a dual listing on a different exchange. A delisting occurs when a company's listing is terminated. Listings and delistings are regulated by the JSE in its role as self-regulatory organisation.

4.3.2 There is a distinction to be drawn between the number of instruments and the number of listed companies. Some listed companies may have two classes of listed share, such as an A-ordinary share and a B-ordinary share. This has historically been a feature of listed property companies, particularly before the implementation of the Real Estate Investment Trust (REIT) structure. Another scenario is two companies in different jurisdictions that have a group profit-sharing arrangement. A final scenario is a listed holding company whose valuation is dominated by its majority holding in a single subsidiary, which is also listed.

4.3.3 For the purposes of analysing the investable universe, we consider the number of listed instruments rather than the number of listed companies. Figure 6 plots the number of listed instruments in the investable universe over the modelling period. There is a clear downward trend in the number of instruments, particularly over the last five years.

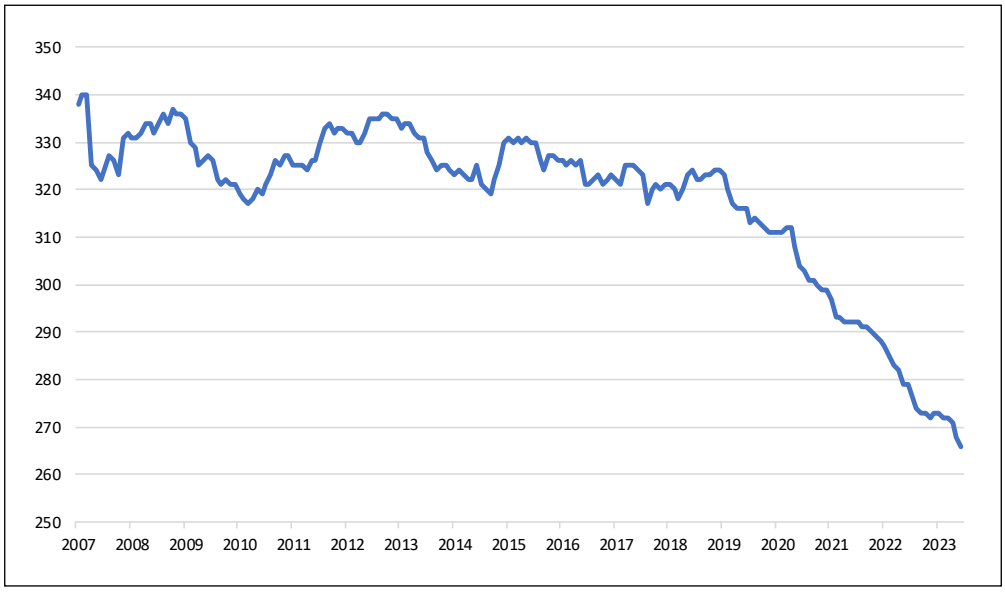

FIGURE 6 Number of listed instruments in the investable universe (Source: JSE data)

4.3.4 The number of instruments appears to have varied on a cyclical basis between 320 and 340 for the period 2007 to 2019. However, the period from 2019 to June 2023 seems to indicate a shift to a sustained downward trend, decreasing from 324 in December 2018 to 266 in June 2023. A detailed analysis of reasons for the decrease in listings is outside of the scope of this paper. However, South Africa is not globally unique with respect to this phenomenon, with various forces contributing to this global trend, including costs associated with maintaining listings, increased concentration as a result of corporate actions, and increasing appeal of private equity funding.

4.4 Domicile

4.4.1 Listed companies in South Africa can either be classified as domestic or foreign. The company domicile is determined by the South African Reserve Bank as part of the listings application process and is typically disclosed in the company's listing circular. The company domicile is not necessarily a function of where that company earns most of its earnings, nor necessarily where its operations are concentrated or managed.

4.4.2 A company with a foreign status with shares that are listed on the JSE is classified as a domestic asset for domestic equity managers since any equity share that trades and settles on the JSE in South African Rand is automatically classified as domestic for foreign portfolio allowance and prudential limit purposes. As a result, JSE-listed companies with a foreign domicile are still included in the investable universe and the split between domestic and foreign instruments is shown in Figure 7 to illustrate the long-term trend of the investable universe.

4.4.3 Figure 7 compares the number of foreign instruments in the investable universe to the number of domestic instruments. The number of foreign instruments is in the minority compared to domestic instruments, but steadily increasing from 5% of listed instruments in January 2008 to 19% in June 2023.

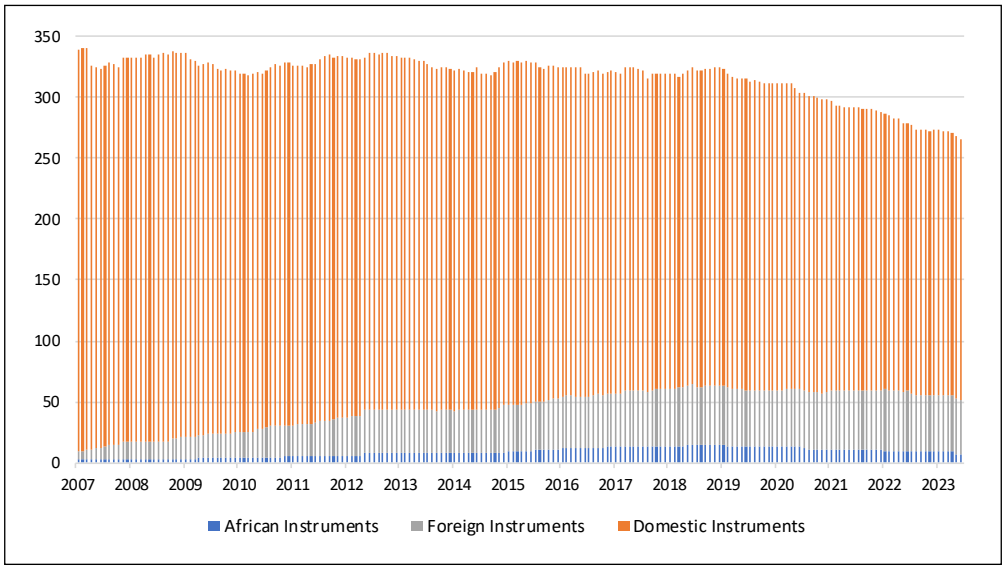

FIGURE 7 Number of domestic instruments versus number of foreign instruments (Source: JSE data)

4.4.4 Even though there are fewer foreign instruments than domestic instruments, these foreign instruments are on average of larger size than domestic instruments. Over the modelling period, the average month-end market capitalisation of foreign instruments ranges between 3.8x and 8.9x larger than the average domestic instrument. Foreign companies that choose to list on the JSE, or domestic companies that have moved their domicile offshore, tend to be larger in size than domestic companies on the JSE. Figure 8 plots the total market capitalisation of foreign companies in the investable universe as a proportion of aggregate investable universe market capitalisation.

4.5 Dual listed

4.5.1 A dual listed company has its shares admitted to more than one exchange for secondary market trading. One form of secondary listing is where there are competing exchanges in the same country. In this case, the dual listed stock can be traded on either exchange using the same domestic currency for transactions. Trading on either exchange is available to the same universe of trading participants (i.e. stockbrokers) and the same universe of underlying investors.

4.5.2 Another form of dual listing is when a company maintains a listing on

FIGURE 8 Market capitalisation of foreign instruments relative to the total investable universe (Source: JSE data)

exchanges in two different countries. Where there is a time zone difference between the countries, this may mean that the trading hours of the two exchanges are different, and where the countries do not share a common currency, the secondary trade on the two exchanges may be quoted in different currencies. The secondary listing may also take the form of a sponsored depository receipt listing.

4.5.3 In the case of the JSE, there are three types of dual listing to be considered:

— **Listed on the JSE with a secondary listing on A2X**. No domestic company can have a listing on A2X without having a primary listing on the JSE. A2X facilitates trade in South African Rand and markets its services to broadly the same trading participants and investors that use the JSE. It also operates largely on the same trading hours, although it does not offer a closing auction. A2X does not publish a daily closing price.

— **Listed on the JSE and the Namibian Stock Exchange (NSX)**. The JSE operates the trading technology for the NSX equity market. Many of the instruments listed on the NSX have a primary listing on the JSE, with price formation typically occurring on the JSE market.

— **Listed on the JSE and an exchange other than A2X or NSX**, and trading in a currency different to South African Rand.

4.5.4 This paper excludes A2X and NSX secondary listings from the definition of dual listed. Dual listings therefore reference the scenario where the same stock can be traded in a different country and currency, with a material pool of liquidity and investors.

4.5.5 When a share is dual listed, there is still only a single class of share. A shareholder's rights are no different whether shares are purchased on the JSE or on the London Stock Exchange. The difference is that the two shares are purchased in different currencies and held on different share registers. They both offer the shareholder the same partial company ownership, voting rights, and share in profits.

4.5.6 The number of instruments issued by a company is independent of which register those instruments are held on at any point in time. If shareholdings move between country registers this will not impact on the company's total shares in issue or total market capitalisation, notwithstanding exchange rate differentials.

4.5.7 Where a company maintains a dual listing, their shares are fungible across all the country share registers. A shareholder who is a participant in both the United Kingdom and South Africa can transfer their shares from the English share register to the South African share register through an administrative process, while retaining ownership of the share. This is not classified as a trade since ownership does not change. As a result of this process, market supply and demand forces across share registers (and trading venues) are met by shifting shares to the trading platform where there is demand for them.

4.5.8 Where there are apparent pricing discrepancies in share trading between two trading venues (after allowance for exchange rate fluctuations and fees), participants can buy a share on one exchange and sell it on another exchange. The resultant market dynamics will remove any sustained arbitrage opportunities across the two trading venues.

4.5.9 Dual listing status is separate from a company's domicile. A South African company can be listed on both the JSE and an offshore exchange, and a foreign company can be dual listed on the JSE. Table 2 shows the number of companies as of 30 June 2023 categorised by their domicile and dual listing status. Nearly 30% of dual listed instruments on the JSE are in fact domestic companies with a secondary offshore listing.

Table 2 Number of listed instruments categorised by dual listed status and foreign listed status.

Foreign status	Only listed on the JSE	Dual listed
Domestic listing	195	20
Foreign listing	6	45

Source: JSE data

4.5.10 Figure 9 shows the number of equity shares listed on the JSE categorised by their dual listing status.

4.5.11 Figure 10 reflects the same pool of dual listed companies but shows the total proportion of market capitalisation of listed equity shares on the JSE that is represented by dual listed companies, rather than the number of instruments. The increase in relative market capitalisation over time is markedly greater than the increase in relative number

of companies. This reflects that delistings have been concentrated in domestic listings and that dual listed stocks are generally larger in market capitalisation than those with a single listing.

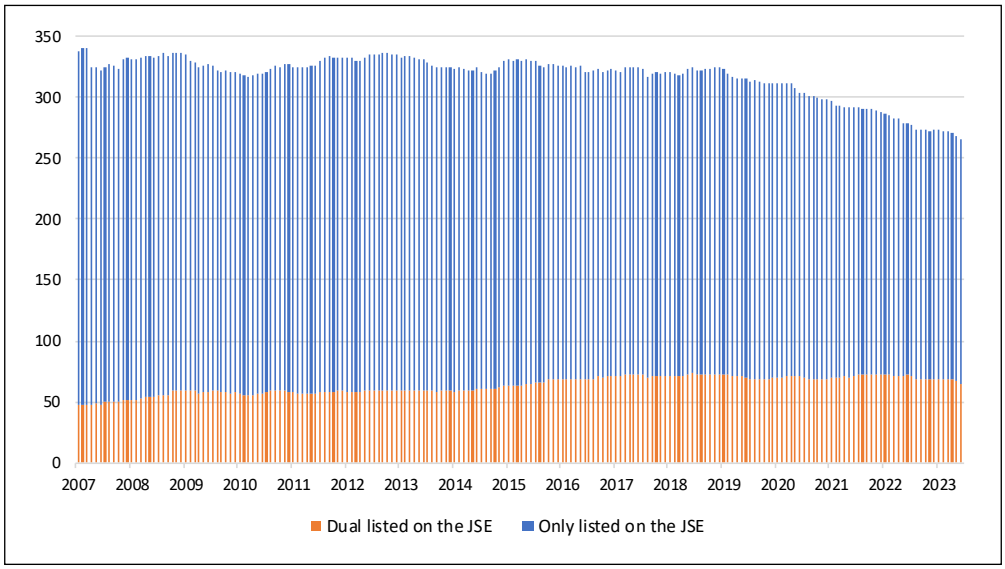

FIGURE 9 Number of listed instruments categorised by dual listing status (Source: JSE data)

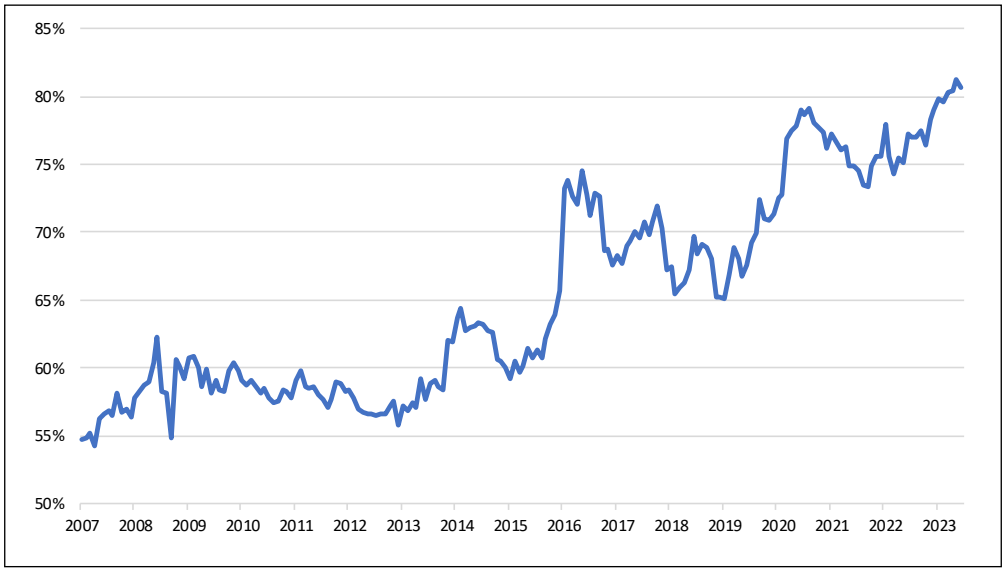

FIGURE 10 Market capitalisation of dual listed stocks as a proportion of the investable universe (Source: JSE data)

4.6 Primary listing

4.6.1 The primary listing of a listed company determines the listings regulations regime to which the company will be subjected. A listing on any regulated exchange is subject to listings requirements and other rules or directives. If a company elects to have a primary listing on a particular exchange, then it is bound by the complete set of listings regulations of that exchange. A dual listed company can choose to have a primary listing on both exchanges, or to maintain a primary listing on one exchange and a secondary listing on the other exchange where they are dual listed.

4.6.2 In most cases, a company that is domiciled in South Africa and listed on the JSE will have a primary listing on the JSE. Similarly, a foreign company that is dual listed on the JSE will maintain a secondary listing on the JSE. Table 3 provides the list of all foreign companies that have a primary listing on the JSE as of 30 June 2023.

Table 3 List of foreign companies with a primary listing on the JSE

Alpha	Instrument
AIL	African Rainbow Cap Inv
EPE	EPE Capital Partners Ltd
GML	Gemfields Group Limited
HIL	Homechoice Int plc
LTE	Lighthouse Properties plc
MMP	Marshall Monteagle plc
MSP	MAS P.L.C
NRP	NEPI Rockcastle N.V.
NCS	Nictus Ltd
PAN	Pan African Resource plc
SRE	Sirius Real Estate Ltd
THA	Tharisa plc
TTO	Trustco Group Hldgs Ltd

Source: JSE data

4.6.3 Many exchanges allow a secondary listing for companies that already have a primary listing on another recognised exchange. It is recognised that the other exchange is the primary regulator of the company's listing. It is likely that there are requirements associated with the primary exchange that are not fully harmonised with the secondary exchange; in this event the company will comply with the primary exchange requirements.

4.7 Liquidity

4.7.1 Liquidity generally is a measure of whether a stock can be bought or sold in the required size without undue market impacts to the share price. Liquidity is an important characteristic of capital market assets, and it has a high impact on their

prices (Le & Gregoriou, 2020). There are several metrics that can be used to assess a stock's liquidity:

— **Absolute measures:** tracks the stock's total value or volume traded for the analysis period.
— **Relative measures:** tracks the stock's total value or volume traded for the analysis period relative to its total market capitalisation (value) or shares in issue (volume), often referred to as stock turnover ratios.
— **Other measures:** more sophisticated measures that track price impact, for instance Amihud's illiquidity ratio (Amihud, 2002) which tracks the change in share price per fixed amount traded (e.g. basis points share price movement per million Rand traded).

4.7.2 Considering the analysis period introduces further complexity since stock liquidity is not distributed uniformly over time. Individual days may see abnormal spikes in liquidity driven by a large trade or corporate action, whereas other days may see reduced liquidity (e.g. Christmas Eve or a UK banking holiday). It is generally better to consider a stock's liquidity over a period, such as a calendar month, or monthly over the past year. Equity investors will often be able to build up or dispose of a single stock position of a period and may thus not be forced to interact with available liquidity on a particular day.

4.7.3 What is considered liquid for one fund or investor may not necessarily be liquid for another fund or investor and will depend on the total intended trade size. A larger fund will typically buy stocks in larger sizes and will therefore have a more conservative liquidity requirement in line with their trading patterns. It is therefore not possible to create a single liquidity metric that is directly applicable to all funds.

4.7.4 Considering the calendar year 2022, Naspers Ltd had the highest value traded at R43.7 billion per month on average. There was a total of 17 companies with a monthly average value traded in excess of R10 billion in 2022, and a further 49 companies with a monthly average between R1 billion and R10 billion. The median company monthly average value traded was significantly lower at R86 million in 2022. Figure 11 indicates the distribution of the top quarter (75) companies according to average monthly value traded in 2022, and Figure 12 shows the next 75 companies. The two charts confirm the skewed distribution of average value traded across listed stocks, with significant concentration in the top 20 names.

4.7.5 The analysis of total value traded per month gives an indication of how much trade a company can absorb on an average month. For instance, JSE Ltd traded R358 million per month on average in 2022. For an investor aiming to purchase R30 million worth of JSE this may indicate a good liquidity profile. For an investor looking to purchase R300 million worth of JSE this would indicate poor liquidity and would require a longer timeframe to execute. Total trading volumes correlate strongly with market capitalisation with larger companies seeing more secondary market trade.

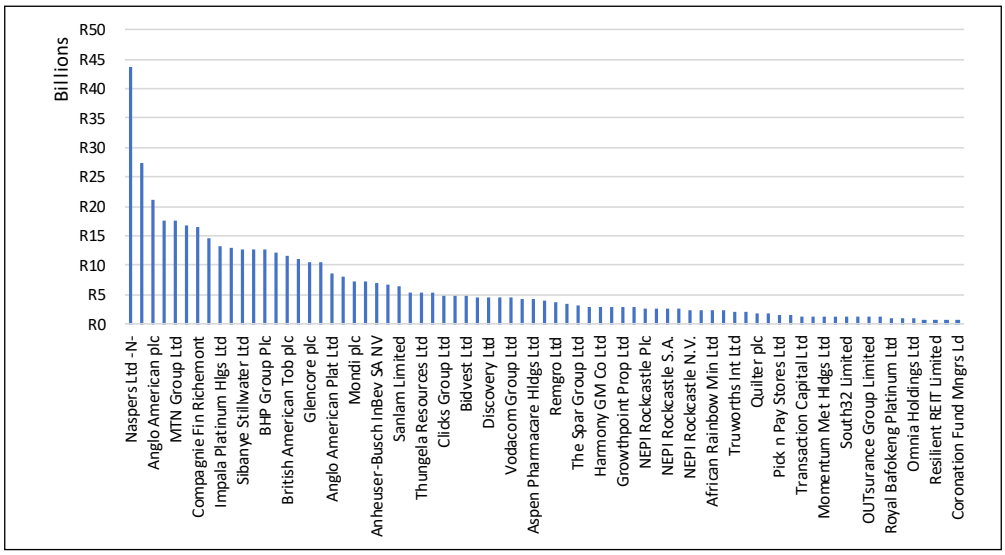

FIGURE 11 Top quarter of instruments by average monthly value traded in 2022
(Source: JSE data)

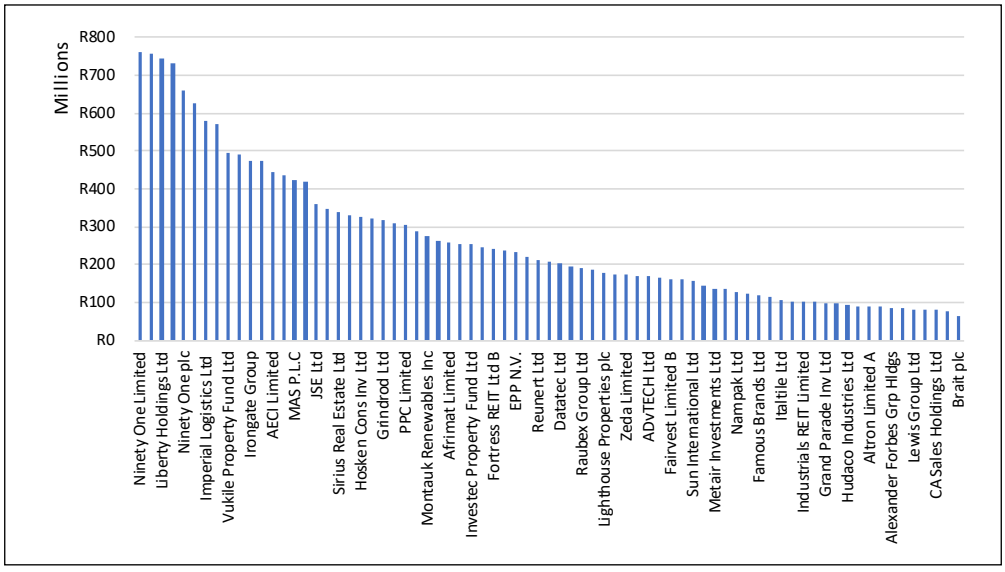

FIGURE 12 Next 100 instruments by average monthly volume traded in 2022
(Source: JSE data)

4.7.6 Considering traded volumes relative to company size provides a view on companies which are trading a large proportion of their total issued share capital per month, although not necessarily large in absolute value traded. Table 4 lists the top ten companies by average 2022 monthly trading volumes as a proportion of their month-

end shares in issue. These are the instruments that are trading the highest proportion of their total market capitalisation each month, and therefore seeing significant turnover between shareholders. This metric tends to be more time sensitive than average monthly volume traded since it can be impacted by once-off company announcements, results, corporate actions or even controversies.

Table 4 Top ten instruments by 2022 average monthly volume traded as a proportion of shares in issue

Instrument	Average liquidity
Thungela Resources Ltd	16.4%
The Foschini Group Limited	11.5%
RMB Holdings Ltd	11.0%
The Spar Group Ltd	10.6%
Absa Group Limited	9.8%
Tiger Brands Ltd	9.6%
Truworths Int Ltd	9.6%
Telkom SA SOC Ltd	9.5%
Mr Price Group Ltd	9.3%
Sappi Ltd	9.0%

Source: JSE data

4.7.7 Figure 13 shows the distribution of average monthly volume traded as a proportion of shares in issue. A little of two thirds of all instruments traded between 0% and 3% of their total issue shares on average per month in 2022.

4.7.8 Figure 14 plots the average monthly liquidity data for 2022 per instrument against the average market capitalisation of that instrument. There is a broadly positive correlation when considering both metrics on a logarithmic scale, confirming in general larger companies.

4.8 Register analysis

4.8.1 The analysis of the domestic share register is an essential component of defining accessible market capitalisation and therefore building a representative market benchmark. While the JSE facilitates trading of securities, it does not manage the share register. This process in South Africa is run by Strate, South Africa's principle central securities depository (CSD), together with its network of central securities depository participants (CSDPs). The Strate share register, as maintained by the CSDPs, will have an entry for all equity shares listed on the JSE. However, the register will only reflect equity shares that are:

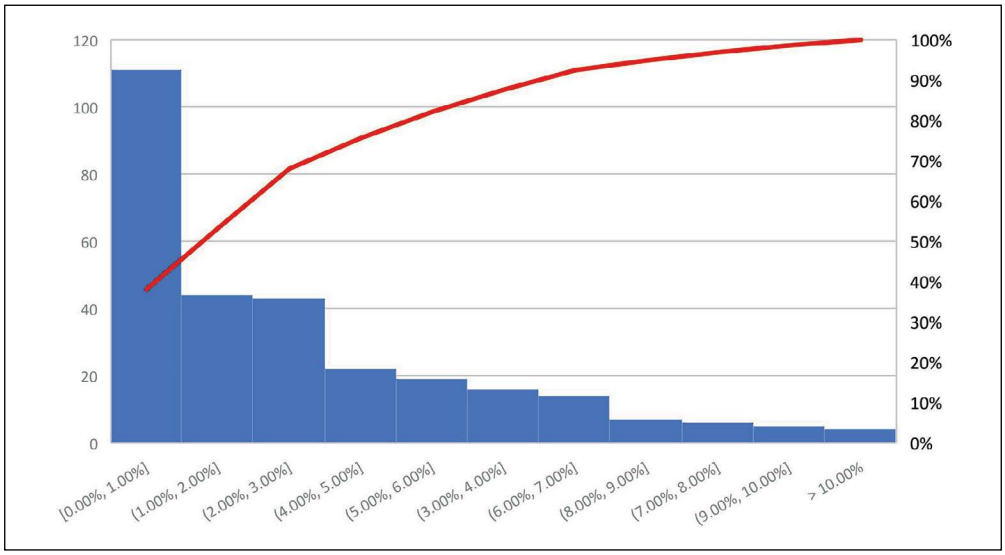

FIGURE 13 Distribution of average traded volumes as a percentage of issued shares (Source: JSE data)

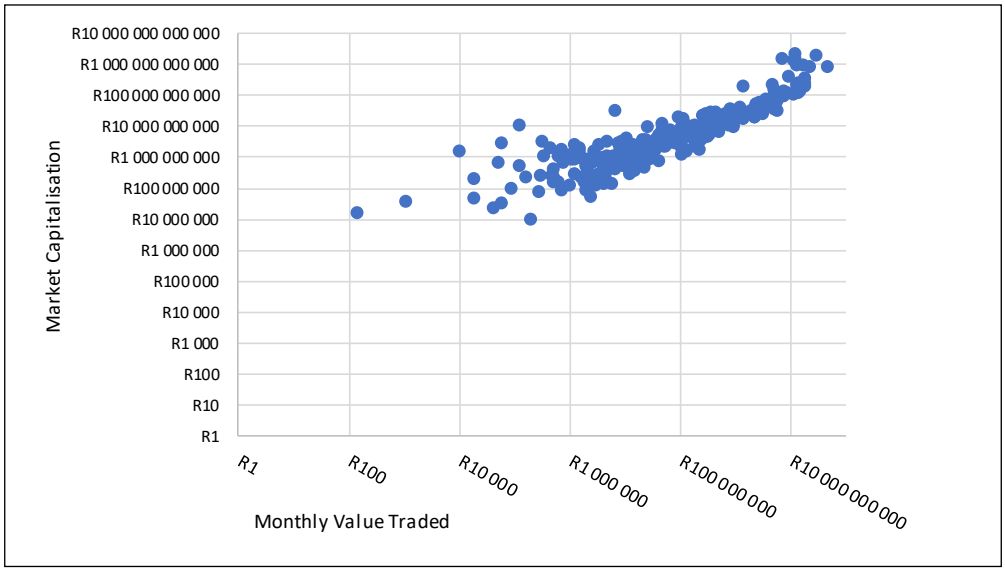

FIGURE 14 Analysis of average monthly value traded against market capitalisation for 2022 (log scaled) (Source: JSE data)

— Dematerialised – i.e. not held in certificated form.
— Held in South Africa – i.e. excludes shareholdings of dual listed companies that are held on a foreign register.

4.8.2 Strate also reflects the nationality of the shareholder for each shareholding. This could be a non-resident of South Africa who owns shares on the domestic share register. The shareholder identification is not necessarily at a beneficial shareholder-named level, since it could reflect the name of the broker, fund, or omnibus account. In this case the nationality will reflect the named entity rather than the ultimate beneficial shareholder.

4.8.3 Register analysis provides insight into two important questions concerning the investable universe:

— For dual listed shares, what proportion of the shares are held in South Africa at a point in time?
— What proportion of the shares held in South Africa are held by South African resident investors at a point in time?

4.8.4 Both metrics will vary over time as shares are traded on the JSE or other exchange or are transferred between registers. Smaller movements are driven by the relative supply and demand dynamics between the two registers, whereas larger movements are generally the result of corporate actions.

4.8.5 Figure 15 reflects the aggregate value, in South African Rand, that is recorded on the Strate register for both SA resident and non-resident shareholders. In addition, the remaining market capitalisation of JSE listed equity shares that is not reflected on the Strate register is inferred and reflected as a balancing figure, represented by Off Register holdings.

4.8.6 The combined resident and non-resident Strate holdings reflect the aggregate investment holdings in South Africa of JSE listed equity shares by South African

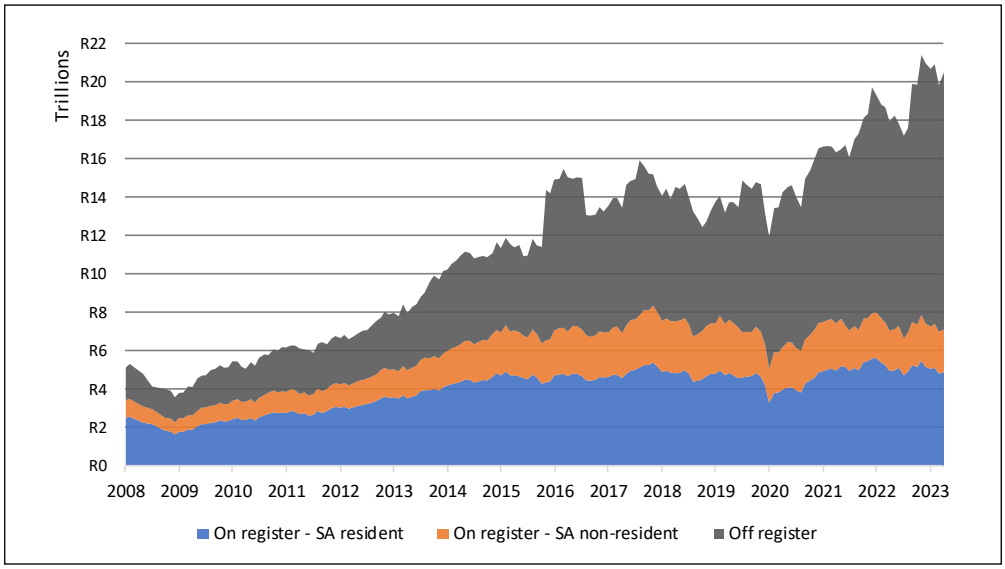

FIGURE 15 Aggregate equity register holdings (ZAR) (Source: JSE data)

residents and non-residents over time. The growth in off–register assets has been much larger than the growth in on–register assets over the modelling period. The aggregate assets of SA-resident equity shareholders have been largely flat in Rand terms over the past eight years, whereas the total market capitalisation of the investable universe has doubled in the same period.

4.8.7 Movements in overall aggregate value (or total JSE market capitalisation) is a function both of price movements but also listings, delistings and other corporate actions. If a large foreign company lists on the JSE this would have an immediate impact on JSE market capitalisation, but unless domestic investors purchase shares and transfer them to the Strate register, it will not impact on SA resident-held aggregate equity investments.

4.8.8 Figure 16 shows the Strate register holdings data but reflected as a proportion of total market capitalisation. The proportion of the overall investable universe that is accounted for on the Strate register shows a steady downward trend of just over 4% per year, for both the overall register and just the SA-resident portion. The proportion of the Strate register that is held by SA-residents has shown a more consistent trend, ranging between 63% and 73% over the modelling period. This is likely to be a function of non-resident investor interest in trading South Africa on the JSE.

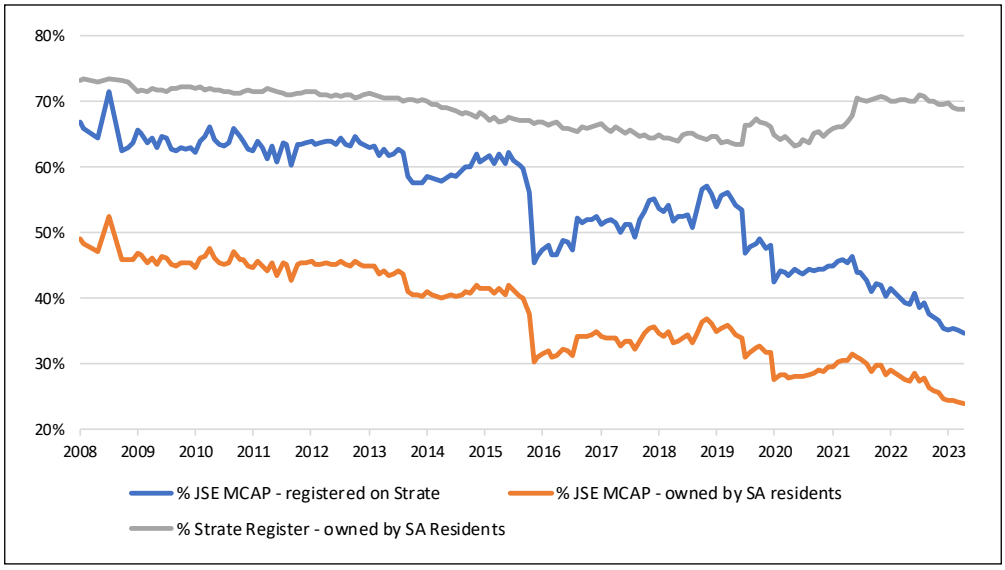

Figure 16 Proportional analysis of the domestic share register against market capitalisation (Source: JSE data)

5. CURRENT MARKET BENCHMARK DESIGN

5.1 Existing market benchmark

5.1.1 FTSE/JSE is an index partnership between the JSE and FTSE Russell, an LSE Group company. FTSE/JSE has been calculating and publishing benchmarks for the

South African equity market since 2002, when it took over the calculation and methodology of the JSE Actuaries Indices.

5.1.2 There are two broad market benchmarks in the FTSE/JSE Africa Index Series, namely the FTSE/JSE All Share Index (All Share) and the FTSE/JSE Shareholder Weighted All Share Index (SWIX All Share). Both indices are calculated in an uncapped version and also a capped version (capped All Share and capped SWIX All Share). The Capped SWIX All Share is currently the *de facto* equity benchmark for general equity funds in South Africa, with Alexander Forbes reporting 74%[4] of SA equity manager assets benchmarked against the index.

5.1.3 The rules that govern the methodology for the All Share Index and the SWIX All Share Index are recorded in the FTSE/JSE Africa Index Ground Rules.[5] These rules are publicly available for all index users to understand and verify the benchmark construction and weighting.

5.2 An index as a notional portfolio

5.2.1 An index is designed as a notional portfolio of constituent instruments. The calculated index value is the aggregate value of the portfolio or weighted average price of the constituents. An index normally has a methodology that defines how the constituents are selected, and how the notional portfolio is weighted to determine the average price. Questions relating to selection consider which securities are eligible to be added to the index, and how the final set of constituents are selected. Questions relating to weighting consider how the relative portfolio allocation of each constituent is set. The index methodology must therefore define:

— Which securities form part of the eligible universe for index construction.
— How the final index constituents are selected from the eligible universe.
— How frequently the index constituents need to change and the mechanics around constituent changes.
— How the constituents are weighted to determine the index value.

5.2.2 The index calculation methodology will also consider the treatment of corporate actions in the underlying constituent securities and the impact that they have on the index construction. Corporate actions could add or remove constituents from the index or impact on relative weightings.

4 R352 billion out of R477 billion AUM, Alexander Forbes, SA Equity Manager Watch Survey, December 2022. https://myapi.alexanderforbes.co.za/content/download/afinvestments/industrysurveys?path=Equity%20Survey%20December%202022%20-%20Final.pdf

5 FTSE/JSE Africa Index Series Ground Rule v8.2. https://www.jse.co.za/sites/default/files/media/documents/ftse-jse-africa-index-series-ground-rules-2023/FTSE%20JSE%20Ground%20Rules%20v8%202%20Feb%202023.pdf

5.3 Free float

5.3.1 When considering market capitalisation of a security for indexation purposes, FTSE/JSE identifies certain shareholdings that may not be readily accessible to the general investor. These restricted shareholdings are either held by certain categories of shareholder, or in sufficiently large quantity to make them inaccessible to new investors looking to purchase stocks on an arms-length basis. The free float is then the percentage of the entire issued capital of the company that is not subject to any free float restrictions.

5.3.2 FTSE/JSE considers the following specific shareholdings as free float restrictions:[6]

> Shares directly owned by State, Regional, Municipal and Local governments (excluding shares held by independently managed pension schemes for governments).
> Shares held by directors, senior executives and managers of the company, and by their family and direct relations, and by companies with which they are affiliated.
> Shares held within employee share plans.
> Shares held by public companies or by non-listed subsidiaries of public companies.
> All shares where the holder is subject to a lock-in clause (for the duration of that clause).
> All shares where the holder has a stated incentive to retain the shares (e.g. bonus shares paid if holding is retained for a set period of time).
> Shares held by an investor, investment company or an investment fund for strategic reasons as evidenced by specific statements to that effect in publicly available announcements, has an employee on the board of directors of a company, has a shareholder agreement, has successfully placed a current member to the board of directors or has nominated a current member to the board of directors alongside a shareholder agreement with the company.
> Shares that are subject to on-going contractual agreements (such as swaps) where they would ordinarily be treated as restricted.

5.3.3 FTSE/JSE considers the following specific shareholdings as free float restrictions if the holding is 10% or greater:

— Shares that are held by Sovereign Wealth Funds.
— Shares held by founders, promoters, former directors, venture capital and private equity firms, private companies, individuals (including employees) and shares held by several holders acting in concert.

6 FTSE/JSE Africa Index Series Ground Rule v8.2. Supra

5.3.4 In addition, where any single portfolio holding (such as pension funds, insurance funds or investment companies) is 30% or greater it will be regarded as strategic and therefore restricted. This implies that any one fund that purchases more than 30% of the issued share capital, even if not for a strategic control reason, is unlikely to be able to sell off that stake rapidly in the case of changing company sentiment, and subsequently the index weighting of that instrument will decrease to reflect the potentially locked-up stock.

5.3.5 FTSE/JSE calculates the free float for each listed company on the JSE that may be eligible for index inclusion. This calculation is based on publicly accessible information such as company annual reports or SENS announcements. In the absence of any significant corporate actions, the free float is updated once per year at the first quarterly index review after the publication of the company annual report.

5.4 Eligibility criteria

5.4.1 Eligibility criteria determine the eligible universe that can be drawn on to construct the benchmark. This paper aligns eligibility criteria for the alternative indices with that used for the current All Share Index and SWIX All Share Index. Some notable criteria include:

— Companies that have a full listing on the Main Board of the JSE.
— All classes of ordinary shares are considered. This excludes for instance preference shares, convertible loan stocks, investment trusts and exchange traded funds.
— Minimum free float screen.
— Minimum liquidity screen.

5.4.2 The eligibility criteria for the All Share Index have changed from time to time as FTSE/JSE have aligned the index methodology with prevailing market conditions and investor requirements. For example, the current eligibility criteria for free float requires a minimum free float of 5% whereas a previous rule required a minimum of 15%.

5.4.3 The liquidity screen is intended to ensure that an accurate and reliable price exists in order to calculate the market capitalisation of each company for daily index pricing. The current liquidity screen excludes companies that do not turn over at least 0.5% of their free float adjusted shares in issue each month, for at least ten out of the previous 12 calendar months. This screen only considers secondary trade on the JSE and not on any other exchanges where the stock may be dual listed.

5.4.4 FTSE/JSE does not apply any eligibility screening for the following:

— Primary listed – if a company has a primary listing on an offshore exchange and a secondary listing on the JSE it is still considered eligible for index inclusion. In fact, there is no eligibility screen applied on dual listed status, primary listing status or domicile. This is in contrast to broader country, regional and world indices which only include a company in the country where it is primary listed in order to avoid double counting.

— There is no qualitative screening to exclude companies. For example, companies that experience significant controversies (such as environmental or governance failures) or companies that experience a rapid collapse in share price are not excluded from index eligibility.
— There is no screening around sustainability compliance or activities.
— There is no screening around specific sector exclusions, such as munitions, gambling, or alcohol.

5.5 Selection methodology

5.5.1 Selection methodology refers to the rules that are applied when selecting the constituents that are included in any given index. This could be all eligible instruments or could be a representative sample. Most indices include a representative subset of their total eligible universe of instruments.

5.5.2 The All Share Index and SWIX All Share Index do not include all eligible companies in their notional portfolio construction. They include a sample of eligible companies that is representative of the entire market. Since both indices are broadly weighted on market capitalisation, the market capitalisation of companies is used to select constituents for index inclusion. This is done using the full market capitalisation of each company before the application of any free float restrictions, which is referred to as the full market capitalisation.

5.5.3 The All Share Index and the SWIX All Share Index have the same constituents since they are both constituted on the same full market capitalisation metric. These constituents are currently selected to comprise 99% of all eligible securities ranked by full market capitalisation, meaning that up to 1% of securities from the eligible universe are excluded from the All Share Index. A previous version of the selection methodology constructed the indices with a fixed 160 instruments as constituents.

5.5.4 The exclusion of this 1% tail of smaller companies would have a very limited impact on the index value, which is weighted by market capitalisation, albeit adjusted for free float. However, this selection does exclude many companies from the index, resulting in a notional portfolio that is far simpler to review, interpret and analyse.

5.5.5 In order to enhance comparability to the existing All Share Index and SWIX All Share Index, the authors use the same notional portfolio of index constituents to calculate the three alternative approaches to market benchmark weighting. This means that the FTSE/JSE eligibility criteria and selection criteria are applied, and that on any given day the three alternative benchmarks provided will have the same constituents as both the All Share Index and the SWIX All Share Index.

5.6 Weighting methodology

5.6.1 The weighting methodology of an index determines how the individual companies within the notional portfolio are weighted when calculating the final index

value. For a traditional market benchmark approach, the notional holdings of each share in the index would be the same as the total shares in issue, and the weighting methodology would therefore be based on full market capitalisation. This is indeed the approach that was taken prior to 2002 in the JSE Actuaries Indices before the FTSE/JSE index partnership introduced the concept of free float to South African indices, and based market benchmarks on free float adjusted market capitalisation.

5.6.2 However, full market capitalisation does not accurately reflect the investable universe since it includes restricted shareholdings that are not available to purchase by the typical investor. As noted by Bailey and Tierney (1998) a benchmark needs to be investable for it to be useful. FTSE/JSE therefore introduced an investability weighting factor, or free float, in order to weight the constituents on investable, or free float adjusted market capitalisation.

5.6.3 FTSE/JSE implements the free float adjustment using a combination of three rules. Firstly, if the company is domestic then the global free float is applied directly as a percentage to the gross market capitalisation. This global free float applies in both the All Share Index and the SWIX All Share Index and is calculated as a function of the types of restricted holdings listed in paragraph 5.3.

5.6.4 Secondly, there is an additional free float rule applied to dual listed companies to determine a SWIX free float. Under this rule, shares that are not accounted for on the Strate Register are classified as restricted, regardless of who owns them. The SWIX free float is the lesser of the global free float and the proportion of shares accounted for on the Strate register. The SWIX free float applies to the SWIX All Share Index. Historically the SWIX free float also included an adjustment for sponsored and listed depository receipt programmes, but this is no longer the case. This rule down-weights dual listed companies, and foreign dual listed companies in particular.

5.6.5 The third rule deals with the treatment of dual listed companies in the All Share Index and is due to a historical anomaly dating back to October 2011. Prior to this there were several inward listed companies included in the All Share Index such as Anglo American, BHP Billiton, Old Mutual, SAB Miller and Richemont. However there were other, more recently listed, inward listed companies that were not eligible for index inclusion since at that stage their purchase would have counted towards a fund's foreign portfolio allowance. The largest example was British American Tobacco. In 2011, these newer inward listings were reclassified as domestic assets and were therefore eligible for index inclusion.[7] The FTSE/JSE Ground Rules effectively create two classes of dual listed shares in the All Share Index with this rule:

— For the list of grandfathered companies that were already index constituents in October 2011, the global free float is used as the All Share free float.

7 National Treasury Medium Term Budget Policy Statement 25 October 2011, page 23. https://www.treasury.gov.za/documents/mtbps/2011/default.aspx

— For the list of inward listed shares that are not grandfathered, the SWIX free float is used as the All Share free float.

In short, this means that dual listed companies have the same free float in the All Share Index and the SWIX All Share Index, except for the grandfathered companies which are not down-weighted in reference to the domestic share register.

5.6.6 This creates a differential treatment for foreign companies, with some of them being down-weighted in line with the Strate register in the All Share Index, and others using their larger global investable market capitalisation. Over time, the list of grandfather companies has decreased to seven due to corporate activity and listings changes, and currently [10 July 2023] only three grandfathered companies remain in the large cap space, namely Anglo American plc, Investec plc and Mondi plc.

5.7 Capping

5.7.1 The market benchmark is weighted by investable market capitalisation. Since there are no controls in place to manage concentration risk, it is possible that significant concentrations can emerge. This can be at a single name level, where one constituent of the index has a dominant weight, or alternatively at a sector or industry level. Any concentration will be reflective of the investable universe that is available to investors in that market, and based on the constituent weighting approach used for that index.

5.7.2 Markets that are smaller, less diversified, or emerging are more likely to see concentration in a single large stock. Historic examples are Nokia in Sweden and Samsung in Korea. As noted by Raubenheimer (2010) concentrated benchmarks limit the ability of long-only equity fund managers to add value relative to those benchmarks, and may therefore be less suitable for performance benchmarking purposes.

5.7.3 One method to deal with concentration is to cap excessive constituent or sector weights. This is done by decreasing the investability weighting factor, or free float, by applying an additional capping factor between 0 and 1. This in turn will decrease the investable market capitalisation of that constituent and its index weighting. FTSE/JSE calculate variants of the All Share Index and SWIX All Share Index with a constituent cap applied. The current capping factor is applied at 12%, although this was previously applied at 10%.

5.8 Index valuation

5.8.1 The market benchmark is modelled as a notional portfolio of equity shares. An index value can be calculated for the benchmark and this number is published as the headline benchmark value. It can also be referred to as the price index or the capital index. The equation for the closing, or end-of-day index level on day t is:

Equation 1: Price Index Level[8]

$$Index\ Level_t = \frac{\sum_{i=1}^{n} Shares\ in\ Issue_{i,t} \times Free\ Float_{i,t} \times Closing\ Price_{i,t}}{Divisor_t}$$

Where:

— Shares In Issue × Free Float × Closing Price represents the investable market capitalisation of each constituent. The Shares in Issue and Closing Price will be constant across all indices at a point in time, but the Free Float may vary from index to index. Using an intraday price at a point in time in the equation will generate an intraday index level.

— The numerator in the formula represents the index market capitalisation which is the sum of the investable market capitalisation across all of the constituent stocks that form part of the index.

— The divisor is a factor (fixed per day *t*) used to scale the index value to a practical numerical level, and to ensure inter-day continuity of the index value.

— The index level is quoted in index points. The nominal index value does not carry meaning in a currency or valuation sense but should be used to compare valuations over time.

5.8.2 An important principle of stockmarket indices is that the calculated index level can only change as a result of changes to underlying share prices, which only occur whilst the market is open and trading activity can be observed. This means that the closing index level on any day is by definition equal to the theoretical opening index level on the subsequent trading day, immediately prior to any market activity. As a corollary, the notional portfolio valuation cannot change if the relative asset weightings change (i.e. shift from one share to another) but only if the individual share prices move. However, this continuity can be disrupted in the application of Equation 1 when there are changes made to the index composition, such as at quarterly reviews. In order to maintain the overnight continuity in the index level, there is a numerical adjustment made to the index divisor whenever there is a change to the index composition.

5.8.3 The price index models a notional portfolio where dividends are not reinvested but rather withdrawn by the investor. For each benchmark index, there is also a Total Return Index level that is calculated on the basis that over time all dividends are reinvested back into the entire portfolio, using the prevailing constituent weights. The model assumes that dividends are reinvested at start of business on the dividend effective date, from when the instrument is trading *ex dividend*. The equation to calculate the Total Return Index value is:

8 Guide to calculation methods for the FTSE/JSE Africa Index Series. https://www.jse.co.za/sites/default/files/jse_document_manager/RW/Internal/Indices/FTSE%20JSE%20Africa%20Index%20Series/Rules%20%26%20Classification/Calculation%20Guide.pdf

Equation 2: Total Return Index Level[9]

$$Total\ Return\ Index_t = Total\ Return\ Index_{t-1} \times \frac{Capital\ Index_t}{Capital\ Index_{t-1} - Ex\ Dividend\ Adjustment_t}$$

Where:

— The Ex Dividend Adjustment reflects the portfolio value of all ordinary dividends that have an effective date, or *ex date*, of *t*.

5.8.4 The Total Return Index level is calculated on a cumulative basis with all dividends reinvested. On days where there are no ordinary dividends paid from the market portfolio, the return on the total return index will be the same as on the capital index. On days where there are one or more constituents that trade *ex dividend*, the total return will be higher than the capital index return.

5.8.5 The formula makes an adjustment to the start of day, or opening, index level to calculate a total return for each day. This models a portfolio where any dividends received are immediately reinvested across the entire portfolio before the start of trading on the day that the instrument trades *ex dividend*. An alternative approach is to add the *ex dividend adjustment* to the capital index value at the end of the day. This models a portfolio where dividends are reinvested at the end of the trading day in which the instrument trades *ex dividend*, and therefore cannot be exposed to the portfolio returns on that same day.

5.9 Index review

5.9.1 The FTSE/JSE index methodology incorporates many rules that can change the weighting or composition of the All Share Index or the SWIX All Share Index. There are a large number of data points that need to be considered when determining a specific company's index inclusion and weighting, and these data points can change frequently across the set of the investable universe.

5.9.2 Every time there is a change to the market benchmark composition, this triggers a potential response from index users. This response could be a trading event (i.e. portfolio rebalance), consideration of a new company for research purposes, or an update to analytical and performance attribution models, and will trigger direct costs for benchmark users. To limit these costs and to reduce benchmark turnover, FTSE/JSE aggregates changes and applies them to the benchmark composition on a quarterly basis. These are applied in March, June, September, and December. As a result of this quarterly review process, there may be numerical values used in the daily benchmark calculation that are not aligned with the "real-world" position. Some examples include:

9 Guide to calculation methods for the FTSE/JSE Africa Index Series. Supra

— A company may issue more shares during the quarter but the shares in issue used for benchmark weighting is not updated until the next review.
— A company could decrease significantly in market capitalisation value due to price movements and fall outside of the 99% target for the All Share Index but remain in the index until the next review.
— A company director may increase their restricted shareholding in their own stock, but the free float remains unchanged in the index until the next free float review.

6. RESEARCH METHODOLOGY FOR THE MODELLING OF AN ALTERNATIVE BENCHMARK

6.1 Introduction

6.1.1 FTSE/JSE publishes an All Share Index and a SWIX All Share Index as broad market benchmarks. The SWIX All Share Index largely represents the market capitalisation of the Strate register, although there have been some anomalies over time, such as the treatment of depository receipts and the earlier consideration of investor nationality as a subset of the overall register.

6.1.2 The All Share Index has maintained a list of grandfathered foreign companies that have been represented at a much higher weight than suggested by the Strate register. At the same time, other foreign companies have been included at a lower weight, creating a disparity in treatment. This difference in treatment for some foreign companies versus others supports the view that the existing All Share is not consistent in its weighting of constituent companies.

6.1.3 The authors suggest three alternative market benchmarks that have a more consistent approach to market capitalisation weighting and can be considered appropriate performance benchmarks for domestic equity managers. One of these is the existing SWIX All Share Index with the historical anomalies removed, and the other two methodologies do not exist today. The three benchmarks are collectively called the alternative market benchmarks. Furthermore, the alternative methodologies should be sufficiently differentiated to allow a clearly articulated weighting principle for each one.

6.1.4 The objectives for the three alternative benchmarks include meeting the requirements for good benchmark design as provided in paragraph 2.3, but also to have a locally relevant definition of market capitalisation that aligns with a common understanding of the domestic market. The paper compares and contrasts the historical performance and composition of the three alternative benchmarks with the two existing market benchmarks.

6.1.5 The three alternative market benchmarks being suggested are:

— Global All Share
— SA Register All Share (based on the current methodology of the SWIX All Share)
— SA Investor All Share

6.2 Market capitalisation weighting

6.2.1 All three alternative approaches are based on a market capitalisation weighting, in line with Siegel's (2003) requirement for a useful benchmark. The existing All Share methodology has already introduced the concept of free float to reduce the market capitalisation of individual instruments to reflect their investability, and the SWIX All Share methodology further incorporates the use of the domestic share register to capture the same objective. The three alternative approaches are based on varying definitions of investable market capitalisation.

6.2.2 Broadly speaking, the three alternative benchmarks differ on their definition of market capitalisation, or at least the investable market capitalisation that should be represented in the market benchmark. The Global All Share has the widest lens of market capitalisation, with no adjustment for where that market capitalisation is held or traded, whereas the SA Investor All Share has the narrowest definition.

6.2.3 This paper does not include new inputs to the benchmark weighting that are not related to market capitalisation other than what is already applied in the FTSE/JSE Ground Rules, such as:

— **Sustainability:** use of ESG factors, carbon emissions or other sustainability data points in the determination of instrument weighting.
— **Smart beta:** use of weighting factors related to specific investment styles to more closely align the benchmark to a particular investment mandate. Examples include value, growth, momentum, size, volatility and income (dividends).
— **South African economy:** use of weighting factors that consider the correlation of individual companies to the broader macroeconomic drivers of South Africa. Examples include geographical distribution of company earnings or operations.
— **Investment management:** benchmarks are calculated gross of the trading fees and administrative fees that an investor would be subject to. The benchmarks as calculated do not make any allowance for fees. There is also no allowance for potential portfolio income due to scrip lending.

6.3 Global All Share

6.3.1 The Global All Share index constituent weights are based on their global investable market capitalisation. This approach still applies a free float adjustment based on restricted shares but makes no adjustment for the number of shares that are accounted for on Strate versus on other global trading venues. For example, a company with an investable market capitalisation of R100 million will have the full R100 million accounted for in its index weighting, with no consideration for whether those shares have most recently traded on the JSE or an offshore exchange, whether they are held on the Strate register or with a foreign CSD, or what the nationality of the shareholder is.

6.3.2 The rationale for this benchmark design is the fungibility of shares across registers. It is feasible to purchase shares on a foreign stock exchange (or have an agent

or broker do it on your behalf) and transfer those shareholdings onto the domestic share register and then hold them in South African Rands. At the same time, due to the global nature of markets and payment networks, any domestic investor may be able to access liquidity in a dual listed JSE counter either on the JSE or on some other foreign trading platform where it is listed. As a result, the full available market capitalisation of any JSE-listed company is available and addressable by domestic investors, albeit in different regulatory domains, trading currencies or time zones. As an extreme example, it is technically possible for South African investors in aggregate to purchase all the outstanding shares in Anglo American plc and to transfer the full share register onto Strate, and as such the benchmark weighting of Anglo American plc should not be down-weighted to reflect the current geographical split of trading

6.3.3 This index is calculated by using the global free float for each constituent with no consideration for where the shares are held, or the nationality of the shareholder.

6.3.4 It can be expected that this index will reflect relatively higher weightings for foreign dual listed companies compared to the SWIX All Share Index, with a corresponding down-weighting of domestic companies. This is likely to improve the liquidity of the index since dual listed companies are generally larger and more liquid than those that are not dual listed. It may introduce significant index churn if large new dual listed companies list on the JSE since these would potentially come into the index at an initial large weight. As an example, if a R1 trillion LSE-listed company listed on the JSE without raising any capital in South Africa, it would be included in the benchmark index based on its full R1 trillion market capitalisation, despite no domestic investor holdings of the stock. This could force domestic investors who are benchmark cognisant to purchase significant levels of this new stock into their portfolios over a very short time period, and to sell off the balance of their portfolios to fund this purchase.

6.3.5 This index has the broadest possible definition of the investable universe, however not all domestic investors may have access to stocks trading on foreign markets. Domestic investors may also feel that they are subject to different market dynamics when trading these stocks offshore since they face off against a fundamentally different pool of investors and brokers. For example, Anglo American plc may attract demand from developed market investors or LSE-linked index funds which would not be trading directly on the JSE for SA-domestic stocks.

6.4 SA Register index (based on the current version of SWIX All Share)

6.4.1 The SA Register index is identical to the existing SWIX All Share Index as its methodology exists today. The constituent free float is calculated as the lesser of the global free float and the proportion of shares accounted for on the Strate register, applied consistently to all constituents. While the suggested SA Register index is the same as the current SWIX All Share, it does differ from past versions of the SWIX All Share. As such, retrospective values of the SA Register index could essentially be considered a back-cast

history of the current SWIX All Share using existing index rules. Historical values of the SA Register benchmark would be more comparable over time as the same calculation methodology is applied consistently throughout the historic period. This effect will be slightly offset by various simplifications made in the modelling process.

6.4.2 Since its launch in 2004, the SWIX All Share Index has had a number of modifications made to its weighting methodology that are different to the current prevailing treatment. Some of these include:

— Shares held on the Strate register that underpin listed sponsored depository receipt programmes on other exchanges were excluded from the SWIX free float until March 2023.
— Early calculation of the SWIX Free Float considered the shareholder nationality and not the total Strate register.

6.4.3 This index is more appropriate for investors who feel that large offshore holdings of JSE foreign listings are not fully part of their investable universe, either due to their inability to trade in global markets, or because they believe there is a different market dynamic for offshore holdings traded by non-residents on a foreign exchange. Conversely, they may feel that the Strate register more accurately reflects their opportunity set in terms of investment choices since it most accurately reflects the shares available to trade on the JSE at any point in time.

6.4.4 The index does not experience significant churn due to new listings of dual listed companies since the index weighting of any new addition would only reflect the portion of that listing registered in South Africa rather than the full global market capitalisation. However, as shares move between investors on the Strate register and investors on offshore registers this activity will impact on index weights. To the extent that this movement is driven by foreign investors, some domestic benchmark users may not believe that this supply and demand dynamics of foreign investors should impact the domestic benchmark instrument weights.

6.5 SA Investor index

6.5.1 The SA Investor index bases the investable market capitalisation on that portion of the Strate register which is owned by South African resident investors. This index focuses less on the investable universe and more on the aggregate holdings of comparable investors. It can be seen as the total performance over time of all South African equity investors, and therefore has some parallels to a peer benchmark approach.

6.5.2 This index methodology reflects the aggregate decisions made by domestic investors against the investable universe on the JSE. Instruments listed on the JSE comprise the full investment opportunity for domestic equity investors; however it is only a small subset of the investment opportunity for foreign investors who may have access to multiple emerging and developed markets. By excluding any holdings by non-residents,

and including all holdings by residents, this index is the closest to a full portfolio view, and therefore its weights are the best reflection of real-world portfolio holdings. Both the Global and SA Register approaches include non-resident holdings, but only a portion of those non-resident portfolios since these foreigners will also have holdings in instruments that are not listed on the JSE.

6.5.3 Some benchmark users will however be concerned that the aggregate activity of non-residents may have a significant impact on index weights that is not driven by domestic investors. For example, if a domestic stock is added to a global emerging markets benchmark, it will drive up holdings of non-residents who will need to purchase stock from domestic investors on the JSE. This will act to decrease the weighting of that stock in the SA Investor index without any corresponding change in fundamentals for that stock in the context of the domestic investor. However, this shift of weight will nonetheless reflect the real-world aggregate portfolio dynamics of the domestic investor.

6.6 Market capitalisation modelling

6.6.1 The full market capitalisation of a company must align fully to the aggregate assets held by all shareholders. Figure 17 provides a generalised model to consider how aggregate shareholdings for JSE-listed companies can be spread across three different categories, namely:

— **Share Register.** Some shareholdings may not be dematerisalised onto a central share register and may still be held in certificated form. Typically however the majority shareholdings are digitally represented on a share register. Each JSE-listed company will have shareholders registered on the SA share register, managed by Strate. For instruments that are dual listed, a portion of their shareholdings will be registered on one or more foreign share registers.

— **Shareholder nationality.** The nationality of the shareholder is categorised as SA resident or non-resident. For dual listed instruments, SA resident shareholders are generally more likely to hold their shares on the domestic share register than on a foreign register due to exchange control restrictions.

— **Restricted Shareholders.** Paragraph 5.3 introduced the concept of free float and restricted shareholders. Restricted shareholders could have their holdings on the domestic register or a foreign register and they can be SA resident or non-resident. The precise interaction between register, shareholder nationality, and restricted status will be unique for each listed company.

6.6.2 Figure 18 populates the general share register model with the register data for Prosus on 30 June 2023. Prosus is a foreign dual listed company with a secondary listing on the JSE. Data from the domestic share register shows that 7.7% of the total share capital of Prosus is accounted for on Strate. The remainder of the shares are either held on a foreign share register or else are held in certificated form. The exact split between

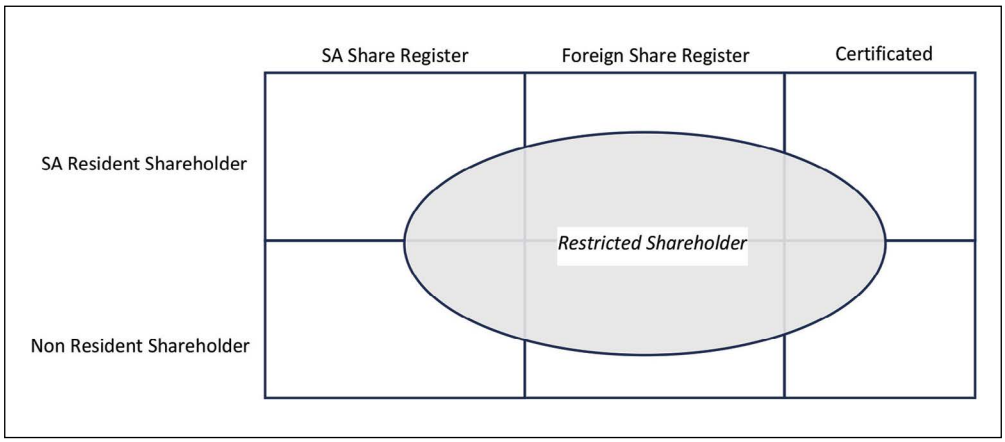

FIGURE 17 Generalised share register model

foreign register and certificated cannot be determined without the register data for each country where Prosus may be listed. The total restricted shareholdings of Prosus according to the free float rules is 57%. When Prosus reports on restricted shareholdings it does not report which register these shareholders maintain their shares on. In relation to the precise definition of market capitalisation used for Prosus, it would have the following index free float values, which ultimately impact index weight relative to other constituents:

— Global free float: 43%
— SA Register free float: 7.7%
— SA Investor free float: 6.8%

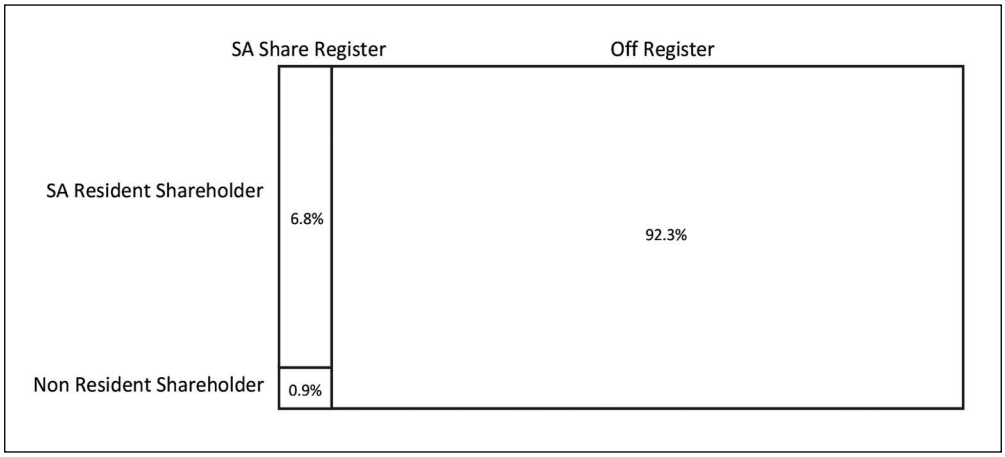

FIGURE 18 Share register analysis for Prosus – 30 June 2023

6.6.3 Figure 19 populates the general share register model with the register data for Naspers on 30 June 2023. Naspers is a domestic company with a primary listing on the

JSE. It is not dual listed.[10] Data from the domestic share register shows that 47.4% of the total share capital of Naspers is accounted for on Strate. Since Naspers is not dual listed, the remaining 52.6% is therefore not dematerialised since there is no other register. These shares are in fact held in treasury either by Naspers itself or by its subsidiary Prosus. The total restricted shareholdings of Naspers is in fact 57% although it is not possible to use the public data available to determine which restricted shareholdings precisely are held on the register versus in certificated form. In relation to the precise definition of market capitalisation used for Naspers, it would have the following index free float values, which ultimately impact index weights relative to other constituents:

— Global free float: 43%
— SA Register free float: 43%[11]
— SA Investor free float: 26%

Naspers is an important example of a domestic large market-capitalisation stock that can have a significantly different free float in the SA Register benchmark compared to the SA Investor benchmark.

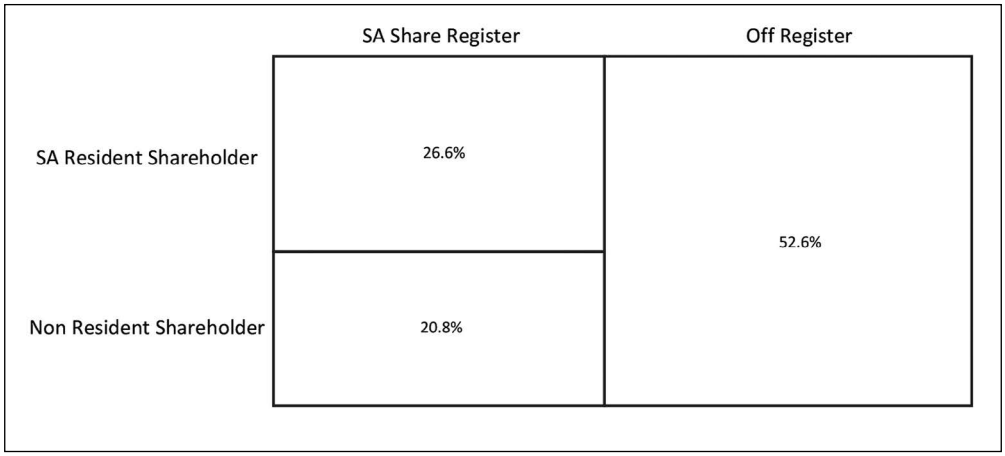

Figure 19 Share register analysis for Naspers – 30 June 2023

6.7 Impact of regulation

Institutional investors in South Africa are subject to a range of laws and regulations, a full analysis of which is outside the scope of this paper. Regulation is likely to have an impact on the choice of a suitable benchmark for an investor. Two examples of how regulation could impact benchmark selection are:

10 Depository receipt programmes are not classified as dual listed in this context since the underlying shares remain on the domestic share register.
11 Even though there is 47% of the shareholdings accounted for on the domestic register, the SA Register Free Float cannot exceed the global free float.

— Regulation 28 of the Pensions Fund Act allows pension funds to invest up to 45% of their portfolio value offshore. Investors that fall into this category may be more likely to consider a Global benchmark approach if they wish to further increase their exposure to large dual listed companies without using their portfolio allowance.
— Board Notice 90 of 2014 of the Financial Services Conduct Authority allows a collective investment scheme manager to hold up to 10%[12] of their portfolio in equity securities issued by any one company or 120% of that security's index weight. Investors impacted by Board Notice 90 may be more likely to consider adopting a capped index as their benchmark.

7. MODELLING RESULTS AND ANALYSIS – UNCAPPED INDICES

7.1 Introduction

7.1.1 This paper presents the calculated daily values for the three alternative benchmarks and compares them to the existing All Share Index and SWIX All Share Index. The results of the modelling provide a numerical comparison of the five indices for the modelling period of 1 January 2008 to 30 June 2023, a period of fifteen years and six months.

7.1.2 FTSE/JSE introduced the SWIX All Share Index in 2004 based on the Strate register data However, the JSE has historical records available for the raw Strate register data from December 2007. While data prior to this may be available directly from Strate, this paper uses a modelling period beginning in January 2008.

7.1.3 Prior to 2012 there was no concept of grandfathered companies in the FTSE/JSE indices. Furthermore, Figure 7 to Figure 10 indicate the increasing relevance of foreign and dual listed companies in the domestic market from around 2015. Figure 3 indicates an increasing trend in market capitalisation from 2020. It follows that the more recent portion of the modelling period is likely to show increased variances between the existing market benchmarks and the alternative market benchmarks, and that this may provide different insights compared to the full modelling period. In addition, a greater reliance may be placed on the more recent portion of the modelling period when considering possible future benchmark characteristics.

7.2 Number of constituents

7.2.1 The methodology of the All Share Index and the SWIX All Share Index ensure that the two benchmarks always have the same constituents. The three alternative benchmarks are designed to mirror this methodology to enhance comparability over time. As such, all five indices always have the same constituents. From inception until 2020, the All Share Index was designed to have a fixed number of constituent companies of 160. From 2020, this was amended to capture 99% of the full market capitalisation of the eligible universe rather than a fixed number of companies.

12 For equity securities with a market capitalisation of R2bn or more

7.2.2 Where companies have multiple classes of equity share that are listed and included in the index, the number of constituent instruments in the index will be greater than 160, even though the number of companies reflected is 160.

7.2.3 Figure 20 shows the number of constituent shares in the benchmark indices over the modelling period. Since 2020 when the selection methodology changed to a 99% market representation target, this number has been on a steady decline in line with the decreasing number of instruments listed on the JSE Main Board, and is currently at an all-time low of 130. This is a function of the decrease in the total number of instruments in the investable universe as indicated in Figure 6, but also a function of the increasing concentration of market capitalisation in the largest companies.

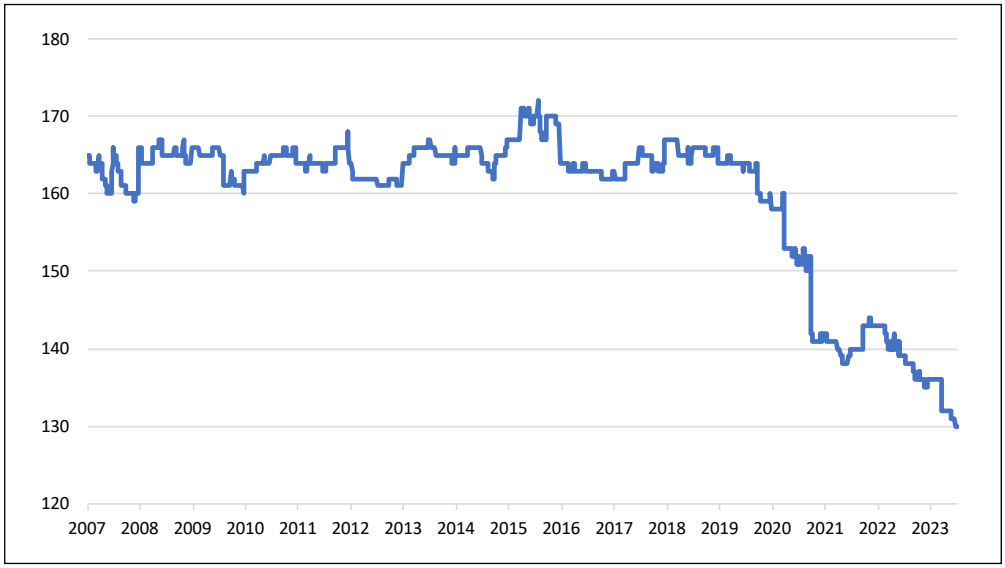

FIGURE 20 Number of constituent instruments in the market benchmark (Source: JSE data)

7.3 Common weighting

7.3.1 Raubenheimer (2010) defines 'active weight' as a term to measure an investor's stock selection choices against the benchmark. Figure 21 applies the same principle when considering benchmark composition but focuses rather on the common weight. This is the stock holding that is common across the existing market benchmark and the alternative index. Figure 21 reflects this overlap between the All Share Index and the alternative benchmarks. Two indices that have the same weighting for each constituent would have 100% common weighting. The lower the common weighting is between two indices, the more their individual constituents differ in weighting. For example, a common weighting of 80% means that 80% of the notional portfolio is allocated identically, across both stock and weighting, and the remaining 20% differs in either stock selection of weighting.

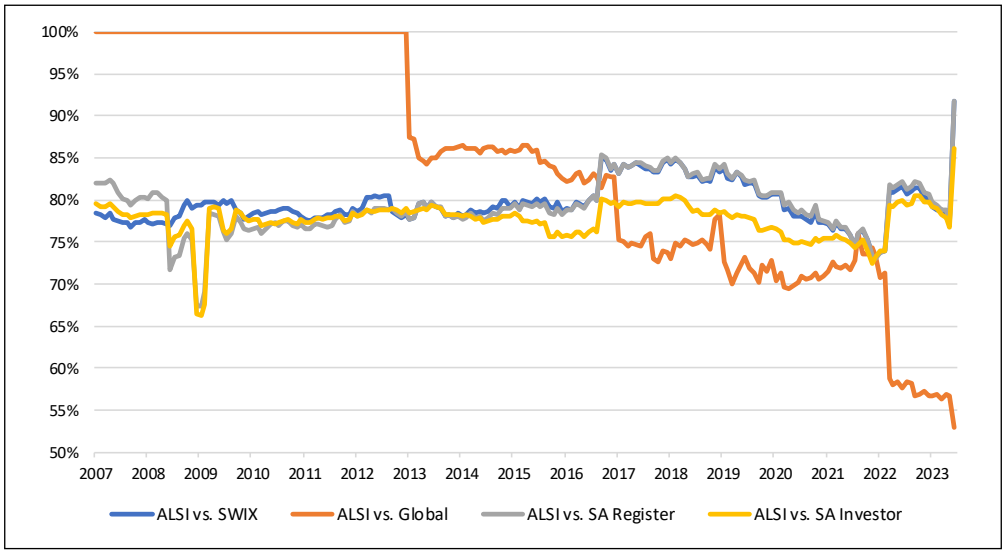

FIGURE 21 Common constituent weighting of alternative benchmarks relative to the All Share index

7.3.2 From inception until 2012 the Global index was identical to the All Share Index. From 2012, the All Share Index started to introduce foreign companies using a SWIX free float, whereas the Global Investor index used the global free float for these additions, regardless of the domicile of these holdings. As the number of grandfathered companies in the All Share Index decreased over time, there was a corresponding decrease in the common weighting between the All Share Index and the Global index, with numerous step changes seen over the modelling period. The Global index has shown the most diversification of the three alternatives against the All Share Index as measured by lowest common weight, with an average common weight of 68.2% over the past five years, dropping to an average of 56.7% over the past twelve months.

7.3.3 Figure 22 reflects the common weighting overlap between the SWIX All Share Index and the alternative benchmarks, with the same series comparing the All Share Index and SWIX All Share Index as seen in Figure 21.

7.3.4 The Global index is again the most differentiated against the existing benchmark with a five-year average of 60.0% and a more recent one-year average of 53.5%. This means that there is currently just over 50% direct overlap between the constituents of the SWIX All Share Index and the Global index. This common weighting has steadily decreased since 2013 indicating that the Global index is increasingly differentiated against the SWIX.

7.3.5 The common weight between the SWIX All Share Index and the SA Register index should be very high since they are both based on the shares accounted for on the Strate register. However, prior to March 2023, the SWIX All Share Index made an allowance for shares held on the Strate register that underpinned listed sponsored

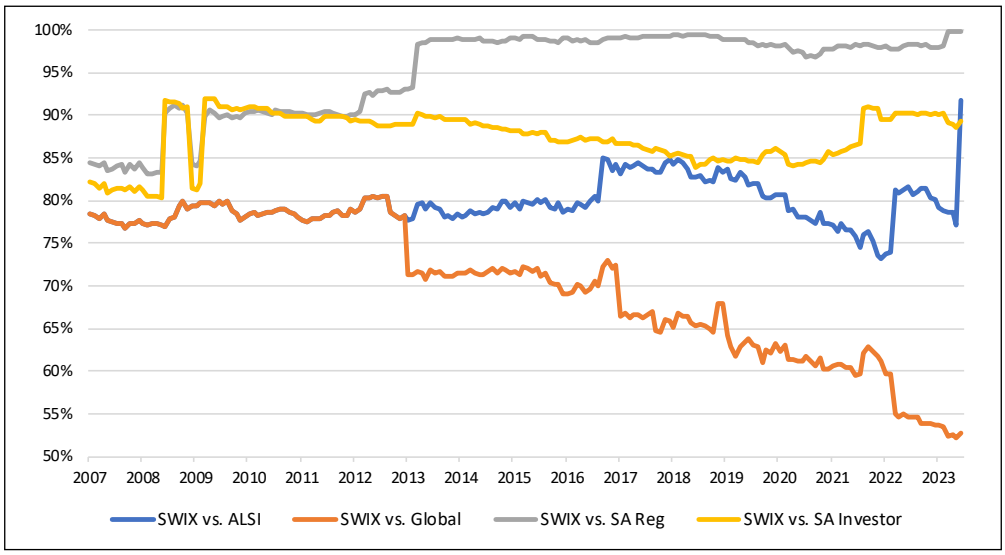

FIGURE 22 Common constituent weighting of alternative benchmarks relative to the SWIX All Share index

depository receipt programmes, and this accounted for the common weight that was previously less than 100%. Prior to other methodology adjustments made to the SWIX All Share Index methodology in 2013 there was a decreased common weight between these two indices. This validates the use of the SA Register index as a better comparable tool for history than the published SWIX All share values, although the historic performance is likely to be substitutable from 2013 to date.

7.3.6 The SA Investor index has a high common weighting compared to the SWIX All Share Index. The difference in common weighting reflects stock holdings on the Strate register that are held by non-resident investors. The impact of foreign investor demand on South African stocks is evident in the time series of this common weighting, lifting from 83% in mid-2018 when SA was a more popular trading venue for non-resident investors to the current levels of just under 90%.

7.3.7 Figure 23 reflects the overlap between the three alternative benchmarks compared directly to each other.

7.3.8 There is a high common weighting between the SA Register and SA Investor indices with levels around 90% since August 2021. This is an expected linkage since both indices are based on shareholdings on the Strate register. The difference between the two indices is a function of the relative split between SA-resident and non-resident investors holding shares on the Strate register. A lower common weighting indicates periods where non-residents had increased shareholdings in South Africa.

7.3.9 The Global index does not consider the Strate register and is therefore more diversified against the other two alternatives. It is noteworthy that the Global index

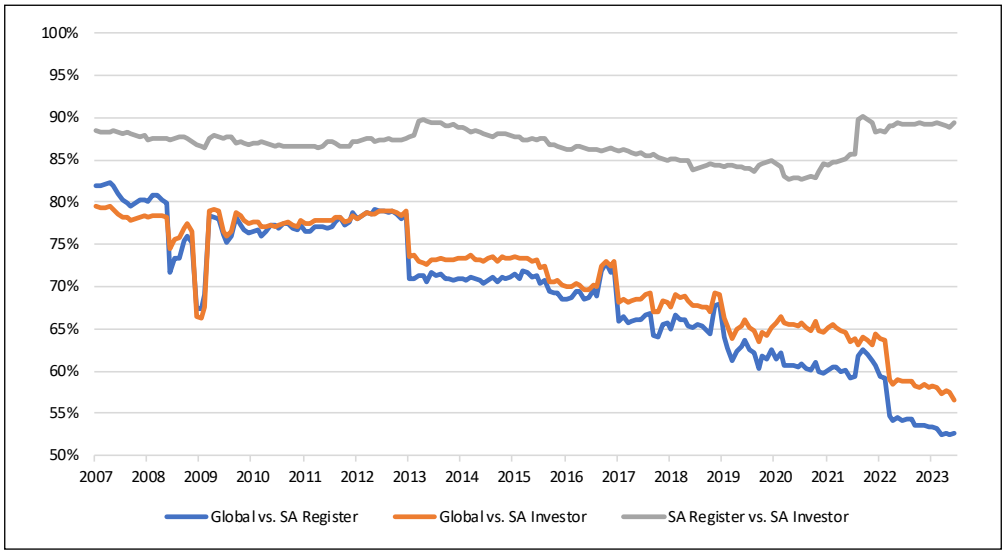

FIGURE 23 Common constituent weighting of alternative benchmarks relative to each other

has a higher common weight with the SA Investor index than the SA Register index, highlighting how the inclusion of non-resident investors in South Africa can provide a skewed view on portfolio holdings.

7.4 Largest holding

7.4.1 The constituents with the highest index weighting will also have the largest scaled impact on overall index return. For example, consider an index constituent that experiences a 20% price return over one year at a stock level. If that constituent was 10% of the benchmark, it would contribute 2% to the total benchmark return over the year. However, if same constituent was only 1% of the benchmark, it would contribute 0.2% to the total benchmark return over that year.

7.4.2 For investors who earn performance fees when their portfolio outperforms the benchmark, there is therefore a disproportionate impact of their stock selection decisions for companies with a high benchmark weight compared to those with a low benchmark weight. Figure 24 shows the weighting of the largest constituent in each index over time, which provides a lens on the relative impact of the largest weighted stock on portfolio selection as a benchmark user.

7.4.3 The largest single stock weighting in the indices confirms the single stock concentration conjecture in the South African equity market. Concentration in the SA Register and SWIX All Share indices peaked in October 2020 at 28%. The consistently increasing single stock concentration in the SWIX All Share Index from 2015 to 2018 was responsible for the launch of the Capped SWIX All Share Index in late 2016 and the subsequent widespread adoption of this index for performance benchmarking in South Africa.

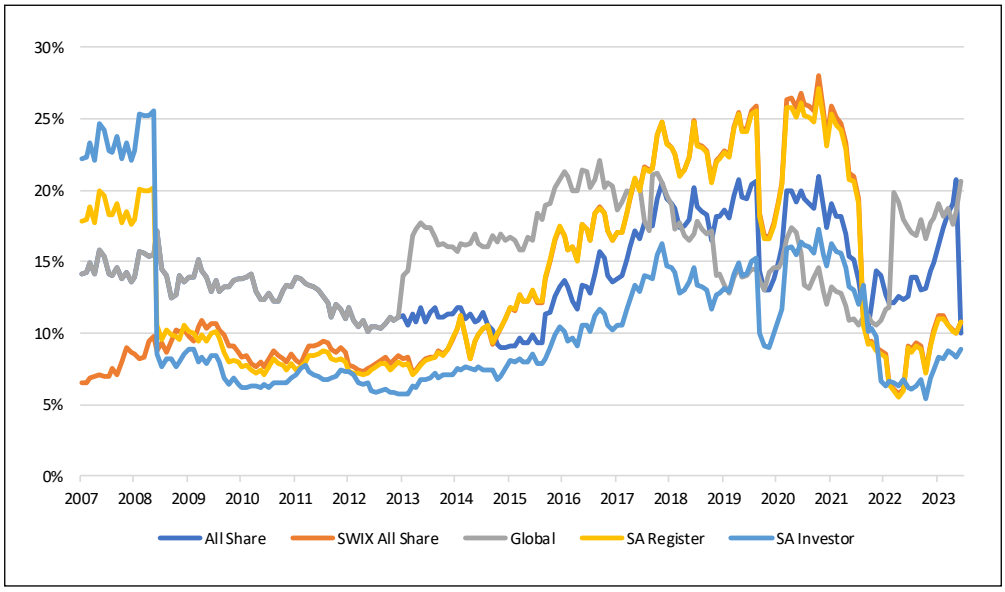

FIGURE 24 Top one largest constituent weighting

7.4.4 Table 5 presents the December year end data from Figure 24 for each index.

TABLE 5 Top one largest constituent weighting at end of each calendar year

Year End	All Share	SWIX All Share	Global	SA Register	SA Investor
2008	13.6%	10.2%	13.6%	10.5%	8.6%
2009	13.8%	8.7%	13.8%	8.0%	6.4%
2010	13.2%	8.5%	13.2%	7.8%	6.8%
2011	11.0%	8.7%	11.0%	8.0%	7.3%
2012	11.1%	8.5%	11.1%	8.0%	5.7%
2013	11.4%	9.6%	16.0%	9.6%	7.0%
2014	9.0%	10.9%	16.5%	11.0%	7.5%
2015	13.2%	17.4%	20.8%	17.5%	10.5%
2016	13.6%	16.5%	20.3%	16.5%	10.2%
2017	19.4%	23.3%	19.6%	23.2%	14.7%
2018	18.1%	22.3%	14.1%	22.1%	12.8%
2019	13.8%	17.7%	14.6%	17.5%	9.9%
2020	17.4%	23.6%	12.0%	23.0%	14.7%
2021	14.0%	8.7%	10.9%	8.5%	6.6%
2022	14.9%	10.2%	18.0%	9.9%	7.5%
2023 (June)	10.0%	10.8%	20.6%	10.8%	8.8%
2023 (Company)	Anglo American	Naspers	BHP Group	Naspers	Naspers

7.4.5 There is no universal view on what the highest appropriate single stock exposure in a portfolio should be. Table 5 indicates that in 14 out of the past 15 year-end snapshots, the index with the smallest maximum single stock weight has been the SA Investor index. This is not necessarily because the other indices reflect a greater market appetite for single stock concentration risk, but rather that the SA Investor is the only approach to capture a full portfolio view. This is relevant in the context of concentration and the need to limit concentration. The SA Investor index models the aggregate domestic shareholder which is a set of contained portfolios. The other two alternative benchmarks however include some non-resident holdings but do not reflect the entirety of those holdings, since these investors would most likely have holdings in other countries or exchanges in the same portfolio. As such, the maximum weighting in the SA Investor index is a better reflection of the largest single stock concentration in domestic equity portfolios and indicates that in aggregate South African investors have managed their single stock exposure more prudently than the existing market benchmarks would suggest.

7.4.6 Including the full register or offshore registers in the weighting tends to increase the weight of large stocks in the index as these are more likely to be in non-resident portfolios. Considering Naspers as a case in point, between 40% and 50% of Naspers is owned by non-resident investors, which is more than the market average implied by Figure 15. However, since it is not dual listed, the full market capitalisation is included in the current SWIX All Share Index, compared to 40% to 50% in the SA Investor index. This difference in weighting reflects aggregate non-resident investors in South Africa far more than domestic investor activity.

7.5 Top five holdings

Table 6 lists the top five weighted stocks in 2012, 2017 and 2022 for the five different indices.

Table 6 Top five average largest weighted stocks for each of the calendar years 2012, 2017 and 2022

Top 5 Average Weighting – 2022		Top 5 Average Weighting – 2017		Top 5 Average Weighting – 2022	
All Share					
Richemont	12.9%	Naspers + Prosus	16.9%	BHP Group	10.8%
Anglo American	10.4%	Richemont	8.1%	SABMiller	8.4%
Naspers + Prosus	9.0%	BHP Group	6.9%	Anglo American	7.6%
FirstRand Limited	4.3%	Anglo American	3.8%	MTN Group	5.5%
BHP Group	3.9%	British American Tobacco	3.3%	Richemont	5.3%
SWIX All Share					
Naspers + Prosus	11.8%	Naspers + Prosus	20.6%	MTN Group	7.8%

FirstRand Limited	5.6%		British American Tobacco	4.1%		Sasol	5.1%
Anglo American	4.8%		MTN Group	3.9%		Standard Bank Group	4.7%
MTN Group	4.7%		Sasol	3.8%		BHP Group	4.6%
Standard Bank Group	3.7%		Standard Bank Group	3.4%		SABMiller	4.1%
Global							
BHP Group	15.8%		British American Tobacco	19.7%		BHP Group	10.8%
British American Tobacco	11.3%		Naspers + Prosus	12.4%		SABMiller	8.4%
Naspers + Prosus	9.9%		Glencore	7.1%		Anglo American	7.6%
Glencore	8.7%		Richemont	5.9%		MTN Group	5.5%
Richemont	7.3%		BHP Group	5.0%		Richemont	5.3%
SA Register							
Naspers + Prosus	11.6%		Naspers + Prosus	20.6%		MTN Group	7.5%
FirstRand Limited	5.5%		British American Tobacco PLC	3.9%		Sasol	6.5%
Anglo American	4.7%		MTN Group	3.9%		Naspers + Prosus	5.1%
MTN Group	4.6%		Sasol	3.8%		Standard Bank Group	4.7%
Standard Bank Group	3.6%		Standard Bank Group	3.4%		Anglo American	4.3%
SA Investor							
Naspers + Prosus	10.1%		Naspers + Prosus	13.2%		Sasol	6.3%
Anglo American	5.8%		British American Tobacco PLC	5.1%		MTN Group	5.5%
FirstRand Limited	5.2%		Sasol	4.4%		Anglo American	5.2%
British American Tobacco	3.8%		FirstRand Limited	4.1%		FirstRand Limited	4.2%
MTN Group	3.7%		Steinhoff International	3.2%		BHP Group	4.1%

7.6 Top ten holdings

7.6.1 A broader view of concentration is to consider the combined weighting of the largest ten constituents in each index. Figure 25 shows the combined daily weighting of the en largest constituents in each index and highlights the increasing range of concentration numbers over the more recent portion of the modelling period.

7.6.2 The Global index has historically had the highest weight for the ten largest stocks, and by implication the lowest weight for the remaining stocks. This means that overall index performance is more dependent on a smaller number of stocks, since the lower weighting at the tail has a proportionally smaller impact on overall index performance. Current levels of over 70% weighting in the largest ten stocks in a 130 stock portfolio reflects the outsize weighting impact that large multinational and dual listed companies have on the index composition.

7.6.3 Table 7 presents the December year end data from Figure 25 for each index.

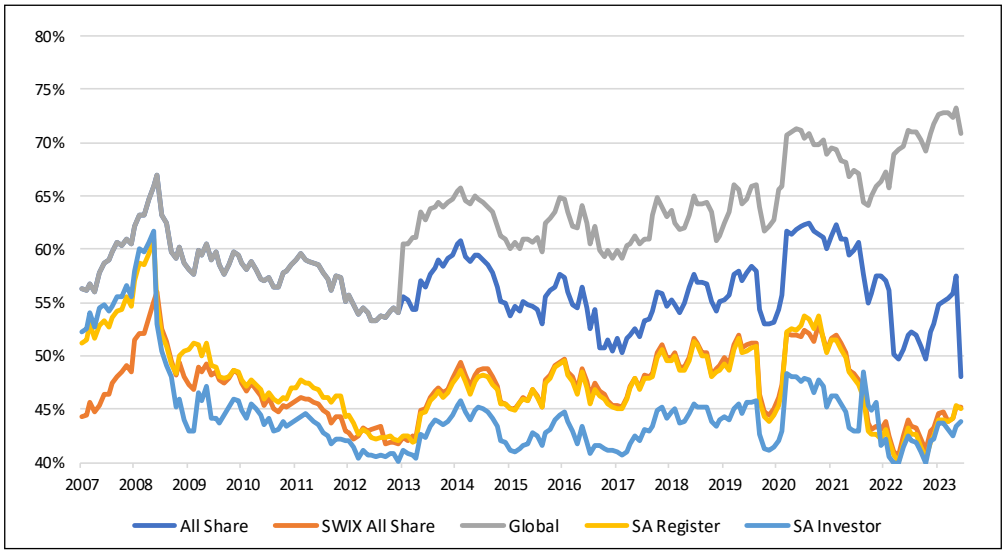

FIGURE 25 Top ten largest constituent weightings

TABLE 7 Top ten largest constituent weighting at end of each calendar year

Year End	All Share	SWIX All Share	Global	SA Register	SA Investor
2007	60.5%	48.5%	60.5%	54.7%	55.5%
2008	58.7%	48.1%	58.7%	50.4%	44.0%
2009	59.5%	48.3%	59.5%	48.4%	45.8%
2010	58.6%	45.5%	58.6%	47.0%	43.7%
2011	55.2%	43.0%	55.2%	44.3%	42.0%
2012	54.0%	41.7%	54.0%	42.1%	40.2%
2013	59.5%	48.0%	64.7%	47.4%	44.5%
2014	54.9%	45.5%	61.0%	45.5%	41.9%
2015	57.7%	49.4%	64.9%	49.3%	44.4%
2016	50.5%	45.4%	59.1%	45.2%	41.1%
2017	54.6%	49.8%	63.0%	49.6%	44.2%
2018	55.2%	49.1%	61.3%	48.6%	44.0%
2019	53.2%	45.0%	62.7%	44.4%	41.5%
2020	60.1%	50.4%	69.0%	50.2%	45.3%
2021	57.6%	43.1%	66.3%	42.2%	41.6%
2022	53.0%	43.2%	71.8%	42.5%	42.2%
2023 (June)	48.1%	45.2%	70.9%	45.1%	43.9%

7.6.4 The use of the Strate register (SWIX All Share, SA Register and SA Investor) results in reduced concentrations of the ten largest stocks in each index. Furthermore, the SA Investor weighting shows a consistently more diversified notional portfolio than the other approaches. This is comparable to the results seen for the largest single holding and top five holdings where the SA Investor shows reduced concentration.

7.7 Stock distribution

7.7.1 The concentration of weights for the largest stock and the top ten largest stocks provides a useful view of the concentration of the market index. However, this is a relatively small number of shares compared to the total number of shares in the All Share Index, and it is important to consider the rest of the shares available to investors in the benchmark. Figure 26 shows the distribution of the 136 constituents at the end of 2022 compared to the 164 constituents a decade earlier in Figure 27.

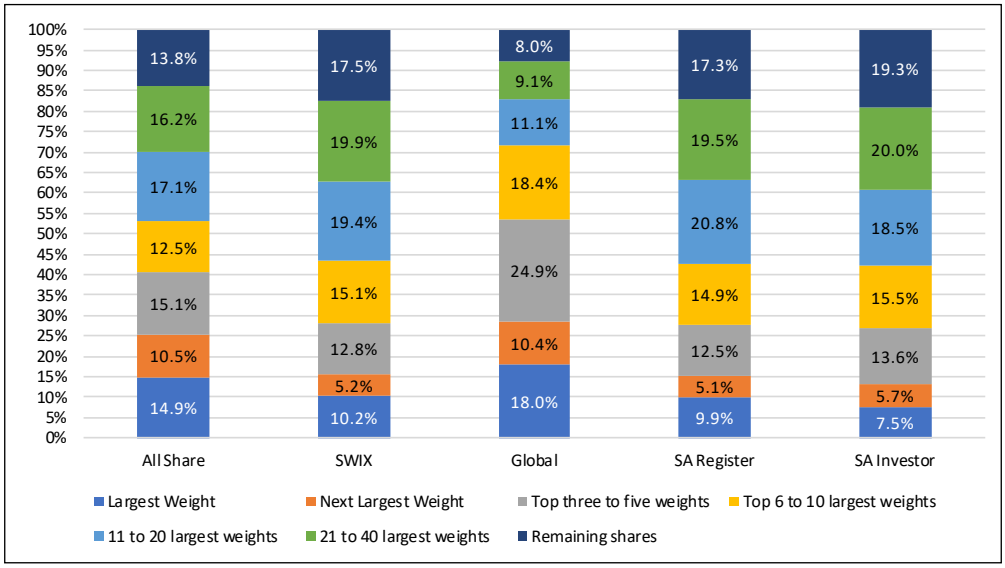

FIGURE 26 Distribution of index constituent weightings on 30 December 2022

7.7.2 The difference in weightings outside of the 20 largest stocks is stark and demonstrates how the pattern of single name concentration extends beyond the top ten. The combined areas of the 21 to 40 largest stocks and the remaining shares represents a total of 116 shares out of the total 136. This is 85.2% of the number of instruments available, but between 17.1% (Global) and 39.2% (SA Investor) of the total index composition.

7.7.3 The weight of the largest stock has increased over the past decade across both the published indices and the three alternative market benchmarks, and the weight of the tail (everything beyond the forty largest weights) has decreased over the same period. This indicates a general increase in market capitalisation concentration over the period.

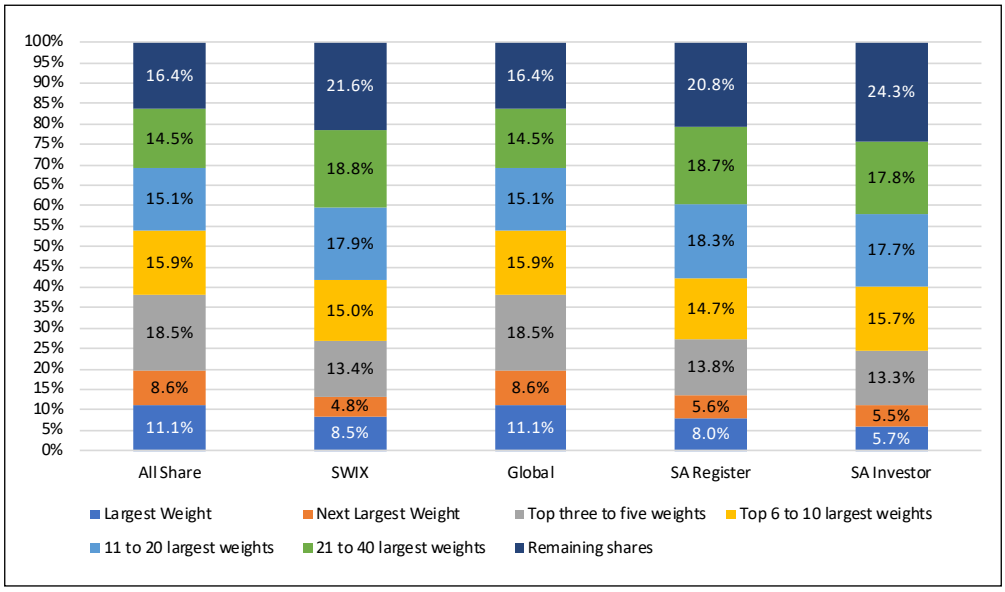

FIGURE 27 Distribution of index constituent weightings on 31 December 2012

7.8 Risk/Return profile

7.8.1 Figure 28 shows the price index level for the five indices over the modelling period, using a base value of 100 on 31 December 2007. Over the long term, the general correlation of all five approaches is clear, highlighting the tendency of stockmarkets to show an overall common trend in price movements over time. However over shorter periods investment returns can differ materially.

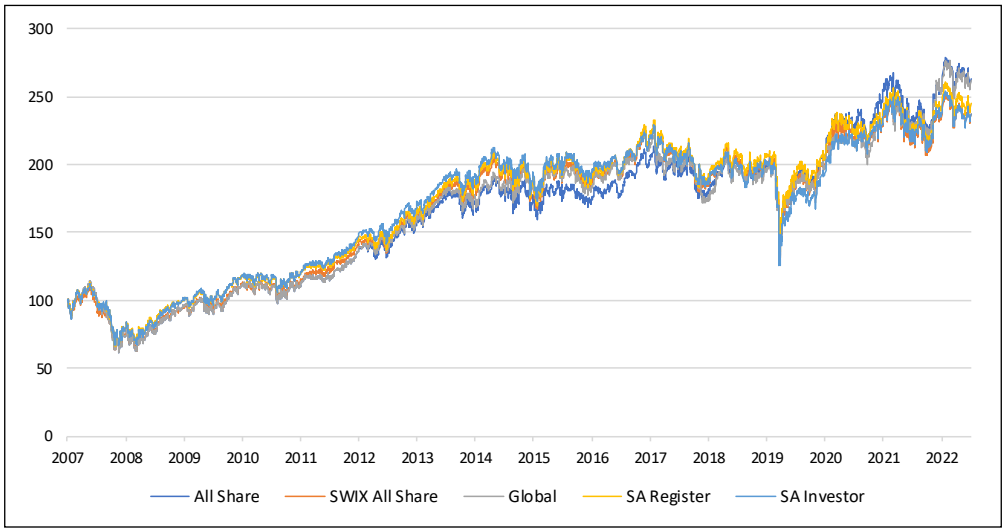

FIGURE 28 Daily index price level

7.8.2 Table 8 presents the annualised return and average volatility for the market benchmarks over the full modelling period. The statistics are presented for both the price index and the total return index. Over the same period, the South African headline Consumer Price Index (CPI) exhibited an annual growth rate of 5.51%.[13]

Table 8 Annualised return and volatility metrics over the full modelling period

Measure	ALSI	SWIX	Global	SA Register	SA Investor
Price return	6.43%	5.72%	6.40%	5.94%	5.73%
Price volatility	19.44%	18.64%	19.95%	18.61%	18.27%
Total return	9.84%	9.17%	9.84%	9.35%	9.33%
Tri volatility	19.42%	18.63%	18.94%	18.59%	18.27%
Implied DY	3.21%	3.26%	3.23%	3.22%	3.41%

7.8.3 Of the three alternatives, the Global index reflects both the highest price return and the highest price return volatility over the modelling period, and the SA Investor index the lowest return. None of the alternatives provided a risk premium meaningfully in excess of inflation when considering the capital return.

7.8.4 Table 9 presents the annualised return for the market benchmarks over the most recent five-year period, together with the average return volatility. Over the same period, the South African headline CPI exhibited an annual growth rate of 4.81%.[14]

Table 9 Annualised return and volatility metrics over the past five years to 30 June 2023

Measure	ALSI	SWIX	Global	SA Register	SA Investor
Price return	5.70%	2.73%	5.08%	3.08%	2.86%
Price volatility	20.01%	19.80%	19.30%	19.70%	19.38%
Total return	9.59%	6.30%	8.91%	6.64%	6.73%
Tri volatility	19.99%	19.81%	19.29%	19.79%	19.54%
Implied DY	3.68%	3.47%	3.64%	3.46%	3.76%

7.8.5 The difference in returns between the alternatives over the more recent five-year period is much more noticeable than over the entire modelling period. The use of the SA register to weigh the portfolio constituents has delivered a much lower return than the Global index, with the SA Investor underperforming by more than 2.5% per annum. Furthermore, both the SA Register and SA Investor benchmarks have delivered a negative real return over the period, excluding dividends.

7.8.6 It is important to note that a higher or lower price return is not a key

13 Statistics South Africa, CPI Headline Index Numbers, updated up to May 2023, https://www.statssa.gov.za/publications/P0141/CPIHistory.pdf (Accessed 7 July 2023)

14 Depository receipt programmes are not classified as dual listed in this context since the underlying shares remain on the domestic share register.

quality objective when designing benchmarks. The overall market performance in any period is essential to determine comparative performance and therefore performance fees. However, a market benchmark should not be optimised to maximise price return but rather be a fair reflection of the opportunity set available to its users, and to satisfy the requirements for good benchmarks as provided in paragraph 2.3. The individual stock and sector weightings are generally more important to benchmark-cognisant investors as part of their daily investment process.

7.8.7 Since index levels do not increase uniformly over time, the selection of the period start dates and end dates will also play a role in the calculated index return. Annualised price return over a fifteen-year period or even a five-year can also average out significant outliers. One way to consider the distribution of index returns more effectively is on a calendar year basis or a rolling basis. Figure 29 presents the price return for each index for each full calendar year.

FIGURE 29 Calendar year price index returns

7.8.8 When considering calendar year returns, the range of index returns becomes evident. Figure 29 indicates two years with clear negative returns (2008 and 2018), six years with near-flat returns (including 2023 year to date), and eight years with positive returns. It is also evident that there is a visible clustering of returns across the five indices in each year.

7.8.9 Figure 30 and Figure 31 plot the one-year trailing total return index performance of the alternative indices against the published benchmarks over the full modelling period and the most recent three years, respectively. One-year returns are not a long-term view for equity investors but do give a better visual indicator of the range of

returns over time. The returns over the more recent past reflect a wider spread in returns among the alternatives, which is aligned with the increasing differentiation in index weights and concentration and decreased common weightings.

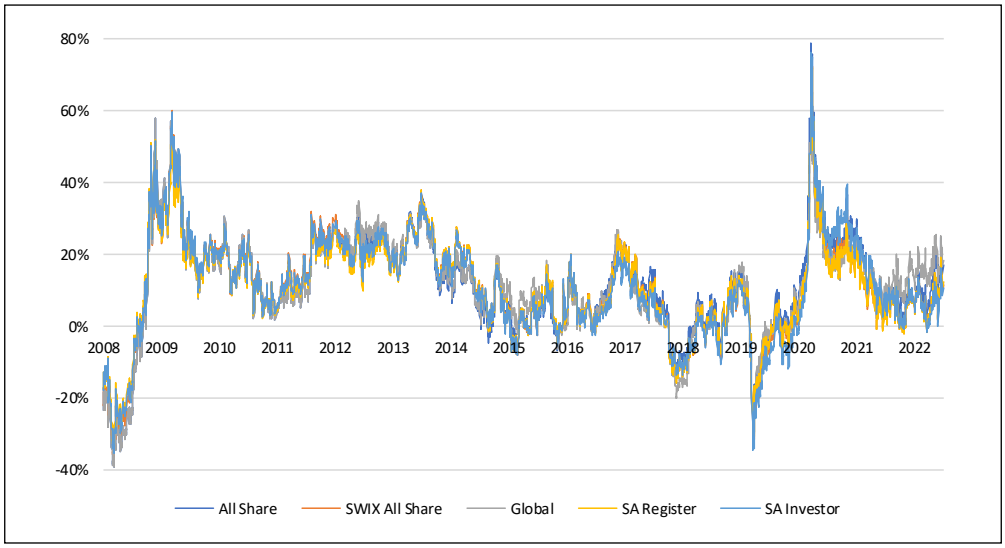

FIGURE 30 One year rolling total return for the full modelling period

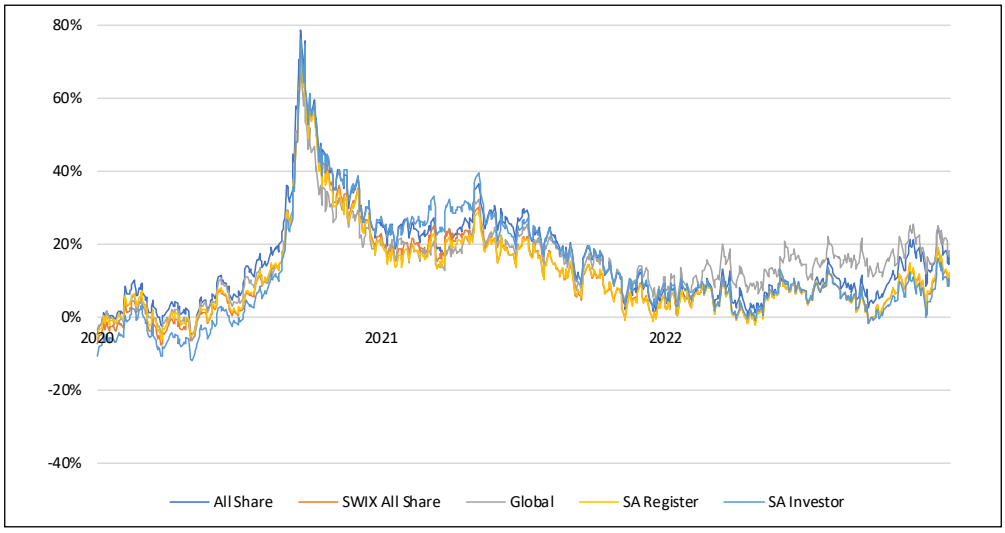

FIGURE 31 One year rolling total return for the last three years

7.9 Beta and correlation

Beta is a measure of the systematic risk of the stock or portfolio compared to the market. Table 10 shows the calculated Beta across the full modelling period of the three alternative benchmarks relative to the SWIX All Share Index.

Table 10 Beta for alternative benchmarks relative to the SWIX All Share Index from 1 January 2008 to 30 June 2023

Alternative	Beta
Global	0.956
SA Register	0.994
SA Investor	0.972

7.9.1 All three variants have a Beta close to a value of one, indicating that all three alternative benchmarks have structurally similar systematic risk compared to the SWIX All Share Index.

7.9.2 Shifting from the longer-term view across the full modelling period to a more recent five-year period, we notice a decrease in Beta values for all three variants against the SWIX All Share Index, but primarily for the Global index. This suggests an increasing disparity between the indices over the most recent five years compared to the full modelling period. Put differently, the Global index has become more differentiated to the SWIX All Share Index over the past five years.

Table 11 Beta for alternative benchmarks relative to the SWIX All Share Index from 1 June 2018 to 30 June 2023

Alternative	Beta
Global	0.886
SA Register	0.998
SA Investor	0.976

7.9.3 The Pearson Correlation Coefficient is a measure of the linear correlation that can be used to compare the daily price returns of the various pairs of indices. A level of 1 indicates a perfect positive linear correlation. Table 12 presents the correlation matrix over the full modelling period and Table 13 over the last five years.

Table 12 Correlation matrix for index daily price returns across the full modelling period

Index	All Share	SWIX All Share	Global	SA Register	SA Investor
All Share		0.974	0.978	0.972	0.974
SWIX All Share			0.940	0.996	0.992
Global				0.937	0.945
SA Register					0.992
SA Investor					

TABLE 13 Correlation matrix for index daily price returns over the past five years

Index	All Share	SWIX All Share	Global	SA Register	SA Investor
All Share		0.971	0.954	0.972	0.973
SWIX All Share			0.909	0.999	0.990
Global				0.908	0.920
SA Register					0.987
SA Investor					

7.9.4 It is again clear that the largest differences between the full modelling period and the most recent five years relate to the Global index. The correlation of daily price returns of the Global index against every other alternative has decreased in more recent times, showing less of a correlation in returns. This implies that the returns from the Global index are less strongly correlated to the returns from the SA Register and SA Investor indices, and that it therefore provides an increasingly differentiated benchmark from the two alternatives that reference the domestic share register.

7.10 Dividend yield

7.10.1 The index dividend yield, illustrated in Figure 32, is the weighted average dividend yield of the constituents, using the same notional portfolio weighting that is used for the overall index valuation. The dividend yield is calculated based on one-year trailing ordinary dividends paid for each constituent, although the value fluctuates daily in line with price movements on the underlying shares.

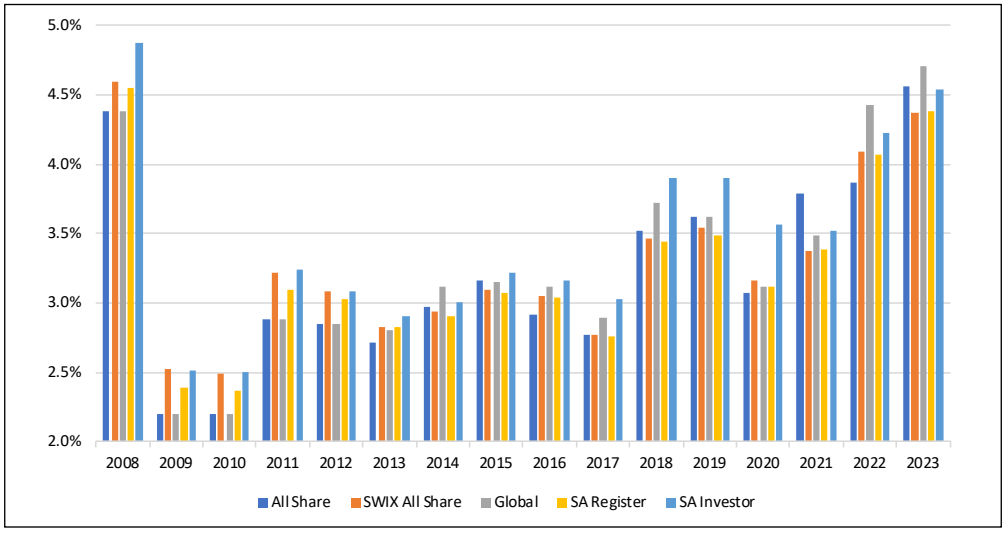

FIGURE 32 Index dividend yield

7.10.2 Using annual snapshot views aligned with calendar year-ends can introduce some bias into the data. It does become evident that dividend yields are largely clustered each year for the five indices.

7.10.3 Comparing the long-term return of the total return index to the price index is an alternative approach to measure the effective dividend yield on the portfolio. We note that the SA Investor index delivers the highest dividend return over the modelling period than any of the variants by 16 basis points. This indicates that those instruments that have a higher SA Investor weight compared to the SA Register weight either tend to have higher dividend yields, or have lower valuations (i.e. market price relative to historic dividends).

7.11 Price earnings

The index earnings yield (Figure 33) is the weighted average earnings yield of the constituents, using the same notional portfolio weighting that is used for the overall index valuation. The earnings yield is calculated based on one-year trailing headline earnings per share declared for each constituent, although the value fluctuates on a daily basis in line with price movements on the underlying shares. The price multiple is the inverse of the earnings yield and is used as one metric to measure value, where a stock with a low price earnings multiple is considered cheap compared to a stock with a higher multiple.

Investors use forward PE multiples as one tool to value individual stocks. The low multiples for all five indices at the end of 2021 and 2022 indicate that South African stocks are valued at lower price levels then their longer-term averages would indicate. This could indicate that the listed companies in South Africa have reported lower earnings over the last two years than their longer-term averages, adjusted for inflation. This could be one force that has depressed more recent market returns, as indicated in Table 9.

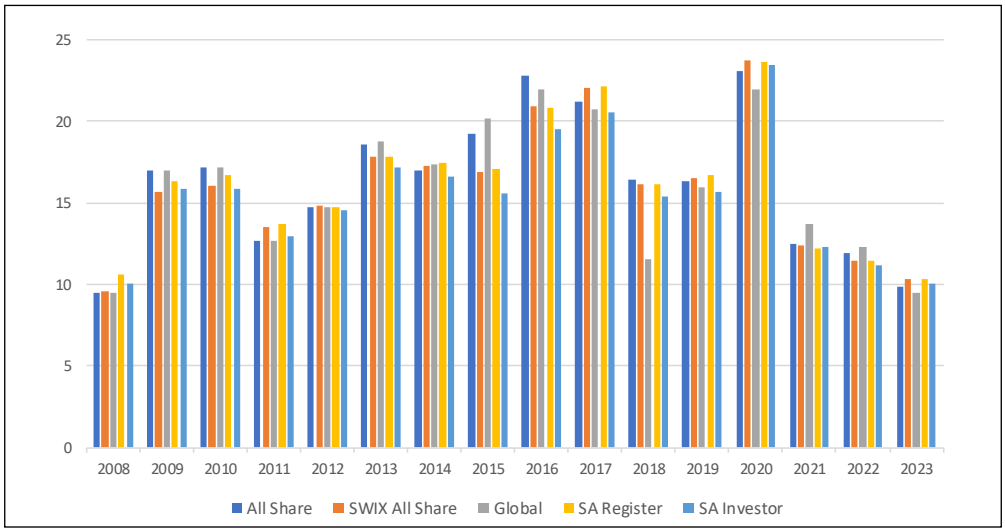

Figure 33 Index price earnings multiple

7.12 Maximum drawdown

7.12.1 Maximum drawdown highlights the worst possible investment period for a portfolio, by determining the period with the largest negative return regardless of start date, as shown in Table 14. This captures the period with the worst-case return profile for the market as a whole and signals maximum losses.

7.12.2 For the All Share Index and the Global index, this was the period from 22 May 2008 to 20 November 2008 where the indices had a drawdown of 46.4% and 47.4% respectively. This aligns with the global financial crisis of 2007/2008 which saw major stockmarket crashes around the world. It took the market benchmark more than three years to recover to the price levels seen prior to the crisis.

7.12.3 For the SWIX All Share, SA Register and SA Investor, the period was from 25 January 2018 until 23 March 2020 The end of this period aligns with the significant market volatility and losses experienced at the start of the global COVID-19 pandemic, coming off market highs in early 2018. It took the SA Investor index significantly longer than the SA Register index to recover to the previous high price levels, suggesting that domestic portfolios proved to be less resilient than the total market available on the JSE.

Table 14 Maximum drawdown

Index	Start date ("buy date")	Start level	End date ("Sell date")	End level	Maximum drawdown	Years to recover
All Share	2008/05/22	114.76	2008/11/20	61.52	–46.4%	3.16
SWIX All Share	2018/01/25	228.83	2020/03/23	131.33	–42.6%	0.96
Global	2008/05/22	114.76	2008/11/20	61.52	–46.4%	3.16
SA Register	2018/01/25	232.67	2020/03/23	135.44	–41.8%	0.96
SA Investor	2018/01/25	228.85	2020/03/23	125.31	–45.2%	1.71

7.12.4 The Years to Recover provides the number of years from the low point at the end date that the index took to recover back in value to the previous high point at the start date. The South African equity market has seen significant drawdown periods of over 40%, regardless of the index referenced. Equity managers will seek to minimise downside risk as well as maximise upside growth, and many investors would prioritise the reduction of maximum drawdown in their portfolios.

7.12.5 The Ulcer Index provides a more extended view on downside risk compared to maximum drawdown which reflects only the worst-case scenario. It is often calculated on a 14-day lookback period as a technical indicator, but Figure 34 plots a longer 250-day lookback period, which is a rolling year. Martin and McCann (1989) devised the index to measure the amount of drawdown over a period and defined it as the root-mean-square of retracement over the rolling period. Figure 34 shows some variance in downside risk between the alternatives, although the relative values do change over time in line with market conditions.

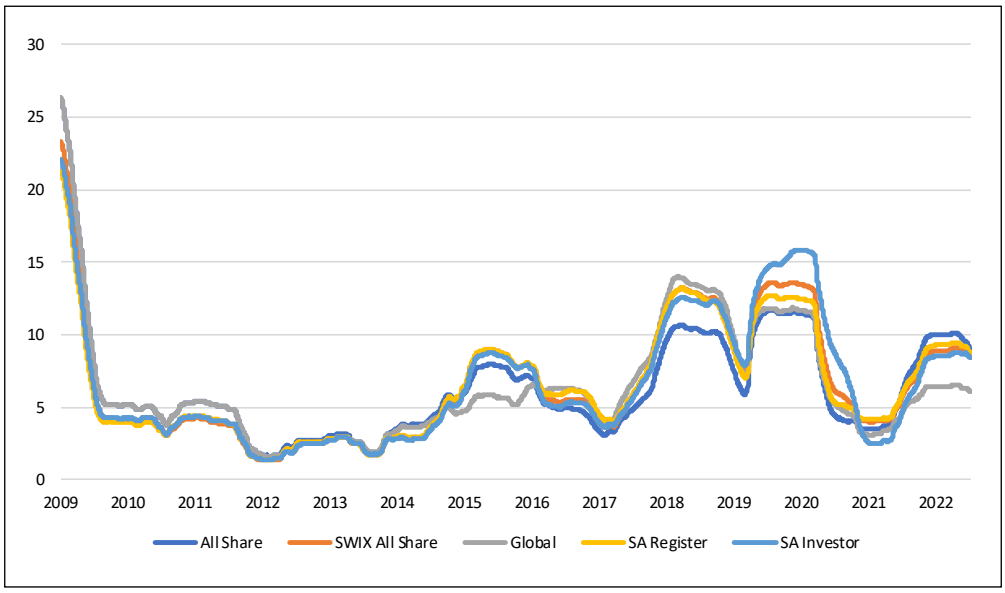

FIGURE 34 Ulcer Index with a 250-day lookback period

7.13 Performance contribution

7.13.1 An alternative view to common weighting between the indices is to consider the performance contribution of individual stocks to the overall index performance. Comparing which stocks drove the most positive index performance and the most negative index performance in each variant gives further context to the impact of concentration. Stocks with a higher weight that outperform the market average will have a larger contribution to overall performance whereas stocks with a smaller weight will have a lower contribution, even if their absolute return is a positive outlier.

7.13.2 Starting with the long-term view across the full modelling period, and considering a base index value of 100, Table 15 provides the total contribution to index performance of the top five and bottom five constituents for each index measured in index points. For each index variant, the index level at the start of the period in January 2008 was 100 index points, and the index level at the end of the period on 30 June 2023 is provided in the table section heading in parentheses.

7.13.3 Index contribution is measured in index points and is calculated per instrument based on the movements in that instrument's price. Index contribution is not impacted by corporate actions, de-listings or index re-weightings. The daily contribution of each instrument to the overall price index movement is calculated by comparing the instrument's closing price to its theoretical opening price, after the application of any corporate actions, and with reference to its index weighting.

TABLE 15 Top five and bottom five constituent contributors to overall index returns over full modelling period

Top five contributors			Bottom five contributors	
All Share (262.55)				
Naspers + Prosus	46.62		Steinhoff	–2.17
Richemont	41.30		Impala Platinum Hlds	–2.02
BHP Group	21.00		Sibanye Stillwater	–1.90
SABMiller	16.97		Sasol	–1.80
FirstRand Limited	6.28		Intu Properties Plc	–1.13
	132.16			**–9.00**
SWIX All Share (236.85)				
Naspers + Prosus	59.36		Steinhoff	–2.40
Richemont	10.17		Sasol	–2.08
FirstRand Limited	8.79		Impala Platinum Hlds	–1.84
SABMiller	8.03		Sibanye Stillwater	–1.68
BHP Group	5.54		Anglo Platinum	–1.25
	91.90			**–9.26**
Global (261.61)				
Naspers + Prosus	36.94		Impala Platinum Hlds	–1.50
Richemont	27.33		Steinhoff	–1.34
BHP Group	24.62		Hammerson Plc	–1.18
Glencore	17.66		Lonmin PLC	–0.86
SABMiller	15.60		Liberty International	–0.85
	122.16			**–5.74**
SA Register (244.58)				
Naspers + Prosus	61.76		Impala Platinum Hlds	–2.59
Richemont	9.57		Steinhoff	–2.44
FirstRand Limited	8.90		Sasol	–2.21
SABMiller	7.70		Sibanye Stillwater	–1.85
Anglo American	6.89		Anglo Platinum	–1.44
	94.79			**–10.53**
SA Investor (237.07)				
Naspers + Prosus	44.23		Steinhoff	–3.36
Richemont	12.23		Impala Platinum Hlds	–2.12
FirstRand Limited	10.60		Anglo Platinum	–2.05
Anglo American	9.65		Sasol	–1.92
SABMiller	8.06		ArcelorMittal	–1.47
	84.77			**–10.92**

7.13.4 For example, a notional investor that invested R100 into the All Share before the start of trading in January 2008 will have a total notional portfolio value of R262.55 on 30 June 2023. Of this R162.55 growth over the 15 years and six months, Naspers and Prosus contributed R46.62.

7.13.5 An investor that wanted to outperform the index would ideally need to overweight these top positive contributors, or at least be index neutral on them. Many of the names on the list have relatively large index weightings, in line with the weighting sensitivity discussed in paragraph 7.4.

7.13.6 The following top five and bottom five contributors for the period 1 July 2018 to 30 June 2023 provide a more recent five-year view to highlight the divergence between the indices. The contribution numbers in Table 16 have been rebased to reflect an index level of 100 on 29 June 2018, and the numbers in the parentheses therefore reflect an index level on 30 June 2023 relative to a base value of 100 on 29 June 2018.

Table 16 Top five and bottom five constituent contributors to overall index returns over the last five years

Top five contributors			Bottom five contributors	
All Share (131.97)				
Richemont	14.97		Sasol	–2.17
BHP Group	6.74		Sibanye Stillwater	–0.95
Naspers + Prosus	5.68		Growthpoint Prop Ltd	–0.64
Anglo American	3.68		Redefine Properties	–0.59
Gold Fields	2.59		Mondi Plc	–0.52
	33.67			**–4.88**
SWIX All Share (114.43)				
Naspers + Prosus	5.97		Sasol	–2.43
Richemont	2.67		Sibanye Stillwater	–0.81
Gold Fields	2.29		Growthpoint Prop Ltd	–0.77
Anglo American	2.11		Redefine Properties	–0.72
BHP Group	1.50		Sappi	–0.48
	14.54			**–5.22**
Global (128.14)				
BHP Group	8.80		British American Tob.	–1.93
Richemont	8.30		Sasol	–1.35
Glencore	5.93		Hammerson Plc	–0.56
Naspers + Prosus	3.52		South32	–0.48
Anglo American	2.97		Growthpoint Prop Ltd	–0.41
	29.52			**–4.73**
SA Register (116.36)				
Naspers + Prosus	5.96		Sasol	–2.44
Gold Fields	3.28		Sibanye Stillwater	–0.88
Richemont	2.73		Growthpoint Prop Ltd	–0.78
Anglo American	2.18		Redefine Properties	–0.72
Anglogold Ashanti	1.94		Sappi	–0.48
	16.10			–5.30

SA Investor (115.16)				
Naspers + Prosus	5.87		Sasol	–2.72
Richemont	3.49		Growthpoint Prop Ltd	–0.82
Anglo American	3.05		Redefine Properties	–0.77
BHP Group	2.04		Sibanye Stillwater	–0.66
Glencore	1.42		Aspen Pharmacare	–0.52
	15.87			**–5.48**

7.13.7 The difference in top contributors and top detractors highlights the impact that benchmark selection can have on portfolio performance relative to that benchmark. The domestic investor who was aligned with the aggregate South African portfolio would have seen a 15.87% portfolio return contribution from their top five winners. However, investors who upweighted their holdings of foreign and dual listed stocks to the levels indicated by the Global index would have experienced a 29.52% portfolio uplift from their Top 5 winners. These results again indicate that the typical domestic investor has experienced weaker market results over the last five years than what was available when considering a heavier weight to global stocks.

7.14 Churn

7.14.1 As the index rules are applied to change or reweight constituents, this results in turnover of the constituent weights as there is a reallocation across the stocks in the index. Index turnover, or churn, can drive trading activity in the market as investors rebalance their portfolios in line with the new benchmark weights. This creates costs for the industry as a whole, which can be sub-optimal if the corresponding index changes are not material in nature. Edelen (2013) found that funds' annual trading costs negatively affect their performance. Trading activity that is required to maintain a manager's active weight against the benchmark is not necessarily generating alpha and can be seen as a rebalance cost to be avoided where possible.

7.14.2 Index methodology balances the need to keep an index 100% accurate in the context of its rules, against the need to manage trading and rebalance costs. One mitigant applied by FTSE/JSE is to use a quarterly index review as an opportunity to "true up" index weights with real-world metrics like free float and shares in issue. By grouping this rebalance into one event there is offset between the weighting changes which reduces costs and administrative overhead.

7.14.3 However, there may be specific corporate actions from time to time that do require a trade event and cannot be delayed until the next quarterly review. A capital repayment is an example of this, where the cash received needs to be reinvested into the portfolio.

7.14.4 Table 17 provides the index churn for each index per calendar year. This only includes churn relating to quarterly index reviews and excludes any intra-quarter

corporate actions. This index churn is therefore a measure of the annual index portfolio rebalance quantum due to the application of the index methodology.

7.14.5 Churn is measured as the one-way turnover as a percentage weight of the full portfolio. The one-way turnover can be taken as either the total purchase amount or the total sales amount since they must be equal by definition.[15] Since the index does not have a cash portion and is fully invested into equities, each share sale must have a corresponding share purchase.

Table 17 Annual index churn relating to quarterly index reviews

Year	All Share	SWIX All Share	Global	SA Register	SA Investor
2008	1.78%	5.17%	1.78%	27.23%	34.90%
2009	2.47%	3.98%	2.47%	18.52%	24.97%
2010	1.79%	2.77%	1.79%	3.72%	6.24%
2011	3.59%	5.16%	3.59%	5.78%	8.48%
2012	1.84%	6.63%	1.84%	3.00%	5.01%
2013	9.53%	12.15%	8.41%	9.14%	8.78%
2014	2.28%	4.26%	1.95%	4.12%	6.13%
2015	3.41%	4.58%	2.86%	5.30%	6.98%
2016	2.20%	3.19%	1.72%	3.47%	5.71%
2017	4.04%	4.30%	5.01%	3.96%	6.35%
2018	2.59%	3.79%	1.88%	3.83%	6.66%
2019	5.31%	6.78%	4.71%	7.60%	11.96%
2020	3.56%	5.54%	1.66%	4.62%	7.47%
2021	5.28%	7.18%	1.17%	7.09%	12.89%
2022	11.92%	2.82%	12.45%	2.92%	5.72%
LT Average	**4.11%**	**5.22%**	**3.55%**	**7.35%**	**10.55%**
5-Yr Average	**5.73%**	**5.22%**	**4.37%**	**5.21%**	**8.94%**
2023 YTD	17.38%	3.68%	9.24%	3.21%	3.48%

7.14.6 Table 17 provides the long-term average churn over the full modelling period as well as the average of the past 12 months. These turnover rates are well below levels considered excessive for index funds,[16] and well below turnover rates for US index

15 For example, selling off a 5% holding in one instrument and using the proceeds to purchase a holding in a separate instrument implies a 5% one-way turnover even though the combined transactions (buy and sell) comprise 10% for the portfolio.

16 https://www.investopedia.com/ask/answers/021616/what-good-turnover-ratio-mutual-fund.asp

mutual funds of 28% (Tucker, 2018). The SA Register and SA Investor indices appear to have an anomalously high churn level in 2008 and 2009, indicating significant turnover in the Strate register over this period, and aligned with some of the 2008/2009 volatility exhibited in Figure 16. However, the published SWIX index does not reflect this churn in 2008/2009, and this high churn does not appear to repeat in subsequent calendar years. This may indicate a potential data inconsistency with the Strate register data for this period that has not since been repeated. The more recent five-year mean annual turnover is suggested as a better indicator of how index methodology creates weighting turnover. The Global index shows the lowest churn due to index rebalances. The Global index has the fewest inputs relating to free float since there is no reference to the Strate register. The weighting contribution of individual stocks is only driven by changes to restricted portfolio holdings. Both the long term and more recent levels are less than that of the All Share Index and SWIX All Share Index, indicating that domestic investors are likely to view this level positively.

7.14.7 The SA Register and SA Investor indices show a higher churn level than the Global index. Since the weighting of individual instruments is also driven by the proportion of any dual listed stock's shareholdings on the Strate register, this confirms that the movement of shares onto and off the register, or between shareholders of different nationalities, is more volatile than the change in restricted holdings.

7.14.8 The SA Register index has a recent churn of 5.2% compared to the Global index level of 4.4%. The level is also broadly comparable to the historic All Share Index and SWIX All Share Index levels of 5.7% and 5.2% respectively. However, the SA Investor index has a much higher churn at 8.9% per annum. This indicates that the movement of domestically registered shares between resident and non-resident investors creates a material impact on index churn. This could be a confirmation of the concern raised in paragraph 6.5.3 that the supply and demand dynamics of non-resident investors in South Africa creates undue turnover in the market benchmark.

8. Modelling results and analysis – impact of capping

8.1 Introduction

8.1.1 FTSE/JSE's methodology of capping constituent weights is described in its Ground Rules.[17] It applies capping in its benchmarks on a single name basis. Where the index weight of a single constituent exceeds the capping level, this constituent is down-weighted so that its index weight is the same as the capping level. This is done through the calculation of a capping factor between the value of 0 and 1, which is then multiplied by the instrument market capitalisation to decrease. An instrument whose weight does not exceed the capping level will have a default capping factor of 1 applied.

17 FTSE/JSE Africa Index Series Ground Rule v8.2. Supra

8.1.2 Capping factors are calculated at each quarterly index review process in March, June, September, and December. The capping factor calculated is then fixed for the subsequent quarter. If the capped stock experiences price growth in excess of the index average for that quarter, it means that the index weight of that stock will be higher than the capping level for the corresponding period. If the instrument weight is still in excess of the capping level at the next quarterly index review then a new capping factor will be calculated to decrease the instrument market capitalisation even more.

8.1.3 Individual investors may have constraints on the total single stock exposure permitted in their portfolio. This may be in the form of prudential limits set by regulation, or it may be defined in their investment mandate or investment management process. A market benchmark that allows single stock weightings in excess of these levels cannot be replicated by the investor and is therefore an unfair benchmark. As such, investors may prefer a market benchmark design that incorporates a single stock capping approach that is aligned with their own investment process.

8.1.4 In order to outperform the market benchmark, the investor will aim to hold greater weightings of stocks that they believe will outperform the market. If the benchmark weight (or capping level) is aligned with the maximum permissible weight for the investor then they would not be able to take active positions on that stock, which in turn would make the benchmark unfair. In this case, the investor may prefer a capping level on the benchmark that is less than their own maximum single stock weight to allow them to take active weights aligned with their investment outlook.

8.2 Risk/return profile

8.2.1 A capped market benchmark will have a different performance return over time compared to an uncapped benchmark. A higher or lower market benchmark return is not an index design consideration in its own right since it should reflect the market performance rather than being maximised or minimised. A benchmark-cognisant investor may have a target to outperform the market benchmark for the same or less risk. Tables 18 and 19 show the impact of capping on the index return and volatility respectively

Table 18 Index total return performance calculated for a range of capping levels

Index	Uncapped	15%	14%	12%	10%	8%	6%
ALSI	9.84%	9.91%	9.93%	9.94%	9.98%	9.87%	9.55%
SWIX	9.17%	9.14%	9.12%	9.05%	8.96%	8.82%	8.77%
Global	9.84%	10.09%	10.17%	10.27%	10.36%	10.44%	10.19%
SA Register	9.35%	9.24%	9.19%	9.09%	8.96%	8.78%	8.67%
SA Investor	9.33%	9.22%	9.24%	9.16%	9.09%	8.99%	8.93%

Table 19 Index total return volatility calculated for a range of capping levels

Index	Uncapped	15%	14%	12%	10%	8%	6%
ALSI	19.40%	19.36%	19.34%	19.22%	19.01%	18.72%	18.38%
SWIX	18.61%	18.55%	18.55%	18.52%	18.50%	18.46%	18.33%
Global	18.92%	18.95%	18.95%	18.88%	18.76%	18.56%	18.25%
SA Register	18.57%	18.48%	18.47%	18.44%	18.41%	18.33%	18.19%
SA Investor	18.25%	18.24%	18.24%	18.23%	18.21%	18.19%	18.11%

8.2.2 Instrument capping does influence index returns and volatility. The direction of the effect will depend on whether the outsized (i.e. having a weight in excess of the capping levels) instruments outperform or underperform the rest of the instruments in the index. Capping will reduce the index return impact of the largest constituents and performance contributors. This may also have a cyclical effect – in periods where the outsized instruments outperform the rest of the market, the uncapped index will outperform the capped index. Conversely, in periods where the outsize constituents underperform the market, the uncapped index will underperform the capped index.

8.2.3 The lower the capping level applied, the more instruments end up being capped and the less the index is reflective of the total market. At an extreme level, the excessive application of capping will result in an equally weighted index. For example, a top 40 index with a 2.5% cap applied is equivalent to an equally weighted top 40 index. Benchmark users must decide on the level of single stock concentration that is appropriate in their investment portfolio, and then choose a capping level that accurately reflects this restriction.

8.3 Churn

8.3.1 Since capping is applied at each quarterly index review based on pricing on a fixed date, the methodology does have some sensitivity to point-in-time prices. In practice, a capped instrument that outperforms the rest of the market over the quarter will end that quarter with an index weighting more than the capping level. Its weighting will then be reduced, forcing index users to sell off a portion of that holding (effectively realising their profits) to maintain their active weights. Conversely, if a capped instrument underperforms the rest of the market over the quarter, then its end-of-quarter weight will be under the capping level, resulting in a weighting increase at the review, back up to the capping level. This will force index users to purchase the instrument (funded through the sale of the rest of the portfolio) to maintain any fixed active weights. This behaviour drives up index review churn for capped indices relative to uncapped indices.

8.3.2 Table 20 and Table 21 illustrate the impact of quarterly capping on the index review churn for the full modelling period and the last five years, respectively. Considering the register volatility referenced in paragraph 7.14, the more recent view may be a better reflection of the structural impact of capping.

Table 20 Impact of quarterly capping on index review churn for the full modelling period

Capping Level	All Share	SWIX All Share	Global	SA Register	SA Investor
Uncapped	4.11%	5.22%	3.55%	7.35%	10.55%
15%	5.18%	6.30%	5.48%	8.19%	10.06%
14%	5.54%	6.29%	6.06%	8.10%	9.96%
12%	6.53%	6.26%	7.17%	7.88%	9.66%
10%	7.76%	6.37%	8.27%	7.81%	9.52%
8%	8.75%	6.50%	9.31%	7.88%	9.30%
6%	9.28%	7.21%	11.06%	8.46%	9.31%

Table 21 Impact of quarterly capping on index review churn for the last five years

Capping Level	All Share	SWIX All Share	Global	SA Register	SA Investor
Uncapped	5.73%	5.22%	4.37%	5.21%	8.94%
15%	7.49%	6.73%	7.18%	6.94%	9.63%
14%	7.36%	6.60%	7.95%	6.79%	9.52%
12%	8.03%	6.66%	9.34%	6.78%	8.74%
10%	9.81%	6.80%	10.10%	6.93%	8.14%
8%	11.64%	6.32%	12.30%	6.51%	7.68%
6%	10.54%	5.70%	13.85%	5.82%	6.99%

8.3.3 In the context of CAPM, a more aggressive maximum instrument weighting level of say 6% may be a desirable outcome in portfolio construction as a tool to diversify away specific stock risk. However it is less likely to lead to a useful benchmark that is an accurate reflection of the broader market opportunity set. Lower capping levels in the index will therefore decrease the accuracy of the index as a reflection of the overall market, particularly for markets that are naturally concentrated in nature.

8.3.4 Across all alternatives, the introduction of a capping factor increases index review churn, with a higher capping level driving a higher level of weighting turnover. In any quarter where there is no instrument that has a weighting in excess of the capping level, the churn for the capped and uncapped index will be identical, however this probability decreases as the capping level is compressed.

8.3.5 Applying a constituent capping factor reduces the market capitalisation contribution of that instrument, and ultimately reduces the aggregate market capitalisation of the index. Comparing the total market capitalisation of the capped index to that of the uncapped index provides the total proportion of the uncapped market index that is effectively removed from the benchmark when applying an instrument cap. Figures 35, 36 and 37 chart the proportion of total index market capitalisation removed by the application of capping for the three alternatives. The Global index has the most extreme impact due to

its natural concentration, with the application of a 6% capping factor removing up to 47% of the original uncapped index's market capitalisation by downweighing large stocks.

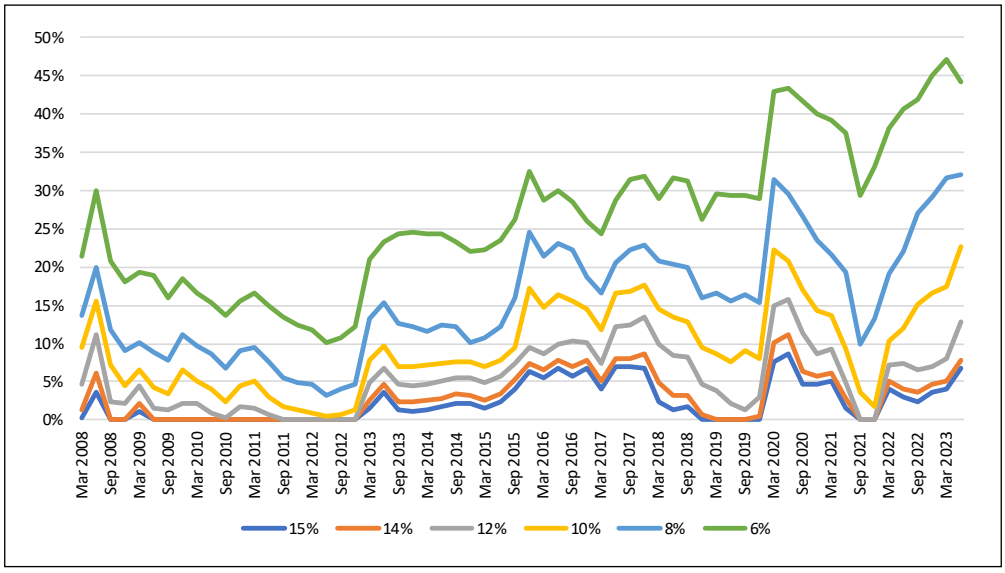

FIGURE 35 Global Index – proportion of uncapped index by index market capitalisation removed by application of capping

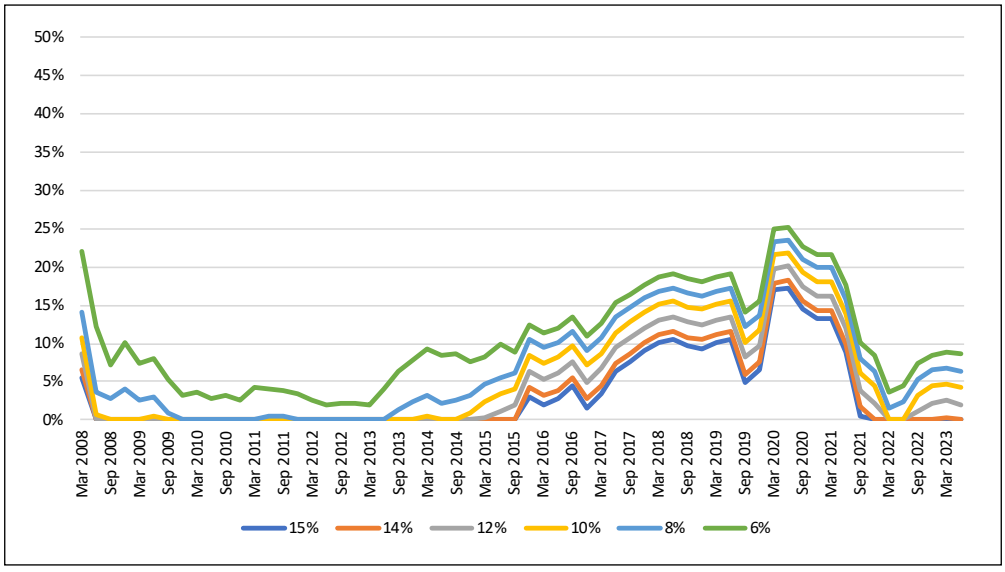

FIGURE 36 SA Register Index – proportion of uncapped index by index market capitalisation removed by application of capping

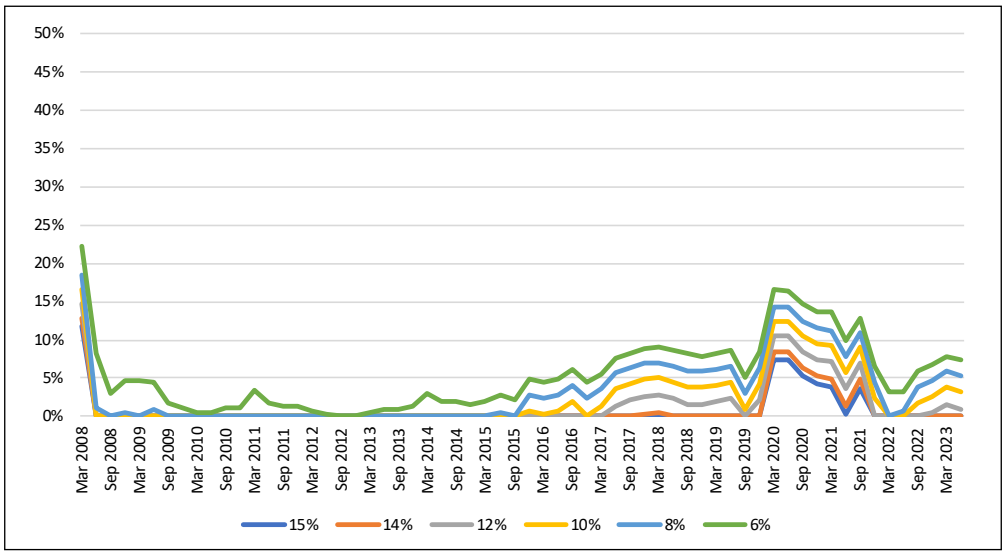

Figure 37 SA Investor Index – proportion of uncapped index by index market capitalisation removed by application of capping

9. SUMMARY AND CONCLUSIONS

9.1 Summary

9.1.1 The FTSE/JSE Capped SWIX All Share Index is widely used as a performance benchmark by domestic investors and asset managers in South Africa. However, the index provides one lens on the definition of market capitalisation in the context of benchmark weighting, and there are other approaches that may be more suitable for different styles of investment. Furthermore, the history of the SWIX All Share Index is not consistent with its current methodology since the benchmark design has regularly changed over time.

9.1.2 The investable universe for the domestic equity investor is modelled by considering all classes of ordinary share listed on the JSE Main Board. The investable universe can be described across various characteristics, including market capitalisation, number of listed instruments, company domicile, dual listed status, location of primary listing, secondary market liquidity and analysis of the country share register.

9.1.3 This paper defines three indices that domestic investors could use as a performance benchmark, namely the Global index, SA Register index and SA Investor index. These three alternatives have the same constituents but differ in instrument weighting according to their definition of market capitalisation. The Global index considers all free float adjusted shares across all country share registers. The SA Register index considers the market capitalisation accounted for on the South African share register. The SA Investor index measures the aggregate market capitalisation held by South African resident investors on the domestic share register.

9.1.4 The calculation methodology for the three alternatives is defined, supporting the calculation of the daily index back-history for the modelling period 1 January 2008 to 30 June 2023. The modelling results for the period are presented and interpreted across various characteristics such as concentration and distribution, risk and return, dividend yield and price earnings multiples, drawdown, performance contribution and churn.

9.1.5 The impact of applying a weighting cap at a single stock level is discussed and modelled, with modelling results presented for capping levels of 6%, 8%, 10%, 12%, 14% and 15% respectively.

9.2 Conclusions

9.2.1 Studies suggest that a market capitalisation weighting index is the optimal benchmark for most investors, however the precise definition of market capitalisation can materially impact on benchmark composition.

9.2.2 The three alternative benchmarks are sufficiently distinct in terms of their definition and purposes, and their characteristics and return profiles, in order for each be considered a standalone benchmark in its own right.

9.2.3 Investors who have the capability to purchase dual listed stocks on offshore exchanges, and believe they are competing for these stocks with global investors, should consider the Global index as their benchmark for domestic equity. This alternative has the highest weighting concentration, predominantly in multinational companies with a secondary listing on the JSE, and therefore may show reduced diversification and increased specific risk. However, its weightings are not influenced by JSE-specific trading dynamics, leading to less index review turnover. This index may also be better suited for investors who prefer an offshore bias in their asset allocation. The global index does tend to be underweight small cap and mid cap domestic companies, potentially leading to a smaller exposure to SA Inc.

9.2.4 The SA Register index is aligned to the current methodology of the SWIX Al Share index, which is already widely used in practice and well understood. Investors who wish to reduce the outsize weight of large foreign companies with a secondary listing on the JSE should consider the SA Register (or SWIX All Share) index as their benchmark for domestic equity, although in some cases it may feel non-intuitive to have exceptionally large listed companies with a small index weighting. This index is likely to overweight large domestic companies that are not dual listed since a large portion of their shares are likely to be held by non-resident investors.

9.2.5 The SA Investor index is most closely aligned to the aggregate domestic investor portfolio and the closest offering to a peer index. At the same time, it reflects a whole portfolio view and is therefore less prone to single stock weights that are in excess of aggregate market appetite. Investors who wish to benchmark their performance against the typical South African investor should consider the SA Investor index as their benchmark

for domestic equity. This index also has greater exposure to small- and mid-cap companies. This index exhibits more churn than the other alternatives will therefore have less stable composition over time.

9.2.6 Applying a single stock capping approach to any of the alternatives will decrease the level of accuracy with which the benchmark represents the market portfolio. However, many investors will have constraints on the maximum single stock exposure allowed in their portfolio, either due to prudential restrictions or due to their own investment risk profile. Where the index weight exceeds the maximum allowance portfolio weight, the investor is not able to take a positive active weight position on that individual stock, creating a deficiency in the benchmark. Investors should select a capping level that is aligned with their individual portfolio limits.

10. RECOMMENDATIONS FOR FURTHER RESEARCH

The authors suggest six areas for future research:

— Provide information on broad market equity benchmarks in use in other comparable countries, typically emerging markets with limited exchange fragmentation. This could include a comparison to South Africa on how free float adjusted market capitalisation weighting is defined and the application of capping.

— Provide information on the regulatory prudential limits in effect for domestic institutional investors, such as foreign exchange limits, Regulation 28 and Board Notice 90, and investigate the impact on ideal benchmark capping levels.

— Consider a more in-depth analysis of the share transfers impacting the Strate share register. This could include an analysis of the shares of dual listed companies that are transferred onto/off the domestic register, as well as the change in holdings between SA-resident and non-resident investors.

— Provide an overview of the regulatory framework impacting the provision of financial benchmarks, including the IOSCO guidelines as well as the draft domestic conduct standards and licensing requirements for benchmark administrators.

— Provide a liquidity analysis of the alternative benchmarks through direct comparison as well as the ability of large funds to be fully invested at benchmark weights.

— Solicit market practitioner feedback from domestic asset managers and/or asset owners through a survey to provide data on the usage of benchmarks in the allocation process, approach to concentration risk, approach to active weights and qualitative views on the alternative benchmarks.

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