Developing an optimal weighting model for fund of funds portfolio construction

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ABSTRACT

This study investigates the various weighting methods of a fund of funds portfolio to determine and construct the optimal fund of funds portfolio. In most fund of funds, the underlying funds are selected with little to no regard for the risk each fund contributes to the fund of funds' total risk level.

The research tested four weighting regimes, namely one based on the Sharpe methodology, the Treynor methodology, a net asset value (NAV) momentum strategy or price momentum strategy, and finally, a momentum strategy based on equal weights. All four weighting regimes were tested over distinct time periods. The first was a 5-year period from 2011 to 2015, which was generally characterised by strong performances from most asset classes. During the second period, from 2016 to 2020, the main asset classes struggled to outperform consumer price index (CPI)+4.4%. Additionally, the study stress tested the four weighting methods under a black swan condition, namely Covid-19 in 2020. Furthermore, the study analysed how these weighting methods performed in a high inflation and later an increasing interest rate environment from 2021 to 2022.

In analysing the test results, it was found that, during a growth period with low market volatility (2011–2015), all four weighting methods outperformed the South African multi asset high equity category average on an absolute and risk-adjusted basis. The equal weight portfolio delivered the second-best absolute return among the four regimes. As soon as market returns were low or slightly negative, the four weighting methods struggled to keep up with the peer group on an absolute and risk-adjusted basis. However, when risk assets were in a bear market or market correction territory, the four weighting methods performed very well, beating the peer group average on both an absolute and risk-adjusted basis. In the first quarter of 2020, equity markets entered correction territory, only to bottom on the 23rd of March 2020. The equal weight portfolio only lost 14.09% over that time, beating not only the other three weighting methods, but also the peer group average, which lost 20.66%. An interesting finding in the subsequent recovery period and inflationary period after that was that the four weighting methods underperformed the peer group average.

There were two weighting methods that performed best overall. They were the price momentum and equal weighting methods. An optimal portfolio should be constructed using one of these methods. Due to the unique methodology of the price momentum strategy, it would not be possible to use both equal weighting and price momentum methodologies in one portfolio simultaneously. A portfolio manager can change the weighting method as market conditions dictate.

Key words: *Fund of funds, Sharpe methodology, the Treynor methodology, price momentum strategy, equal weights Strategy, (ASISA) South Africa multi asset high equity category*.

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CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1. Introduction

Throughout history, humans endeavoured to protect their wealth by investing in more than one asset or income-generating asset. Harry Markowitz, in his 1999 paper (Markowitz, 1999:5), mentions the merchant of Venice who spread out his shipments among different ships. The merchant understood that he cannot eliminate a certain risk but can reduce the impact it would have on the goods he shipped. In the beginning of the 1940s, Wiesenberger (Markowitz, 1999:5) had indicated that investment firms invested in many securities to reduce risk by means of diversification (Markowitz, 1952:78).

Modern portfolio theory, which was first proposed by Harry Markowitz, used a mean variance optimisation model to construct an efficient portfolio which focuses on maximising expected return E(R) (Sullivan & Roy, 2008:255). Markowitz (1952) showed that an investor can construct a portfolio of multiple assets that will maximise returns for a given level of risk. This theory was based on variance, covariance, and correlation. Under this theory, individual investment returns are less important than how the investment behaves within the context of the entire portfolio. To construct an efficient portfolio, various portfolios are simulated, and an efficient frontier is constructed from these simulations (Markowitz, 1999:5). The efficient frontier is mapped by taking the highest expected return for a defined level of risk after each simulation and plotting it on a risk-return graph. According to Markowitz (1999:5), the optimal portfolio will be on this frontier line.

The Markowitz theory was followed up by various authors during 1960s in developing the Capital Asset Pricing Model (CAPM) (Sharpe, 1964:425, Lintner, 1965:13 and Mossin, 1966:768). The CAPM describes the relationship between the expected return and risk of investing in a security. It shows that the expected return on a security is equal to the risk-free return plus a risk premium, which is based on the beta of that security. This model is used in calculating the expected return of an asset, based on the idea of systematic risk (non-diversifiable risk) that an investor needs to be compensated for (risk premium) above the risk-free rate. In contrast, Bernoulli (1738) suggested that, instead of maximising expected return, one should focus on minimising the expected shortfall in targeted/expected return of a portfolio. Bernoulli (1738: 23-36) explained this concept by way of the St Petersburg Paradox example. This paradox is derived from the St. Petersburg Game, which is played by flipping a fair coin until it comes out heads. At that point, the player wins ($R2^n$), where *n* is the number of times the coin was flipped. To gauge the premium that the gambler will be willing to pay, Bernoulli's resolution was to introduce a utility function. The determination of the value of a

play must not be based on the price but rather on the utility it yields. As the pay-out is equal for a rich man and a poor man, the gain for the poor man is more significant than for the rich man. The utility model suggested by Bernoulli shows the gambler's diminishing marginal utility of money and that this model is a good criterion of human behaviour.

The above-mentioned concepts of using risk (variance and covariance) are used in constructing funds in the South African collective investment schemes industry or commonly referred to as a Unit Trust. These unit trusts are similar to mutual funds structures around the world. A mutual fund is a portfolio of assets which can comprise of one asset class like shares, or multiple assets like bonds, listed property, credit, equity both locally and offshore. It is also possible to construct a fund that consist of other funds. When it comes to constructing a fund which consist of other funds, known as a fund of funds, little to no credence are given to risks like covariance. Instead, it became very popular for advisors or multi-managers to use multiple funds in a fund of funds structure to reduce exposure to a single fund manager or investment house. With the ever-changing risk appetite of the end client, it poses a problem in maximising the utility of each investor. To cater for this difficulty, the Association for Savings and Investment in South Africa (ASISA) has categorised all collective investments schemes (CIS) into predefined risk categories based on the perceived risk for each fund. These categories help advisors to select funds (collective investment schemes) which closely match the retail client's risk tolerance and return objectives.

The next challenge for the adviser is to select individual funds in each category and determine the appropriate exposure level to each fund selected. Not all funds are equal, even if they are grouped in the same ASISA risk category. The way the funds are managed differ because of diverging investment philosophies and processes, resulting in a wide range of performance outcomes within the same risk category. For the 2022 calendar year, for instance, the top performing fund out of a random sample of 198 balanced funds in the ASISA South Africa multi asset high equity category, Nedgroup Investments Managed Fund A, reported a total return of 10.19%, while the worst performer was Long Beach Managed Prescient Fund A1, which recorded a decline of 25.29%.

This divergence of fund returns can make it very difficult to construct a portfolio for a client. The financial adviser can accomplish this by selecting more than one fund, thereby diversifying a client's portfolio and reducing risk. The latest regulations from the Financial Sector Conduct Authority (FSCA) states that financial advisers must provide evidence of their research on why they have selected funds for a client and why they are appropriate for that client. Most often, financial advisers do not have the capability nor inclination to conduct thorough due diligence on each manager's fund which can possibly be part of a client's portfolio. However, the

financial adviser can outsource this fund selection function to an asset consultant or discretionary financial service provider (FSP). They provide a portfolio management function for a financial adviser which will fulfil the regulatory requirement of an adviser pertaining to fund selection.

As such, a discretionary FSP can provide a financial adviser with a portfolio consisting of various funds, which in combination aim to satisfy a certain return and risk objective. Alternatively, it can set up a collective investments schemes fund (CIS) in a fund of funds structure, which aims to achieve the exact same return and risk objectives. The challenge of choosing the underlying funds, however, remains for the asset consultant or the fund manager of a fund of funds. A popular method currently used is to choose funds that have differing philosophies and investment processes and then assigning equal weights to each with little to no regard to portfolio variance. Markowitz (1952) and Roy (1952) advocate that total portfolio risk should be considered, which is derived by the covariances of each underlying fund with the other funds used in the portfolio or fund of funds (Rubinstein, 2002:1043). Various portfolio construction methods exist, but are for the most part not used, which can lead to unnecessary leakage of performance.

The current practice followed in South Africa is thus a simplified approach, which would see a balanced fund of funds typically being made up of the following asset classes: South Africa equity, South Africa income, South Africa property, offshore equity, offshore income, and offshore property. A fund of funds manager will then select, for instance, four South Africa Equity managers (funds) to fill the South Africa Equity bucket and give each of the selected funds an equal weighting. This is done on the assumption that the four selected funds have similar risk with a correlation close to 1. This is however not always the case, as each fund's return profile differ due to divergent investment processes and philosophies, leading to a mismatch in the risk profile of the end investor, and that of the fund of funds manager.

This study will investigate the various weighting methods of a fund of funds portfolio, to determine and construct the optimal fund of funds portfolio.

1.2. Problem statement

In most funds of funds, the underlying funds are selected with little to no regard for the risk each fund contributes to the fund of funds' total risk level. It is assumed, for practical reasons, that each fund in a specific category carries the same risk. Roy (1952) and Markowitz (1952) suggest that risk and correlation must be considered when constructing a portfolio, so simply assigning a random weight may lead to the underperformance of a fund of funds portfolio in risk weighted returns terms (Rubinstein, 2002:1043).

1.3. Research question

The study tested the following research question: Is the current weighting regime of the underlying funds in a fund of funds portfolio the optimal way of constructing these portfolios?

1.4. Research objectives

To test the research question, the following research objectives have been formulated:

1. Measure the risk-weighted performance of a fund of funds portfolio where the underlying assets are assigned equal weightings in terms of the Sharpe ratio.
2. Measure the risk-weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to a price momentum strategy.
3. Measure the risk-weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Treynor methodology.
4. Measure the risk-weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Sharpe methodology.

From these objectives, various models for various categories of fund of funds can be constructed to ensure that the optimal weighting of the underlying funds in the fund of funds portfolio is employed. These weightings will ensure that the fund of funds portfolio will reach and maintain its full potential performance.

1.5. Methodology

The study comprises a literature review and an empirical study. The study used quantitative a method of research. The literature review covers the quantitative section of the research by documenting various portfolio construction models like Markowitz's efficient frontier and the Capital Asset Pricing Model (CAPM). Other portfolio construction models referred to are the methods based on the Sharpe ratio, Treynor ratio, an equal weighting method and a price momentum strategy. The price momentum strategy measures the velocity of price changes or the net asset value (NAV) of a fund and this formed the basis for the price momentum strategy.

Various quantitative research models were constructed to assess the research objectives. These models were used to evaluate various portfolio construction methods for three fund of funds portfolios. They focused on the weighting of each underlying fund. The aim was to identify the most efficient underlying fund weighting model in each portfolio.

The study made use of market data derived from the performance of funds from the South African Unit Trust industry, sourced from several data providers: Morningstar[1], Bloomberg[2] and IRESS[3]. This data was used in constructing various fund of funds portfolios based on different weighting methodologies. Each fund of funds portfolio was tested over various periods through a full economic cycle. Performance was measured over three distinct periods, a risk-on (upward market trend) period, a sideways market period and a risk-off (downward market trend) period. Each weighting methodology was measured in terms of absolute performance and risk-adjusted performance. The results were compared to each other and other funds within the market.

1.6. Ethical considerations

This study poses no risk with regard to ethical considerations. Secondary data were used, which are in the public domain. No aspects of this study are confidential as the data used were supplied by data vendors.

1.7. Contribution of the study

The intended contribution of the study is to find the most effective model to construct an optimal weighting approach for a fund of funds portfolio in the South African collective investment scheme industry. Over the recent past, fund of funds (and equivalent WRAP portfolios) is becoming more and more popular in the financial advice industry. This is due to regulatory requirements as well as the move away from a single product provider to multiple providers.

From observations, portfolio managers of fund of funds portfolios tend not to follow a scientific process in constructing a portfolio. Most often the manager resorts to equal weighting. An equal-weighting regime may not be the optimal way to construct a portfolio. The study attempted to find a more scientific approach to construct a portfolio of funds.

1.8. Chapter layout

The study starts by providing background and context of the African financial markets (Chapter 1). The literary review (Chapter 2) explores the origins of the different asset classes as well as the establishment of the mutual fund industry in South Africa. Furthermore Chapter 2 explores the evolution of portfolio construction theory. The academic work done by the likes

[1] Morningstar: the study will use the data provider Morningstar which is a platform that supplies investment information. This platform compiles and analyses fund, share and general market data.
[2] Bloomberg: is a global financial markets and economic data provider.
[3] IRSS: is a financial markets data provider, specialising in the South African market.

of William Sharpe, Roy, and Markowitz on this emphasises the importance of risk in a portfolio construction context.

To test the research question, the study designed various testing methodologies, as reported in Chapter 3. These weighting methods were tested over different time periods. Each of these time periods covers different market conditions, aiming to test the characteristics and performance of each weighting method. A short summary of the performance of each weighting method over these time periods is given in the latter part of Chapter 4.

Lastly, in Chapter 5, the key findings and conclusions are presented, with recommendations for future study in this field.

CHAPTER 2: HISTORY AND ORIGINS OF ASSET CLASSES AND FINANCIAL MARKETS

2.1 Introduction

The aim of this chapter is to give a broad background on the history and origins of asset classes, financial markets, and mutual funds. Investors over the last 350 years endeavoured to reduce risk by spreading their wealth over multiple investments, or to join a group of investors where they pool their resources. As the problem statement suggests, management of risk plays in integral part of any investment decision regarding portfolio construction. This chapter elaborates on the development of the concept of risk management through the literature.

The chapter, therefore, explores the different theories involving capital allocation within a portfolio of risky assets as well as drivers of return. The literature review commences with a brief history of the origins of mutual funds which started in the 17th century as a pool of investor funds (Section 2.2). Pooling of investments allowed investors to ensure income for retirement via a **contract of survival** or a **tontine**. **Plantation loans** or **negotiaties** allowed developers to secure funding for capital projects and provide investors a fixed return.

Section 2.3 provides background on the formation of financial markets in South Africa, funded by Dutch and English capital. Section 2.4 examines the formalisation of the financial industry with a specific focus on the South African collective scheme investment industry. The final section reviews the evolution of different theories and how financial markets go about allocating capital among different asset classes. Also, it examines the sources or returns for a portfolio of risky assets.

2.2 The origins of a mutual fund

The pooling of funds dates back to the 17th century. These pools of funds (financial and nonfinancial) may not be considered a mutual fund in modern times, but still resembled key characteristics of what makes up a fund with the underlying risks and returns. They provided distinct advantages compared to direct investments into securities on an exchange, like liquidity and diversifications (Rouwenhorst, 2004:1). One of these was to provide income later in life. An example would be a contract of survival or a tontine. Another reason investors would pool funds was to diversify risk and a prime example of this is plantation loans or negotiaties (CFA Institute Research Foundation, 2016:216).

A **contract of survival** or **tontine** was a financial contract in which members form an asset pool and then mutually and irrevocably agree to receive disbursements until death. Upon the

death of a member, all the investments of the deceased in the pool are forfeited and distributed among the surviving members (McKeever, 2009:491). Therefore, the income or benefit for the surviving members increases until one person is left. At that stage, the contract is dissolved. Some tontines were managed and set up by the state to increase revenue as members were only entitled to income payments and not the initial capital invested. Lorenzo de Tonti was one of the first to propose such an agreement to the French government in 1653, but it was rejected by *The Parlement of Paris*, a court-like institution which never registered the scheme even though it had royal support (McKeever, 2009:493).

The latter part of the 18th century saw the emergence of plantation loans or negotiaties. Plantation owners in colonies situated in South America were struggling to secure enough funding to operate successfully due to high costs. Slave labour was especially expensive as it was imported from Africa (Hoonhout, 2013:87). A source of finance was needed to support the plantation owners. The mayor of Amsterdam asked Willem Deutz to create a credit system to facilitate the colonial expansion. Willem Deutz's solution was the negotiatie system, which was implemented in 1753. The negotiatie took on the form of a fund, with the director being the intermediary between the Dutch Republic and plantation owners in the colonies. Funds were raised by selling bonds (mortgages), which promised the holder an attractive yield of five to six per cent per annum. The plantation owners, in turn, could negotiate a mortgage with the fund. The credit worthiness of the borrower was based on the value of their assets, which included the value of the land, slaves, and buildings.

Investors were assured that, because the risk was spread across multiple plantations, risk of failure was low, and the other profitable plantations would be able to compensate for those who defaulted. Management responsibilities of the fund fell on an individual called "Director". The equivalent in modern times would be a fund manager. The director's responsibilities were to balance the credit extended to the planters and the capital invested by the bond holders (Hoonhout, 2013:88). This structure closely resembles a mutual fund, but with one key difference that disqualifies it as a modern mutual fund. The difference is that the mortgages to planters were not securities in themselves (Rouwenhorst, 2004:5). It was bespoke bonds or loans issued based on the value of each individual plantation. The heyday of investments in plantation loan continued to 1770, after which demand started to wane. This decrease was due to decline in the prices of coffee and slaves (Hoonhout, 2013:90). The scheme ultimately failed in 1772 as it became apparent that the planters could not repay the loans according to the agreed terms. This resulted in permanent losses for the investors or bond holders.

The late 18th century was a precarious time for investors. In 1772, several British banks failed as they were overextended to the British East India Company (Rouwenhorst, 2004:11). These

bank failures triggered a financial crisis in the rest of Europe. The writing was already on the wall a couple of years before, in 1770, as credit extension began to slow, coupled with large numbers of plantations being sold. A few years after the 1772 financial crisis, Abraham van Ketwich started a new negotiatie named *"Eendragt Maakt Magt"*. Subscriptions were limited to the first 2000, and thereafter the fund could only be accessed by purchasing an existing subscription. This negotiatie can be considered a closed-end fund in modern times (De Jong *et al*., 2020:5). This fund invested in several instruments, which included bonds issued by foreign governments and banks, as well as plantation loans in the West Indies. The unique aspect of this negotiatie was the explicit requirement of diversification set out in the fund's prospectus. The 2000 share subscriptions were divided into twenty classes, of which the capital of each class was invested in a portfolio of fifty bonds. Each class comprised at least twenty to twenty-five different securities and no less than three securities, to provide equal opportunity (Rouwenhorst, 2004:7). This vehicle offered investors, who normally did not have sufficient capital, an opportunity to invest in a broad variety of securities and reduce portfolio risk. The investment threshold was reduced to 500 guilders per share, compared to a normal security which traded at a nominal value of 1000 guilders. The fund administrator, Van Ketwich, was responsible for collecting revenues, paying out dividends to shareholders and earning a commission for doing so.

This closely reflects what a modern fund administrator does (De Jong *et al*., 2020:5). This is where the similarities end with a modern mutual fund. *Eendragt Maakt Magt* had a complicated lottery element built into it. This introduced an unnecessary risk to shareholders and reduced some of the diversification benefit of the fund. The lottery worked on the premise that not all the income generated from the portfolio's assets would be passed on to the investors. A portion of the cash flow would be held back and used to retire a single share, determined by a lot, at a premium, and increased the dividends to some of the shares still outstanding. The promised yield of the fund was four per cent, which was lower than the nominal yields of the bonds the fund invested in and gave the fund the means to redeem the one share per year at a premium of 20% and increase dividends on others. Article IV of the prospectus complicated matters even further. It stated that the annual interest rates of the shares preceding and succeeding the redeemed share serial number, according to the share register, had to be increased. Rouwenhorst (2004:9) concluded that the lottery provision did not take away any significance of *Eendragt Maakt Magt*, as it offered investors a diversified portfolio of securities to invest in.

The emergence of diversification became a central theme in the subsequent funds launched. In 1776, a group of investors started a fund named *Voordelig en Voorsigtig* (Profitable and

Prudent) with a specific reference to the benefits of diversification. The prospectus laid out the benefits of diversification, with the primary focus on allocating capital, not to a single investment, but rather to make smaller allocations to several investments. The future is unknown and outcomes uncertain, the prospectus mentioned. *Eendragt Maakt Magt* had a similar provision in its prospectus— that the negotiatie must invest at least forty per cent of the portfolio in plantation loans, but with no detail of specific loans or plantations (Rouwenhorst 2004:9). *Voordelig en Voorsigtig* was marketed as an all-encompassing way to save for one's pension. Some of the investors in the fund were marginalised members of society like orphans, widows, and single women (Hoonhout, 2013:92). An interesting fact from the prospectus of *Voordelig en Voorsigtig* is that the shares of *Eendragt Maakt Magt* were among the potential investable securities (Rouwenhorst 2004:10). Arguably, this can be considered an early iteration of a fund of funds.

The adoption of a mutual fund outside the Netherlands did not happen until the establishment of the *Foreign and Colonial Government Trust* in 1868 by Lord Westbury (Sir Philip Rose). Like the early trusts in the Netherlands, the investment was focused on government bonds. Diversification was embedded within the fund, as the prospectus stipulated that no more than 10% of the assets can be invested in a single security (Hutson, 2003:8). The projected life of the fund was 24 years and it used the same model as the funds from the Netherlands, where the excess income was used to retire or to buy back shares (Rouwenhorst 2004:16). During the 19th century, several investment trusts were established outside of London. Several funds emerged in Scotland, but the most famous of them all was a fund set up by a Scotsman named Robert Fleming in 1873. The fund was named the First Scottish American Trust. This trust preferred American securities, especially railroad securities (Hutson, 2003:8). Funds in the latter part of 19th century were still following the basic design elements of the Dutch funds (Rouwenhorst 2004:16). Hutson (2003:11-12) sets out typical features of the early trusts— the first being that the funds had a fixed dividend pay-out. This was to align it to the other securities of the time which were predominantly interest-bearing securities. Secondly, the composition of the fund could not be changed, except under certain circumstances. Therefore, managers could not change the underlying holding of the trust.

By the 1880s and 1890s, this provision was relaxed, and the managers could manage the fund more actively. Thirdly, these trusts were not set up to be perpetual. They had limited lives. The excess cash generated within the trusts was used to repurchase certain shares at par value or above. Usually, shares were issued at a discount to par value. Shares were redeemed at random, hence the reference to a lottery. After all the shares had been repurchased, the trust was terminated. The estimated life span of the trust, which was usually between 20 and

30 years, was set out in the prospectus. Lastly, trusts during that time could make use of leverage, which modern funds cannot.

Another key aspect of these trusts was the welfare benefit of investment trusts. Chabot & Kurz in their 2011 article (Chabot & Kurz, 2011), explained how funds in London, via investment in foreign assets, benefited their investors. If investors could buy and sell securities in each foreign market, they could enhance their welfare if markets were segmented, and risks were not shared. The financial intermediary played a crucial role in extracting this welfare benefit. When market segmentation (due to information or transaction costs) prevented investors from sharing risks, financial intermediation stepped in and facilitated this exchange. Due to the market segmentation in the 19th century, railroad bonds in the United States and U.K. traded at different prices. In the U.S., the bond was priced according to its expected coupons and covariance of the coupons with U.S. aggregate consumption. A similar bond's price in the U.K. would be determined by its covariance with British aggregate consumption. If U.K. and U.S. consumption risk were not similar, then the bonds would trade at different prices in different markets. If the U.S. bond traded at higher yields due to increased perceived risk and the financial intermediary sold it in the U.K., the British investor would be willing to pay more for the bond compared to the U.K. equivalent. British funds attempted to profit from this market segmentation by selling shares in their fund and using the proceeds to purchase foreign bonds. This intermediary function via a fund gave the ordinary British investor the opportunity to earn foreign income. British consumption was uncorrelated to the U.S. consumption, enabling these British funds to lower the cost of capital abroad and increase the level of international risk sharing (Chabot & Kurz, 2011:9-10).

Funds continued to be set up in the United States, but these funds closely resembled the closed-end structure of Dutch funds like *Eendragt Maakt Magt* (Rouwenhorst 2004:17). In 1890, John Quincy Adams, Moses Williams, William Minot, Abbott Lawrence Lowell and Robert Sedgwick Minot started The Boston Property Trust. This fund primarily invested in real estate and the vehicle might today be described as a hedge fund rather than a mutual fund. Provisions within the fund set out in Appendix B of the fund deed allowed the fund to borrow or mortgage or pledge out any of the fund's assets as the trustees deemed fit. As with the other funds, the structure was set to dissolve after 20 years or the death of the longest living members, as set out in Part III of the prospectus (Grayson, 2015).

Before 1924, most, if not all, funds could be classified as close-end funds. The open-end fund as we know it today was the U.S. domiciled Massachusetts Investors Trust. Today, this fund still exists and is managed by MFS Investment Management. An open-end fund can continuously issue and redeem shares at a price which is proportional to the fund's nett asset

value (Rouwenhorst, 2004:17). This continuous redemption and issue of units is what enables the fund to be perpetual in nature.

Fund structures continued to evolve over the last 100 years with the notable advancement in fund structures. In 1962, the first fund of funds structure was set up by Bernard Cornfeld. It allowed investors access to different types of funds within one structure. These types of funds were distinguished from the traditional fund by the type of securities they invest in. A fund of funds invests in shares of other funds, rather than buying the traditional instruments like shares and bonds (Bertin & Prather, 2008:1). One of the primary advantages of this structure is the enhanced diversification by not concentrating exposure to one single manager and investment style. Also, it provides the investor with greater flexibility to react to changing market conditions (Bertin & Prather, 2008:2) as it can alter the exposures to various markets, sectors, and asset classes like bonds, equities, and property (Stein *et al*., 2008:7).

The most recent development was the emergence of passive investments with the creation of the Exchange Traded Fund (ETF) in Canada and the U.S. in the 1990s. An ETF is an index fund which endeavours to replicate the performance of some reference index, like the S&P 500 Index. The ETF holds a basket of securities which closely resembles the index it tracks. Investors can enter and exit an ETF by depositing a basket of securities when investing and receiving a basket of securities when disinvesting. The key difference between other funds and ETFs is the fact that ETFs are exchange traded or listed and can be traded inter daily as opposed to daily trading and settlement for non-listed funds.

An ETF provides the investor with various advantages compared to a normal fund. They are tax efficient and cost less due to lower management fees and transparency (Deville, 2006:2). Investors were on the lookout to trade a whole basket of securities or an entire index in one trade. Therefore, in the 1970s, U.S. brokerage firms began providing such trading facilities. The introduction of index futures made the trading of the index more popular. ETFs as we know it today were developed in the 1990s in Canada and three years later in the U.S. In Canada, the first equity-like ETF was set up on the Toronto Stock Exchange. The fund was named the Toronto Index Participation units (TIPs). In 1993, the American Stock Exchange (AMEX) started trading the Standard & Poor's 500 Depositary Receipts (SPDR) and many consider this the first ETF (Deville, 2006:5). In Europe, things got off to a slow start with the Deutsche Börse and the London Stock Exchange only introducing ETFs in April 2002 (Deville, 2006:6). The popularity of ETFs continues to increase as more funds are listed to provide solutions for investors.

2.3 History and origin of asset classes and financial markets in South Africa

Formal financial activities in South Africa started with the establishment of the first bank in Cape Town in 1793, while still a Dutch colony. It was a state-owned bank, named the Lombaard Bank (Arndt, 1929:311). The purpose of establishing the bank was to increase circulation of money, as the Cape Colony suffered from a shortage of coinage.

In 1806, the British took over control of the Cape Colony and it became part of the British Empire. In 1825, sterling was introduced as legal tender by the Order-in-Council (Shannon, 1951:336). From this date to 1961 it was linked to the value of the British pound sterling, which in turn was linked to the US dollar after World War II in accordance with the Bretton Woods Agreement (Federal Reserve History, 2013). Imperialism was to have a material effect on the South African financial system. British banks, namely Standard Bank and Barclays, which had headquarters in the United Kingdom well into the 1970s, dominated the South African banking sector since the 1860s (Mohamed et al., 2016:40). Other smaller banks like Volkskas Bank and Netherlands Bank of South Africa played a less prominent role.

South Africa took the first step in having an independent financial system by establishing the South African Reserve Bank (SARB) in 1921 (SA Reserve Bank, 2020). It was established because of unusual financial and monetary conditions stemming from the First World War. The Bank held other commercial banks' gold and silver and in turn it issued banknotes. This step was crucial in the advancement of the financial system in South Africa. The Banks Act 26 of 1965 defined that commercial banks were entities that can create money. With the supply of money increasing, these commercial banks faced ever-increasing liquidity and capital reserve requirements, which needed to be deposited at the SARB at zero interest. This put them at a distinct disadvantage as these reserve requirements reduced margins and, in turn, profitability. Banks responded by acquiring majority stakes in other financial institutions that specialised in exempted areas. This gave rise to the five large, consolidated banking groups in the 1980s, namely First National Bank Group, Standard Bank, Nedcor, Bankorp and Volkskas (Mohamed *et al*., 2016:45). These deposit-taking institutions are supervised by the SARB and regulated by various laws and regulations.

The SARB gave borrowers and lenders confidence that South African banks abide by certain rules and regulations set out in the bank acts through the 20th century, with the latest iteration published in 1990 (Banks Act 94 of 1990). The Act and regulations provide a regulatory framework and supervise the taking of deposits from the public. This gave the public an opportunity to earn interest on the surplus cash. However, this is extremely limited in scope and risk appetite. This limited scope led to the formation of other financial structures and insurance companies in South Africa in the 20th century. Sanlam (The South African National

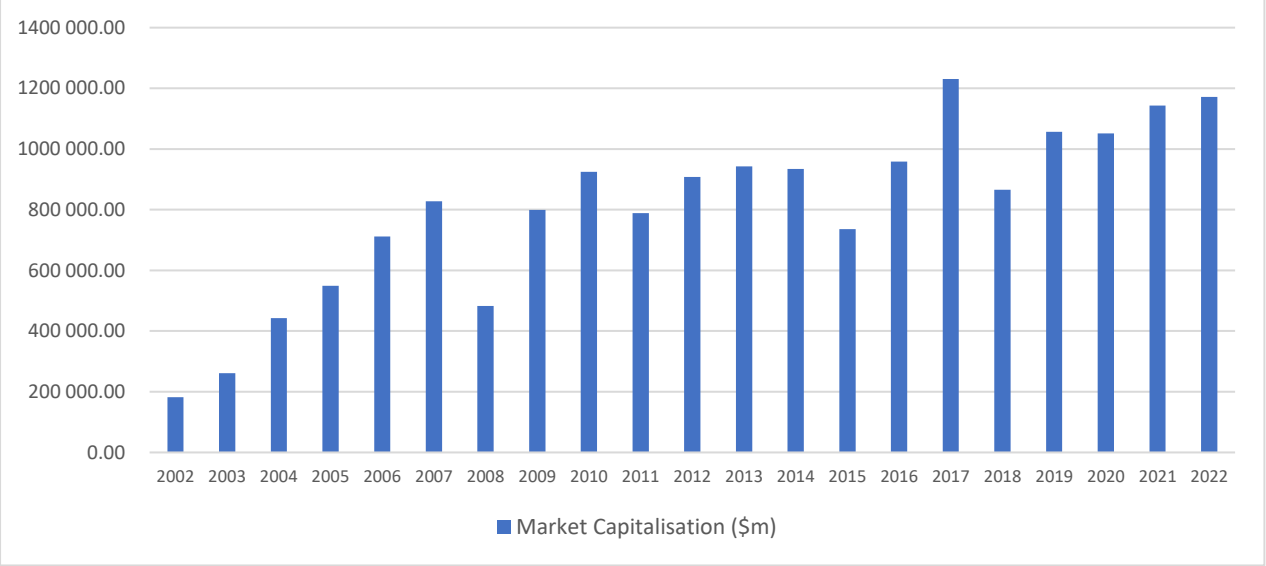
Life Assurance Company) and Santam (The South African Trust and Insurance Company) are examples of insurance companies. Founded in 1918, they paved the way for other financial markets and participants to enter the ever-growing financial system in SA (Mohamed *et al*., 2016:138). Over the next two decades, the SA government continued to establish large public enterprises, setting up the Electricity Supply Commission (ESKOM) and South African Iron and Steel Corporation (ISCOR) (Mohamed *et al*., 2016:138). In 1940, the South African government established the Industrial Development Corporation (IDC) and in 1949, the National Finance Corporation. These corporations used depositors' funds to invest in various industries, which lead to the dilution of the influence the British had in South African commerce at that time. These structures were some of the very first examples of institutions pooling funds to invest in risky ventures, like establishing a new mine (Goldfields) in the Orange Free State (Mohamed *et al.*, 2016:40). For a single investor, this project may have been too risky, but by spreading the risk among numerous investors, it became possible.

South Africans were no strangers to investing in companies or corporations, as the first formal stock exchange, the Kimberley Stock Exchange, operated during the Cape Colony's diamond boom in the 1800s (Maphosa *et al., 2021:154*). This exchange helped the diamond prospectors to raise and secure capital. During the 1880s, the mining boom led to the opening of several exchanges in towns like Pietermaritzburg, Potchefstroom, Klerksdorp, and Barberton (CFA Institute Research Foundation, 2019:3). Similarly, the gold boom of 1886 laid the foundation of the establishment of the Johannesburg Stock Exchange, as joint-stock companies became the preferred vehicle for investors to invest in the high-risk emerging mining sector around Johannesburg (Lukasiewicz, 2017). The Johannesburg Stock Exchange (JSE) was founded on 8 November 1887 by Benjamin Wollan to formalise the informal trading of mining stock. That same year, Chambers and Company was the first company to list on the exchange. In 1895, a gold company named Durban Roodepoort Deep (DRD) listed on the JSE and remains the oldest listed company. Numerous listings, de-listings, mergers, and acquisitions occurred since the establishment of the JSE. One notable period was the listing boom of small companies in 1986 and 1987, which saw 293 companies listed. This boom was also observed on the JSE's junior boards, namely Developmental Capital Markets (DCM) and Venture Capital Markets (VCM), with a total of 102 listings over that 24-month period.

As the market continued to grow, the SA government started to impose its first set of laws, with the Stock Exchanges Control Act passed in 1947. The aim of the legislation was to regulate capital requirements for members and parameters of conduct for brokers (CFA Institute Research Foundation, 2019:3). Change for investors, brokers and members continues with new rules, regulations and technology changes impacting the way investments

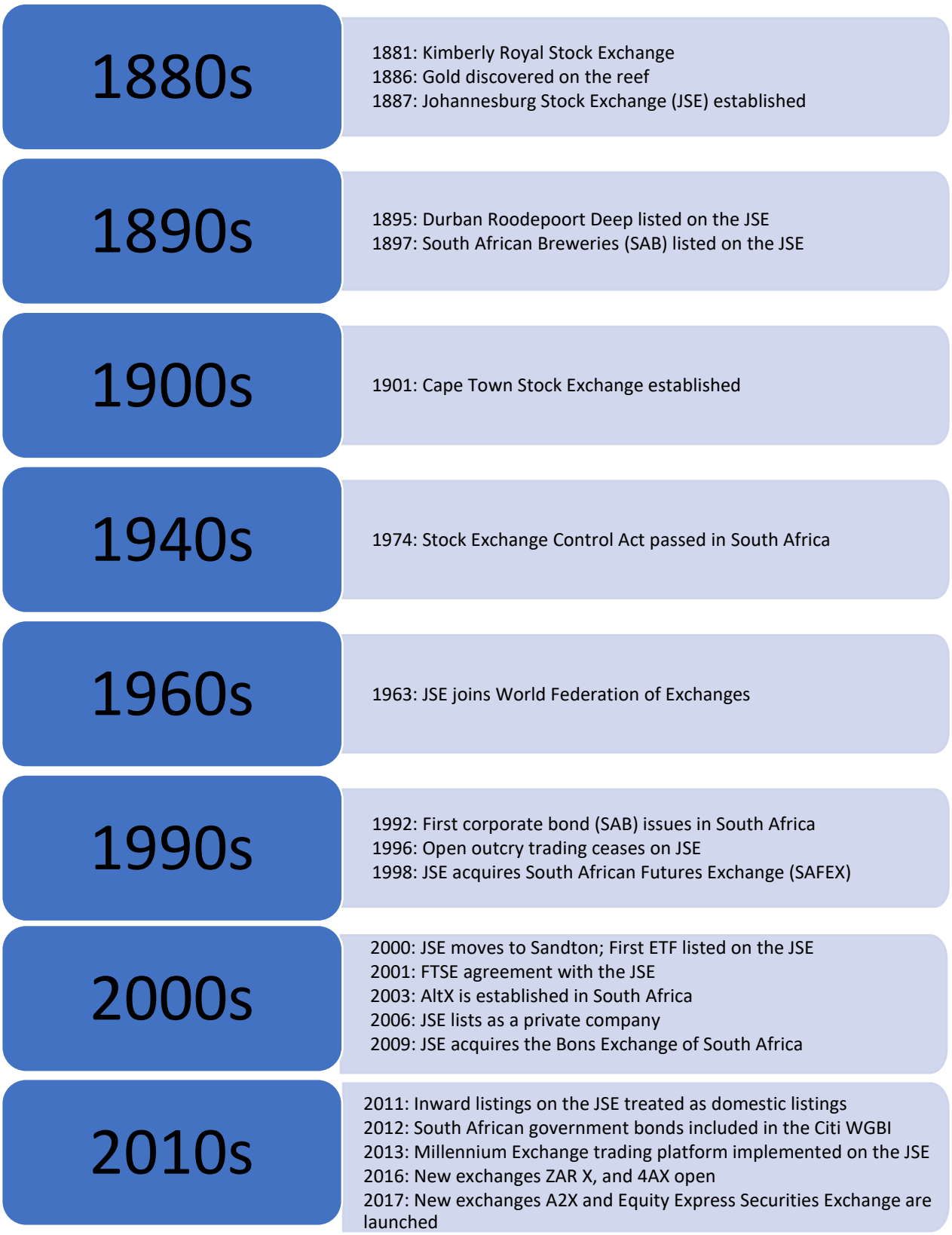
are done. One of the most notable changes occurred on 7 June 1996, with the ceasing of the open outcry trading system. By then the traditional trading floor became outdated as technology advancements enabled traders to make a market via electronic channels. Thus, the 108-year-old practice was replaced by an order-driven, centralised, automated system known as the Johannesburg Equities Trading (JET) system. Because of the structures and processes that have been put in place, the financial sector has gone from strength to strength and makes up a very large part of the SA economy. Financial markets have grown in size and stature, as well as advancing in sophistication. South Africa's equity and public debt markets are unusually large relative to the size of the SA economy (Rand Merchant Bank, 2001:1). Even though South Africa has only the second largest economy in Africa, it boasts the largest stock exchange by market capitalisation in Africa. According to data from the World Federation of Exchanges (WFE), the market capitalisation of the South African listed equity market stood at just over $1 trillion, with 343 listed companies in 2019, just before the Covid-19 pandemic (CFA Institute Research Foundation, 2019:9). During the pandemic, the equity market indices declined in this unprecedented risk-off event. Subsequently, equity market indices recovered as the pandemic was brought under control. By the end of 2022, the World Federation of Exchanges reported that the JSE's market capitalisation stood at an impressive $ 1.1 trillion, with 304 listed companies. The decline in listed companies on the JSE remains a concern. In its 2021 integrated annual report, the JSE states that the main cause of de-listings were a result of mergers and acquisitions. Figure 1 indicates the continued upwards progression of the JSE's market capitalisation.

Figure 1: Johannesburg Securities Exchange Market Capitalisation



Source: World Federation of Exchanges (WFE), amounts are in USD dollar as on 31 December.

Figure 2: Timeline of the evolution on SA financial markets



Source: CFA Institute: African capital markets challenges and opportunities

The Equity market was not the only market that underwent huge changes. During the 1970s and 1980s, the South African Capital market did not exist formally. The government and state-owned enterprises financed their budget deficits directly in the bond market and with large non-banking institutions. They dominated the capital market for more than two decades (LIU, 2013:40). There was no regulatory oversight on bond trading, and therefore also no real pricing benchmark due to the absence of an efficient market mechanism.

In the second half of the 1980s, the Bond Market Association (BMA) was established to oversee and regulate the capital market. This brought about structural adjustments such as the rationalisation of government bonds as well as a benchmark and an appropriate yields curve. (Bradlow, 2013:7). From the beginning of the 1990s, a more transparent capital market was developed by means of regular bond auctions by the SARB on behalf of the government. The BMA was replaced by the Bond Exchange of South Africa (BESA) in 1996 (Bradlow, 2013:8). The BESA introduced an electronic trading platform to improve settlement of transactions by dematerialising bond issues and a more refined benchmark yield curve. During the same time, the local secondary bond market had developed substantially. The SARB considered it to be matured enough for the SARB to reduce their market making role (LIU, 2013:40).

It was not only government that benefited from the formation of a formal market; private and publicly traded companies also started to issue corporate debt. South African Breweries (SAB) was the first corporate to issue debt in 1992 and since then more than 1 500 corporate bonds have been listed.

Another asset class that resembles a bond, but has very similar characteristics as equities, is listed property. Listed property has a key distinction from other equities listed and that is the yield component. These yields are determined by companies' or trusts' (legal structure) cash generating capability, which is more bond like. The JSE was pivotal in the early establishment of listed trusts, like mutual funds, with the listing of two property unit trusts in 1969 (Carstens, 2018:129).

2.4 The origin of mutual funds in South Africa

Mutual funds or unit trusts became an increasingly important part of the financial system in South Africa and one of the most important channels of savings and investments. A collective investment scheme or a unit trust is defined under the Collective Investment Schemes Control Act 45 of 2002 as: "*a scheme, in whatever form, including an open-ended investment company, in pursuance of which members of the public are invited or permitted to invest money or other assets in a portfolio, and in terms of which:*

(a) two or more investors contribute money or other assets to and hold a participatory interest in a portfolio of the scheme through shares, units, or any other form of participatory interest; and

(b) the investors share the risk and the benefit of investment in proportion to their participatory interest in a portfolio of a scheme or on any other basis, determined in the deed, but not a collective investment scheme authorised by any other Act.

The first unit trust was launched in June 1965 by Sage, with assets totalling R 600 000 (Nana, 2011:12). According to Oldert (2005), the aim of the fund was to offer the investor a convenient investment product that is managed professionally, to spread risks across a broad spectrum of financial assets. Also, the fund allowed low initial investment amounts and was tax friendly and saved costs for the investor (Nana, 2011:14). This type of financial product was very attractive for the public. The unit trust industry saw strong growth with large inflows into the funds. By 1970 the industry had R 358 million in assets under management. Seven months earlier, the market crashed, which had a negative effect on the whole investment industry. The crash of 1969 scared the public from investing and by 1975 the industry still has not recovered, with a combined total of only R 313 million in the various funds. After this 5-year period of stagnation, the industry just took off. The assets under management increased to R 7.5 billion by 1990 and not even the crash of 1987 could stop the growth of unit trusts (Meyer-Pretorius & Wolmarans, 2006:49-52). According to the Association for Savings & Investment South Africa's (ASISA) quarterly industry statistics, there were 1 769 funds with a total of R 3 141 310 million at the end of December 2022 (ASISA 2022). This is a far cry from the humble beginnings 65 years ago.

Table 1: ASISA Fund Statistics – Total assets and number of funds.

	TOTAL ASSETS		**NO OF FUNDS**
	31/12/2022		**31/12/2022**
	Rm	**%**	
SOUTH AFRICAN FUNDS	2 662 238	85	1 296
WORLDWIDE FUNDS	74 999	3	160
REGIONAL FUNDS	26 708	1	25
GLOBAL FUNDS	377 366	11	288
FUND OF FUNDS	484 693		449
TOTAL	3 141 310	100	1 769

Source ASISA fund statistics – 31 December 2022

Table 2: ASISA Fund Statistics – Split between Institutional and retail funds.

	TOTAL ASSETS	
	31/12/2022	
	Rm	%
Retail Funds:		
Retail Funds	754 494	24
Third Party Funds	347 037	11
Sub Total	1 101 531	35
Institutional Funds:		
Institutional Funds	479 510	15
Third Party Funds	145 799	5
Institutional Assets in Retail Funds	1 414 471	45
Sub Total	2 039 779	65
TOTAL	3 141 310	100

Source: ASISA fund statistics – 31 December 2022

As the industry grew, so did the number of different types of funds on offer. ASISA allows funds to be categorised as domestic, foreign or worldwide. Each of these categories has certain parameters. These parameters enable a financial advisor to better choose a fund that is in line with a client's risk profile and financial plan. Domestic funds, which are categorised under the South African Portfolio category, largely invests in SA, with a maximum of 20% allowed to be invested internationally. Foreign funds focus on international investments and must have at least 85% invested outside SA. Worldwide funds are free to allocate any amount to local assets or foreign assets. At the second tier, fund classification becomes more focused. A fund is classified as equity funds, asset allocation funds, real estate funds or fixed interest funds. (ASISA standard on fund classification, 2018).

In addition to the above classification system, unit trusts are either deemed compliant with Regulation 28 of the Pensions Fund Act or not (ASISA standard on fund classification, 2018). The act limits the extent to which retirement funds may invest in particular assets or in particular asset classes. The main purpose is to protect the members' retirement provision from the effects of poorly diversified investment portfolios. This is done by limiting the maximum exposure to more risky asset classes, making sure that no unnecessary risks are taken with retirement money. The Act outlines the following maximum exposures per retirement fund.

- A maximum of 75% in equities (local & offshore)
- A maximum of 25% in property (local & offshore)
- A maximum of 45% in offshore assets (including Africa)
- A fund may invest up to 10% in commodities (gold and exchange traded commodities) and 5% for any other physical commodity
- A fund may invest up to 15% in alternative assets and 10% in hedge funds
- There is no limit to cash investments, but a retirement fund can only allocate a maximum of 25% of its asset to a particular bank and 5% to a foreign bank (ASISA standard on fund classification, 2018)

One of the most restrictive requirements of Regulation 28 is the limits on offshore investments. Investing offshore has been a difficult process for decades. In the 2008 Budget, reforms were announced to overhaul the offshore investment process. Prudential rules would replace the previous formal application to the Reserve Bank for funds to invest offshore. The move away from the transaction-based approach to a prudential risk-based approach is an important change in the objectives of exchange controls. The primary objective of exchange controls is to limit the outflow of capital from SA. Prudential legislation is concerned about financial soundness of institutions, in part this is accomplished through adequate portfolio diversification and liquidity. This notion of diversification, especially internationally, is supported by at least two studies. Burtless (2007) used data from 1927 to 2005 to ascertain whether investing internationally enhances returns for mutual funds with lower risk. The study suggests that it indeed enhances returns for investors. Similar results were obtained from a study by Pfau (2008) on international diversification of emerging market pension funds. The author made use of the portfolio selection theory introduced by Markowitz (1952) and Roy (1952) to determine the optimal asset allocation for pension funds in emerging economies. The study used data from January 1988 to December 2006 and made use of four asset classes, namely domestic stocks, domestic fixed income, foreign stocks, and foreign bonds. Given some limitations, the author reaches a conclusion that emerging market funds can benefit from international diversification and mentions the negative effects of not investing offshore.

Other enhancements in portfolio diversification came in 1977 with a study conducted by Stephen Ross. The author postulated a theory of factor investing in a paper on arbitrage pricing theory, where he argued that security returns are driven by multiple factors (Ross, 1977) and not only by a stock's expected return as set out in the Capital Asset Pricing Model (CAPM). Later Banz (1980) established the size premium in shares. The author found that companies with smaller market capitalisation tend to deliver higher risk adjusted returns

compared to those companies with higher market capitalisation in the period from 1936 to 1975. The value factor was identified by Fama and French (1993). They demonstrated that the expected returns of value stocks were higher compared to growth stocks. Jegadeesh Narasimhan identified another factor, which the author named momentum. Carhart (1997) found that the same factor if present in returns of mutual funds. The study examined the monthly returns of individual companies, with the results indicating that share prices do not follow random walks (Narasimhan, 1990).

The above-mentioned fund classification and investment limits were set up to guide or narrow the asset allocation parameters for the fund manager. They have fewer restrictions on the actual instruments that a manager can use but focus on high-level exposures. Hood and Beebower (1986) and numerous other studies confirmed that asset allocation is the prime contributor to above-normal returns. Therefore, asset allocation and factor investing are key inputs in portfolio construction. The origins of portfolio construction are explored in the following section.

2.5 The origin of portfolio construction

Throughout history, humans endeavoured to protect their wealth by investing in more than one asset or income-generating asset. Harry Markowitz, in his 1999 paper (Markowitz, 1999:5), mentions the merchant of Venice, who spread out his shipments among different ships. The merchant understood that he could not eliminate a certain risk but could reduce the impact such a risk could have on the goods he shipped. In the beginning of the 1940s, Wiesenberger had indicated that investment firms invested in many securities to reduce risk by means of diversification (Markowitz, 1999:5). It is this action of diversifying investments that reduces the risk. Markowitz defined risk as the variance of returns and, in a portfolio context, covariance of returns. To diversify a portfolio of risky assets, one needs to avoid securities with high covariances (Markowitz, 1999:8). By using expected returns and risk (covariance) Markowitz constructed the *"set of efficient mean-variance combinations"* (Markowitz, 1999:5). This set of portfolio combinations provides the investor with a possible solution, based on the investors risk-return appetite.

2.5.1 Modern portfolio theory

Modern portfolio theory was first proposed by Harry Markowitz in 1952 (Markowitz 1952). He used a mean variance optimisation model to construct an efficient portfolio which focused on maximising expected return EI (Sullivan & Roy, 2008:255). Markowitz showed that the variance (σ^2) of the rate of return was a meaningful measure of portfolio return under a reasonable set of assumptions. The Markowitz model is based on the following assumptions (Markowitz, 1952).

1. Each investment is an alternative represented by a probability distribution of expected returns over a holding period, from which investors must make a choice.
2. Investors maximise one period expected utility EU (investor). The resulting utility curves demonstrate diminishing marginal utility of wealth.
3. Investors use the variability of expected returns to estimate the risk of a portfolio.
4. Investors base their investment decisions only on the expected return and risk. Their utility curves are therefore a function of expected returns and expected risk. Expected risk is measured by the variance (σ^2) of returns.
5. Investors will always prefer higher returns to lower returns. For each level of expected return, the investor will select an investment with lower risk.

Investors will always face the dilemma of constructing a portfolio of risky assets. Given this dilemma, what would the optimal exposure be for each asset in a portfolio? The law of large numbers suggest that an investor should assume there is a portfolio which gives both maximum expected return and minimum variance (σ^2). Markowitz (1952:79) rejected this assumption and stated that diversification cannot eliminate all risk. In his 1952 paper, he uses the word “variance” and not risk. In portfolio management, risk is defined as a combination of systematic risk and unsystematic risk. Systematic risk is the probability of a loss associated with the entire market or the segment, whereas unsystematic risk is associated with a specific industry, segment, or security. Unsystematic risk can be eliminated through diversification of a portfolio (Adamiec & Cernauskas, 2019:46).

Markowitz (1952) states that a portfolio with the maximum expected return is not necessarily the one with the minimum variance. He illustrated this in Figure 3, the efficient frontier. This convex line represents the various portfolio combinations and their corresponding variance. There is a rate at which the investor can gain expected return by taking on variance, or reduce variance by giving up expected return, by moving up or down along the efficient frontier.

To construct an efficient frontier, various portfolios with different exposures to risky assets need to be created. Each portfolio’s expected return EI and risk (σ^2) can then be plotted on the efficient frontier. The complexity lies in the way variance is calculated for a portfolio or combination of risky assets. Making use of the simple weighted average of each asset’s variance to calculate portfolio variance is incorrect. The co-movement of assets must be included in the calculation of portfolio variance. Covariance measures the joint variability of two random variables (Horasnh & Fidan, 2007:4), and can be expressed as:

$$Cov_{ij} = \{[R_i - E(R_i)][(R_j) - E(R_j)]\}. \quad (2.1)$$

where

R_i = the rate of return of asset *i*
$E(R_i)$ = the expected rate of return of asset *i*
R_j = the rate of return of asset *j*
$E(R_j)$ = the expected rate of return of asset *j*

This metric does, however, not measure the dependency between two variables. When two variables move together, they have a positive covariance. The opposite is true for negative covariance, i.e., when two variables tend to move in opposite directions.

To assess whether one portfolio is riskier than another, the standard deviation of returns is calculated. The portfolio with the higher standard deviation is the one which has the larger risk. For a portfolio of risky assets, an investor needs the weight exposure to each asset, as well as the standard deviation and the covariance as calculated in Equation 2.1. These parameters allow the portfolio manager to calculate the portfolio variance:

$$\sigma_{port}^2 = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \mathrm{Cov}_{ij}. \quad (2.2)$$

where

W_i = the present of the portfolio in asset *i*
σ_i = the variance of asset *i*
W_j = the present of the portfolio in asset *j*
σ_j = the variance of asset *j*
Cov_{ij} = Covariance of asset *I* and *j*

Equation 2.2 uses each risky asset's variance and weight within a portfolio to calculate the portfolio's standard deviation.

The concept of expected returns is fundamental from an investor's point of view. This allows an investor to align risk-taking ability and investment goals. The equation below allows an investor to calculate the expected return of a risky portfolio given the weight of each risky asset.

$$E(R_{port}) = \sum_{i=1}^{n} W_i E(R_i). \quad (2.3)$$

where

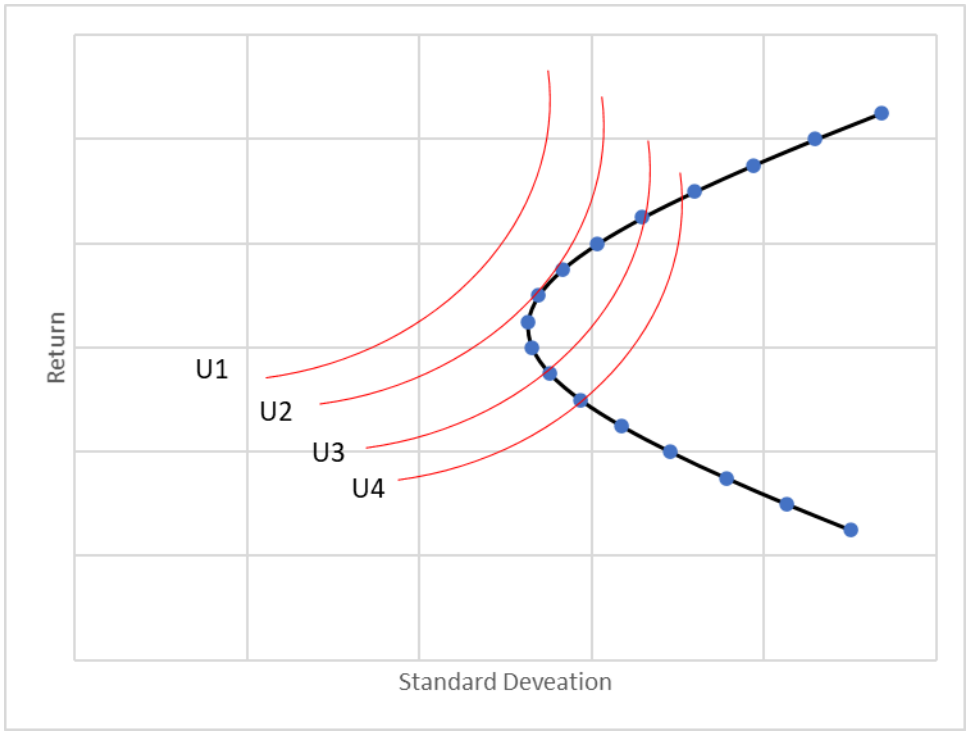
W_i = the present of the portfolio in asset *i*
$E(R_i)$ = the expected rate of return for asset *i*

These formulas above allowed Markowitz to calculate and graph different combinations of risky assets, which are now named the efficient frontier (Figure 3). This gives a visual representation of his theory of expected return for a given risk level. The slope of the efficient frontier curve decreases steadily as an investor moves away from zero risk and zero returns. This implies that adding equal increments of risk as the investor moves up the efficient frontier, gives them diminishing increments of expected return.

$$\frac{\Delta E(R_{port})}{\Delta(\sigma_{port})}. \quad (2.4)$$

Figure 3 depicts a hypothetical efficient frontier with various combinations of portfolios of risky assets. All portfolios that lie below the Efficient Frontier are not good enough because the return would be lower for the given risk. An investor who is risk averse will hold a portfolio on the lower left hand of the frontier and an investor who is not too risk averse will choose a portfolio on the upper portion of the frontier. This model further assumes that all investors want to maximise their utility in terms of risk and return. This can be visually represented by each investor's utility curves. Figure 4 shows the risk-return indifference/utility curve for the investors. Utility curves U1 through to U4 are shown. Each of the different points on a particular utility curve indicates a different combination of risk and return that provides the same satisfaction to the investors.

Figure 3: Selecting an optimal risky portfolio on the efficient frontier.



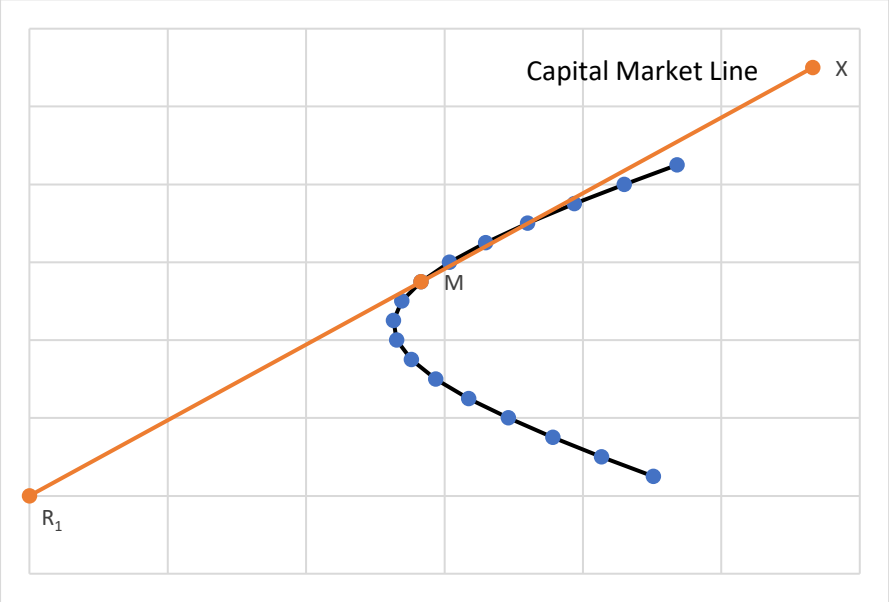
Source: Bierwag & Grove, 1966:338

Therefore, the utility curve specifies the trade-off an investor is willing to make between risk and return. In conjunction with the efficient frontier, these utility curves determine which portfolio of the efficient frontier best suits the individual investor. The optimal portfolio is the portfolio on the efficient frontier that has the highest utility for a given investor. It lies at the point of tangency between the efficient frontier and the curve with the highest possible utility.

All portfolios have been evaluated in terms of risky securities only, but it is possible to include a risk-free asset/security in a portfolio. Assuming the existence of a risk-free asset, with a zero variance and zero correlation to other assets, leads to the formation of the theory of capital asset pricing under conditions of uncertainty from the Markowitz portfolio theory.

In general, a government security is considered risk-free. The graph below shows a combination of a risk-free asset and a portfolio of risky assets. This is represented by straight line R_1MX which is tangent to the market portfolio M on the Efficient Frontier.

Figure 4:The Combination of risk-free securities with the efficient frontier and CML.



Source: Bierwag & Grove, 1966:338

Any point on the line R_1MX shows a combination of different proportions of risk-free securities and efficient portfolios. The standard deviation of a portfolio that combines a risk-free asset with risky assets is the linear proportion of the standard deviation of the risky asset. Because both the expected return and the standard deviation of return for such a portfolio are linear combinations, a graph of possible returns and risks are depicted as a straight line between two assets. All portfolio combinations to the left of the M show the combination of risky assets and the risk-free asset. Those to the right of M represents the purchases of risky assets made with funds borrowed at the risk-free rate. Therefore, this line represents the risk-return trade-off in the capital market. The slope of the CML is upward sloping, implying that the investor will take higher risk if the return of the portfolio is also higher. Point M represents the most efficient portfolio, as it lies on both the CML and the Efficient Frontier. In summary, the CML indicates the return from the portfolio as the risk-free rate plus the risk premium. The risk premium is the additional compensation an investor needs for taking on additional risk. The risk is the standard deviation of the portfolio.

$$R_{port} = RFR - \frac{(1 - RFR)\sigma_{port}}{\sigma_M}. \tag{2.5}$$

where

RFR = risk-free rate

σ_{port} = standard deviation of the portfolio

σ_m = standard deviation of the market

2.5.2 Capital market theory

Capital market theories build on the Markowitz portfolio model, as discussed above. Each theory has assumptions that specify how the world is expected to act. The capital market theory is built on the following assumptions:

1. All investors who want to target points on the efficient frontier, depending on each investor's risk return utility function are Markowitz efficient.
2. Investors can borrow and lend any amount of money at the risk-free rate of return.
3. All investors have homogeneous expectations; they estimate identical probability distributions for the future rates of return.
4. All investors have the same one period time horizon, i.e., one year.
5. All investments are infinitely divisible, which means that it is possible to buy and sell a fraction of a security of any asset portfolio.
6. There are no taxes and transaction costs involved when buying and selling a security.
7. There is no inflation or inflation is fully anticipated, as well as no interest rate changes.
8. Capital markets are in equilibrium, meaning that all assets are properly priced.

An efficient market is the term used to describe a market where investors cannot outperform their rivals by generating abnormal risk-adjusted returns in a consistent manner. Studies were conducted to test this hypothesis, especially among mutual funds. In 1968, Jensen was one of the first to conduct a test on historical mutual fund performances (Jensen, 1968:415). Jensen measured the performance of 115 open-end mutual funds in the period of 1945 to 1964. What he found was that these funds failed to outperform the benchmarks, which are related to some market index. This would suggest that professional money managers on average fail to outperform the market after portfolio management fees. Therefore, the additional fees active managers charge above passive funds do not result in increased alpha. Alpha is this case will be defined as the outperformance of an active managed fund above a passive fund. This would suggest that investing based on fees has merit and that an active manager does not have any higher probability off outperforming the market. It implies that index tracking funds or passive funds, which have a very low fee, are the optimal form of investment for all investors and that all forms of active allocation are useless.

However, real-life examples of investors who outperformed the market on a consistent basis are Warren Buffett and John Templeton. Both Buffett and Templeton made use of the fundamental aspects of a company, like assets, earnings, and dividend pay-out in valuing a company. This led them to derive their own expected return and risk levels. It is this fundamental analysis which gave them the advantage to outperform the market portfolio. Value investors like Benjamin Graham and Warren Buffett use fundamentals of a company to

derive an intrinsic value of each company. If a company is trading below the intrinsic value, then the investor should buy the company and hold the share until the mean price reverts to its true value. This price convergence is only bound to happen in an efficient market. If the market is efficient there is no point to value investing. Eugene Fama suggests, in his 1970 article, that security markets fully reflect all information available about a particular company via that security's price. If all information of the company is reflected, then the market is efficient – *Efficient Capital Markets"* (Fama, 1970:383). This theory later became known as the Efficient Market Hypothesis (EMH). If a market is truly efficient, changes in share prices are random and fundamental analysis adds no value. At any point in time, share prices will represent a good estimate of the intrinsic value of a company (Fama, 1965:59). However, Fama and French (1988) showed that a dividend yield is a strong predictor of future returns, which is somewhat of an anomaly. In response to 'anomaly' research of the 1980s, Fama and French developed a three-factor model which explained why some companies consistently outperform the market. Fama, who postulated the EMH, explained in an interview in 2016 (Fama & Thaler, 2016), that the Efficient Market Hypothesis is only a model and that no model is perfect. The question remains, is the model a good approximation? Fama stated that the EMH is a good approximation for almost every purpose.

2.5.3 The three-factor model

The three-factor model that Eugene Fama and Kenneth French developed in 1992 builds on the Capital Asset Pricing Model (CAPM). This model improves on the way the CAPM estimates expected returns and captures in a better way the variation in mean returns of portfolios formed on book-to-market value, size, and other factors. Their key premise remains that financial markets are efficient and that securities price in all relevant public information.

The three-factor model adds the size risk and the value risk to the market risk factor in the CAPM. The model aims to describe stock returns through three factors: (1) market risk, (2) the outperformance of small-cap companies relative to large-cap companies, and (3) the outperformance of high book-to-market value companies versus low book-to-market value companies. The rationale behind the model is that high value and small-cap companies tend to regularly outperform the overall market.

$$R(E) = r_f + \beta_1(r_m - r_f) + \beta_2(SMB) + \beta_3(HML) + \in, \tag{2.6}$$

where

$R(E)$ = expected return,

r_f = risk-free rate,

β = factor's coefficient,

$SMB(Small - Big)$ = historical excess returns of small capitalisation companies over large capitalisation companies,
$HML\ (High - Low)$ = historical excess returns of value companies (high book-to-price ratio) over the growth companies (low book-to-price ratio), and
$\in$ = risk.

In support of the efficient markets, the outperformance is explained by the excess risk that value and small capitalisation companies face because of their higher cost of capital and greater business risk. In support of market inefficiency, the outperformance is explained by market participants incorrectly pricing the value of these companies, which provides the excess return in the long run as the value adjusts. Investors who subscribe to the body of evidence provided by the Efficient Markets Hypothesis (EMH) are more likely to agree with the efficiency side.

Thaler, in an interview (Fama & Thaler, 2016), suggested that the efficient markets do not work, case in point the 1987 stock market crash, coined *Black Monday*. He suggests that if prices exhibit high volatility, they reflect incorrect valuations. Thaler argues that the difference in share prices between Thursday the 15th of October 1987 and the following Monday, where the market closed lower by more than 25%, cannot be a rational measure of intrinsic value. No new information surfaced to justify the drop in share prices.

It is difficult to explain volatility of share prices in the short term in terms of market efficiency. Fama suggests that risk aversion moves dramatically through time and is high in bad periods like a recession and low in good economic times. This affects the pricing of assets and the expected returns (Fama & Thaler, 2016). Lo (2004:19) argues that emotional responses are an important factor in assessing and dealing with financial risks. Emotional responses such as loss aversion, overconfidence and overreaction can be construed as irrational behaviour but this behaviour is more consistent with the evolutionary behaviour of humans, which is the driving force for a reward and punishment system that facilitates winning behaviour (Lo, 2004:20). The adaptive market hypothesis tries to reconcile the irrational assumptions of the EMH and the rational aspect of investor behaviour.

2.5.4 Adaptive market hypothesis (AMH)

The EMH developed by Fama in 1970 is dependent on two key assumptions: 1) that all information is reflected in the current share price of a security and 2) markets are efficient and that investors cannot obtain excess risk adjusted returns. (Degutis & Novickytė, 2014:8). Market efficiency, where security prices reflect all information, can be broken down into three levels, namely weak, semi-strong & strong.

Weak Form

The weak form of the EMH assumes that the prices of securities reflect all historical publicly available information, but not new information. This information includes historical price, volumes and returns, which are independent of future returns. The lack of predictability of prices based on historical price movements renders technical trading strategies moot. However, it leaves open the possibility that an investor can outperform the overall market by conducting superior fundamental analysis.

Semi-strong Form

The semi-strong form expands on the weak form by including not only historical data, but current information as well. Such information includes acquisitions, dividend payments, changing in accounting principles, and economic data like non-farm payrolls. The EMH assumes that markets adjust quickly to new information, which makes fundamental analysis incapable of having any predictive power over future share prices.

Strong Form

The strong form incorporates all available information, both public and private, which is fully reflected in security prices. This information includes both historical and present publicly available information, as well as insider information. It is unlikely that this form of the EMH will exists as it is illegal to trade or disseminate insider information. If this form did ever exist, then not even insider information can give investors the advantage to outperform the market (Degutis & Novickytė, 2014:8).

The weak form dictates that historical prices fully reflect all available information and that price changes are random. Therefore, returns are not predictable and can be categorised by the Random Walk Hypothesis (RWH). The key requirement for the RWH is that security prices are independent and identically distributed (IID) (Smith & Dyakova, 2014:259). Numerous studies have found that IID security prices exhibit autoregressive conditional heteroskedasticity (ARCH). One such study was done by Lee and Zhou (2013) on the US REIT market from January 1980 to December 2009. They found the REIT returns are skewed to the left skewness and display fat tails. This result proved that REIT returns were not normally distributed, violating one of the key requirements of the EMH. However, Lee and Zhou's conclusion was that markets cannot be classified as efficient or inefficient under the EMH, but rather to which degree markets are efficient and that the efficiency varies over time. The second conclusion was that efficiency is dependent on certain market conditions. Furthermore, they found that regulatory changes improved market efficiency.

For investors, the question remains, “how should we view financial markets?”. In which form do markets fall (strong, semi-strong, or weak) and are there opportunities to outperform the market? Investors like Warren Buffet has shown that it is possible to outperform the market over time. One of his well-known quotes is “We simply attempt to be fearful when others are greedy and to be greedy only when others are fearful” (Buffet, 1986). In 2004, Andrew Lo suggested that human behaviour plays a big role in the efficiency of a market. He postulated the Adaptive Market Hypothesis (AMH), stating that overtime market efficiency varies and is never constant. This hypothesis does not discredit the EMH, but attempts to complete it. Lo argues that behaviour of investors is often irrational, as witnessed in the 2007-2009 financial crisis. Rather than following logic, which is based on known facts, investors often rely on instinct, which is a sure recipe for financial disaster (Lo, 2012:8). Investors will act in their own best interest, which often leads to mistakes. These lessons and the endeavour not to repeat them drive the evolution in behaviour. From this biological perspective, Lo derived insight in formulating the AMH. Therefore, Lo described the AMH as an evolutionary alternative to the EMH (Lo, 2004:16). This was confirmed in the US REIT study conducted by Lee and Zhou in 2013. They showed that the US REIT market became more efficient over time (Lee & Zhou, 2013:1660). The AMH explains that market efficiency evolves or changes over time and is not static or fully efficient as stated in the EMH.

2.5.5 Asset allocation

The AMH shows that investment ecology and ecosystems can change over time. Muralidhar *et al*. (2014:57) argued that financial markets evolved in two ways over the last five decades; firstly, that investment management moved away from an asset-only approach to an asset-liability approach, and secondly, that portfolios have become more complex, moving away from simple construction.

One of the biggest changes is the ever-growing involvement of institutional investors in financial markets, as highlighted by the IMF (2011). Institutional investors are more focused on relative asset pricing and thus manage a portfolio’s asset to the expected liability. MPT, on the other hand, is based on an absolute pricing process to maximise utility or wealth. This approach is prevalent in normal retail client investment accounts. Institutional investors construct portfolios differently, as these portfolios are constructed for a certain purpose, like the popular 60/40 (60% equity, 40% bonds) multiple asset funds in the USA. These portfolios track or aim to outperform the 60/40 benchmark, which commonly comprises 60% S&P 500 Equity and 40% Lehman Aggregate Bond Index (Muralidhar *et al.*, 2014:56).

This departure from a relative measure was also driven by changes in legislation around the world, forcing pension funds into more bond-like investments which more closely resembles

the fund's liabilities (Muralidhar *et al*., 2014:57). This led to the wider adoption of a strategic asset allocation (SAA). Modern portfolio theory (MPT) dictates that an investor should invest in the optimal portfolio on the security market line. This optimal portfolio does not necessary allow for asset liability matching, leading portfolio managers to focus more on the return requirement of a portfolio to match the liabilities. A certain combination of risky assets on the efficient frontier would achieve the desired outcome based on long term average risk and return on each asset class. It is this portfolio that is used to construct an SAA. Managers in the short term makes tweaks to the asset allocation as the expected return of each asset class changes. This is referred to as tactical asset allocation (TAA). Unlike expected return, risk is considered to remain constant for the large part under TAA and SAA, which leads managers to focus only on expected return as it is considered the only variable.

Lo (2012:18-19) argues that SAA may not be the best way to invest, as risk changes over time with market evolution. The volatility in volatility is where the problem comes in. Lo explains that volatility is not constant and exhibits variances. He suggests that a manager should focus on portfolio total risk and construct a portfolio according to a risk budget. As risk of the underlying assets of a portfolio changes, the risk-weighted allocation to that particular asset class should also change. However, fund mandates target explicit return targets, with wider risk tolerance. In the SA market it is only the low-risk money market funds and income funds that want to reduce the volatility in the short term to avoid negative returns of a quarter. Funds within the multi-asset low to high categories are given more leeway in terms of volatility of returns; therefore, volatility is considered to be stable regarding SAA and expected returns are variable to adjust for.

2.5.6 Sorting and weighting methodologies for fund of funds

A fund of funds manager must manage the ultimate source of portfolio volatility, which is the underlying funds. Selecting a fund to be included in a portfolio is not straight forward and can suffer from various biases if done subjectively. Even if a fund of funds manager uses straight forward performance measures, they open themselves up to tournament biases. Broihanne (2005) show that the underlying fund managers compete sort of tournament, with the goal of outperforming your peers. Broihanne (2005:1) shows that fund managers' risk appetite change given recent relative performance. A fund that is likely to end up in 3rd of 4th quartile of the peer group increases risk more than mid-year winners. This leads to distorted picture for a fund of funds manager who uses historic risk and performance measures to assess if a fund is eligible for inclusion in a fund of funds. This would suggest that yearly rebalancing is more appropriate than quarterly or semi-annual. Research into methods of fund of portfolio construction are thin. Brands and Gallagher's (2003:4) observations and discussions with fund of fund managers

and asset consultants found that there are no formal or standard practice used to optimise techniques to determine portfolio weights. Therefore, it is not surprising that Elton *et al.* (2004) found that investors tend to allocate assets equally. This can be achieved by 1/n rule. A weighting regime is only one aspect of fund construction, the second crucial aspect is fund selection. Logic would suggest that fund of funds managers will be able to outperform the peer group average or a portfolio of randomly selected funds. Elton *et al.* (2018:2) suggest just that, that professional investors should be able to outperform the normal market due to their superior knowledge, research capabilities as well as informal interactions with the managers. This non-public information should give them the ability to make superior fund choices in terms of manager skill, giving larger weighting to those managers that exhibit superior skill. Yet, fund of fund managers tends to equal weight these funds.

2.6 Conclusion

In this chapter, the history and formations of pooled funds or mutual funds, as well as the evolution of modern portfolio theory, were examined.

The first part described how different role players in society and financial markets found ways to reduce risk using a tontine or secure funding by pooling funds via negotiaties. During the early years, as these structures became more widely used and the financial industry became more diversified, the first institutional failures also occurred. After the first financial crisis in 1712, a new negotiatie named *"Eendragt Maakt Magt"* was established with the specific focus on diversification to reduce risk. It was Harry Markowitz (Markowitz 1952), who first postulated a formal theory that performance of the individual security is not as important as the composition and performance of the entire portfolio. Markowitz constructed the efficient frontier to visually explain the relationship between risk and return. Eugene Fama later built on this where he proposed that capital markets are efficient and incorporate all publicly available information.

This implies that all assets are always correctly priced and that it would be near impossible to earn returns above that of the market. However, there are numerous examples of investors who consistently outperform the market. This led to the development of the three-factor model by Eugene Fama and Kenneth French to improve the way CAPM estimates expected returns. The three-factor model adds the size risk and the value risk to the market risk factor in CAPM. Other factors also influence asset prices.

Andrew Lo suggested that human behaviour plays a big role in the efficiency of a market. Lo introduced the AMH, which states that overtime market efficiency varies and is never constant. The behaviour of investors is often irrational, as witnessed in the 2007-2009 financial crisis.

Rather than following logic, which is based on known facts, investors often rely on instinct. This instinct is formed from past performances. These lessons that lead investors not to repeat them drive the evolution in behaviour. Investment management continues to evolve, with the recent development being that institutional investors are moving away from an asset return only approach to an asset liability approach.

This gave rise to the formation of the 60/40 portfolio, where investment managers are more concerned with the relative valuation compared to the absolute return of each asset. Regulation around these portfolios also forced the industry to focus more on asset allocation as regulation has imposed limits on certain assets and asset classes.

In the next chapter, the research design and methodology are outlined. Various fund of funds portfolios will be constructed to determine a weighting scheme that not only incorporates returns, but also considers risk.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Portfolio management has several challenges like security analysis, portfolio analysis and portfolio selection. Even when these tasks are completed, the portfolio manager still needs to establish the portfolio proportions by using an appropriate weighting scheme. Weighting schemes are an integral part of the portfolio selection problem. Even if the fund manager overcomes the aforementioned challenges, outperformance is still not guaranteed. This is also confirmed in the literature. Jensen (1968) for example, found that managers struggle to outperform the market. One important factor in using a measure like Jensen-Alpha (Jenson 1968) to determine whether a fund delivers outperformance or not, is the choice of benchmark. For instance, an appropriate measure for a South African equity fund would be the FTSE/JSE All Share Index. This index is a market-cap weighted index, giving higher weights to companies with larger market capitalisations. It can be argued that the Capped SWIX All Share is a better benchmark as it reduces concentration risk. Several studies found that the choice of benchmark is very important in measuring performance (Barroso and Ruiz, 2012), (Lehmann *et al.*, 1987). This study used the ASISA South Africa multi asset high equity category average as benchmark because it is transparent, and the underlying funds have similar risk and return objectives and mandates. The study used a quantitative research design. The approach was non-experimental and based on a cross-sectional data design, which employs a theoretical construct and observable indicators (Fouché & Roesterburg, 2021). The research was based on an observation of fund phenomena by means of numerical analysis.

Research design can be defined as the plan of study that sets the overall framework for collecting data (Leedy, 1997:195). This plan defines the process of data collection procedures, research sites and selecting subjects (MacMillan & Schumacher, 2001:166). The aim of this process is to provide results that can stand up to scrutiny and is credible. The framework links the research question and the implementation of the research strategy (Durrheim, 2004:29). To determine the various relationships between variables, the current study subjected the data to statistical analysis. Testing was conducted over distinct time periods of 5 years, as it is the appropriate holding period for a fund classified under ASISA's South Africa multi asset high equity category (balanced fund). The study constructed various test portfolios using different methodologies. Firstly, the study made use of the Sharpe ratio as the basis of portfolio construction. The second portfolio was based on the Treynor value, and the third portfolio was constructed by applying equal weight holdings. Finally, a fourth portfolio was constructed by

employing a price momentum-based strategy, capturing the momentum in the net asset value (NAV) or price of a fund.

This chapter sets out how the study was conducted, and which methods were used. Section 3.2 expands on the data analysis be done, while Section 3.3 gives on overview of the benchmark that was used. Section 3.4 lists different performance measures be used in assessing the performance of the different test portfolios. Section 3.5 sets out the different time periods over which the study measured performance and risk statistics of the different test portfolios. These test portfolios were constructed by selecting balanced funds, but regulation imposes limits and restrictions on which funds can be included in a fund of funds portfolio. The choices of funds and the fund availability list are explained in Section 3.6. Finally, in Section 3.7, the different portfolio construction methods are set out. Each test portfolio had a unique construction method, and it is these methods that were analysed throughout the study.

3.2 Data analysis

The general purpose of data analysis is a process of inspecting, cleaning, transforming, and modelling data to discover useful information and make conclusions. Quantitative analysis consists of techniques by which researchers convert data into numerical form. This implies the determination of the relationship between variables and discern patterns of differences among different groups in the data sample. The approach was to make use of various databases to analyse data in terms of portfolio construction, fund selection and performance analysis.

3.3 Benchmarks

Tracking and measuring performance for funds are critical for all stakeholders like portfolio managers, investors, and fund trustees. The basic aim of investing is to increase the value of assets or investments over time. To monitor this change in asset values, a performance metric was used and continuously monitored. Performance can either be viewed in absolute terms or in relative terms. Absolute performance measures are often associated with hedge funds, as they aim to give investors positive returns, irrespective of how the broader market indices perform. Individual investors are most often concerned about the absolute performance as these investments must match specific liabilities or outcomes. The most common absolute measure is the Sharpe ratio. An interesting outcome of this measure is the standardisation of performance on a risk-adjusted basis. The results of each fund's individual Sharpe ratio allows a fund of funds manager to compare the one fund relative to another fund, or a benchmark, on a risk-adjusted basis. Relative measures are most used in the mutual fund industry as they indicate how an actively managed fund performs to a benchmark or peer group. The choice

of benchmark is very important. Often a fund manager's remuneration is dependent on the relative performance of the fund. Therefore, a fair and equitable benchmark must be chosen to ensure fair treatment of the investor and the fund manager.

The benchmark chosen for the fund is based on investment goals. For instance, equity indices are often used for equity funds, allowing an investor to compare the fund's performance relative to the market. However, making such a quick assessment may not be accurate. The mandate of the fund and risk tolerance of the fund manager may have significant influence on how the fund is managed and performs. Chang and Lewellen (1985), Admati *et al*. (1986), Lehmann and Modest (1987), and Daniel *et al.*, (1997) also noted other important factors that drive the performance of a fund. These include survivability, portfolio composition and non-CAPM return generating factors in measuring performance. Therefore, measures like Jensen's alpha are very sensitive to the chosen benchmark. For instance, a South African equity fund that uses an equal weighting scheme runs the risk of having a materially different performance outcome compared to the FTSE/JSE All Share Index.

This divergence can be attributed to the different weighting schemes. In other words, if a fund can take an active stance to reduce concentration risk by equally weighting its securities, it runs the risk of underperforming the benchmark in absolute terms and on a risk-adjusted basis using a measure like Jensen's alpha. The main reason for this stems from the FTSE/JSE All Share Index being value weighted (market capitalisation). If, say, the larger cap-weighted shares perform well, the risk conscious manager, who reduces concentration risk, can materially underperform the FTSE/JSE All Share Index. A peer group relative measure may be a more accurate measure of a manager's performance (ASISA Classification Standards 2021).

For a multi-asset balanced fund, the benchmark is also critical when assessing risk adjusted performances. There are three common benchmarks used within the ASISA South Africa multi asset high equity category, which are the peer group average; inflation target or composite index, comprising equities, bonds, cash, property and offshore equity; and offshore bonds (ASISA Classification Standards 2021). This study used the peer group average as the benchmark as one of the aims of a fund of funds portfolio manager is to at least outperform the average South Africa multi asset high equity fund.

Besides the benchmark, an appropriate risk-free rate needs to be selected as it is a critical component of the Sharpe- and Treynor ratios. According to Sharpe (1964:431), a risk-free rate or riskless asset's expected return must equal the pure interest rate (price of time). In explaining this statement, risk in investments can be defined as when actual return differs from

the expected return over a defined time period. An example is if an investor invests in a government bond for 1 year with an expected return of 5%. If the actual return is 5%, then the instrument can be considered a risk-free asset. Damodaran (2008:30) pointed out that a risk-free rate should exhibit the following two characteristics:

A. There can be no risk of default associated with its cash flows.
B. There can be no reinvestment risk.

Traditionally, a government bond is used as a risk-free rate as government bonds are considered to be risk-free in terms of default risk. However, given the above requirements, a South African bond does not comply. One can argue that the R186 government bond can be used as risk-free rate for measuring fund performances. This bond was issued on 21 May 1998 and matures in three equal tranches, starting on 21 December 2025, followed by two more payments on 21 December 2026 and 21 December 2027. This bond starts to mature in little more than two and a half years and can be considered a good proxy for a 2- to 5-years risk-free rate. The prevailing yield of the bond is the risk-free rate, but a bond yield reflects so much more than just mechanics, like coupon, time to maturity, future value, and present value. The present value, a derivative of a bond yield, reflects risks like country risk and default risk. Even though government bonds are considered default free, as the South African government controls printing of money, rating agencies like Moody's and Fitch have a different opinion. Moody's gives South Africa's long-term local currency debt a rating of Ba2 (Moody's, 2022). Fitch has a similar opinion, rating South Africa's long-term local currency debt at BB- on 23 December 2022 (Fitch, 2023). When looking at the rating definitions, it does not convey confidence that the South African government will be able to meet its long-term debt obligations. According to Fitch, a BB rating indicates an elevated vulnerability to default risk, particularly in the event of adverse changes in business or economic conditions over time; however, business, or financial flexibility exists that supports the servicing of financial commitments. Moody's define an issuer with a Ba2 to be speculative and subject to substantial credit risk. In broader terms, these ratings are sub-investment grade or "junk". What this implies is that the issuer will likely default on its debt and therefore investors require higher yields to compensate for this risk. With default risk priced in, it violates one of the key requirements for a risk-free rate.

The other requirement for a risk-free rate is that an investor does not face reinvestment risk. An investor holding a South African bond does face reinvestment risk as the South African bond market is very volatile. This means that the investor faces a risk that he/she will not be able to invest the quarterly coupons at the same yield as the yield secured on the original investment. For these reasons, South African bonds do not make good risk-free rate proxies.

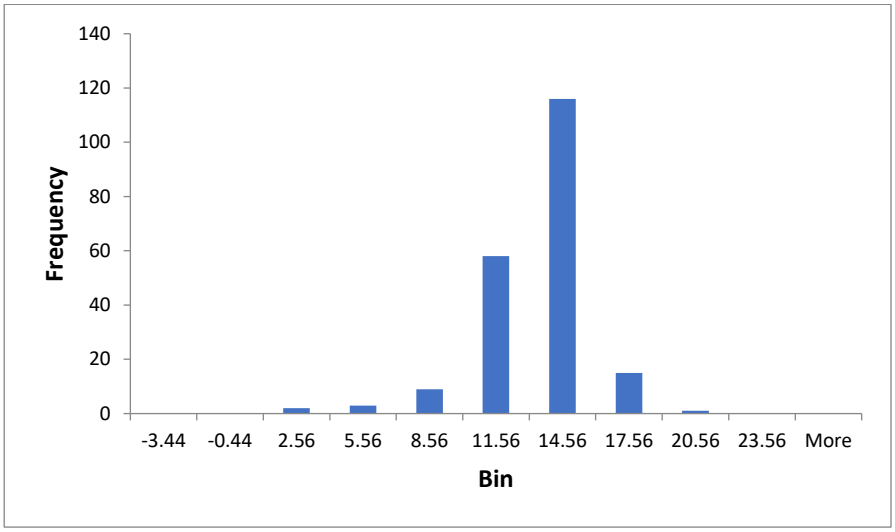
In the retail investment market, a bank rate is often used as a risk-free rate. As a bank rate most closely matches the expected return of a deposit. In other words, if a bank states that a 3-month deposit has a 5% nominal rate, then that is what the investor receives after 3 months. This eliminates the re-investment risk to the extent that the rate is fixed and only changes in rare circumstances, such as in the case of a change in the SARBs REPO rate. The only risk an investor faces is default risk, as banks are private institutions. To reduce the probability of default risk, an investor can use more than one banking institution or use multiple instruments. This is where the SteFI rate come in. The SteFI (Alexander Forbes Short Term Fixed Interest Index) is a commonly used benchmark of returns earned in the South African money market. The money market consists of cash-like investments with a maturity of under one year. Examples of these instruments include call deposits, negotiable certificates of deposit (NCD), treasury bills & bridging bonds. What this index effectively eliminates for an investor is duration risk and term risk.

It was critical for this study to establish a credible risk-free rate as this rate was used in the construction of the various test portfolios as well as for measuring performance of the test portfolios. The Sharpe- and Treynor ratios were used in the performance measuring of the test portfolios. A detailed explanation of performance measurements is given in the next section. For the Sharpe ratio to work, the underlying performance data need to have a normal distribution. To determine whether the benchmark has a normal distribution, the study analysed the ASISA South African multi asset high Equity category data.

To assess the benchmark, the various fund performances within the ASISA South African multi asset high equity category were measured over two distinct 5-year periods. The first was from 1 January 2011 to 31 December 2015 and the second from 1 January 2016 to 31 December 2020. For the first period from 2011 to 2015, a total of 79 funds were analysed within the ASISA South Africa multi asset high equity category. Data were sourced from the Morningstar Direct database. Performances were measured for the oldest class available for funds with more than one class.

The histogram below indicates the distribution of fund performances over the 5-year period. Each bin size is equal to the sample's standard deviation. The peer group average return for this period was 11.95% (annualised) using Morningstar data. What is evident is that a vast majority of funds was close to the peer group average of 11.95% (annualised).

Figure 5: Performance distribution for the 5-year period ending 31 Dec 2015.



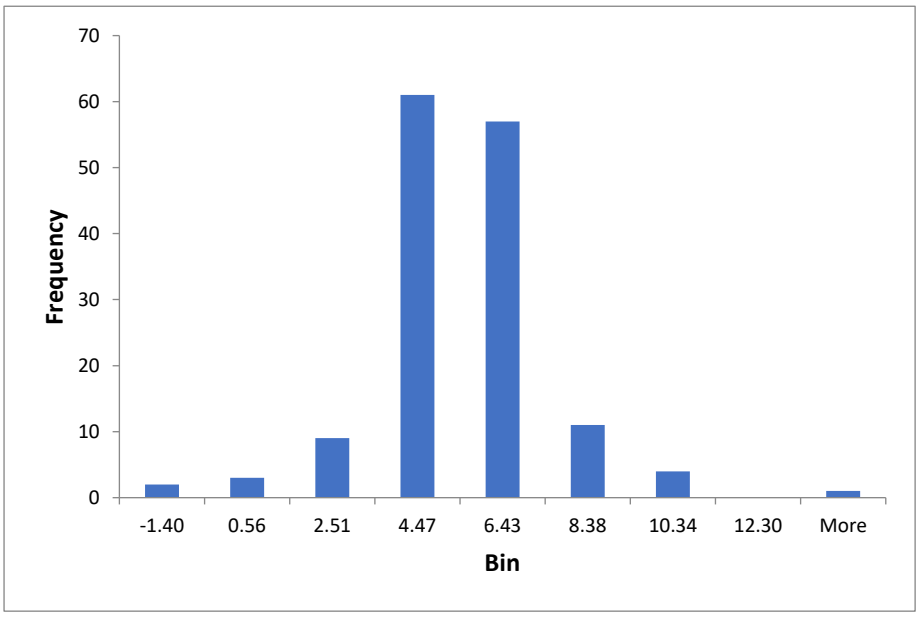
Bin	*Frequency*
-3.44	0
-0.44	0
2.56	2
5.56	3
8.56	9
11.56	58
14.56	116
17.56	15
20.56	1
23.56	0
More	0

Source: Morningstar

The performance distribution had a standard deviation of 2.96% and 67 funds were within one standard deviation (appendix A1).

For the subsequent 5-year period from 2015 to 2020, the total number of unique funds increased to 148, using Morningstar data. The histogram in Figure 6 indicates that most of the funds' performances are concentrated around the mean of 4.47%, with a standard deviation of 1.95%.

Figure 6: Performance distribution for the 5-year period ending 31 Dec 2020.



Bin	*Frequency*
-1.40	2
0.56	3
2.51	9
4.47	61
6.43	57
8.38	11
10.34	4
12.30	0
More	1

Source: Morningstar

For the peer group average to be equitable and fair for both investor and portfolio managers, the performance distribution of the peer group must be normally distributed. Figures 6 and 7

indicate that the distributions are normally distributed and thus can be considered a fair and equitable benchmark.

The study constructed various fund of funds portfolios based on different weighting methodologies. These portfolios were then benchmarked against the peer group average as well as each other. The results of the relative measures indicated which weighting methodology performed the best or worst and which outperformed the peer group average.

3.4 Performance measuring

Measuring of performance is very important throughout the study as it was used in assessing the funds for inclusion in the various test portfolios. The test portfolios were constructed and then evaluated over various time periods.

To measure the performance and risk of the test portfolios the following metrics were used:

1. Absolute performance
2. Sharpe ratio
3. Treynor ratio
4. Standard deviation
5. Downside deviation

The Sharpe- and Treynor ratios were both used in assessing performance and in the portfolio construction. Both ratios were used because these rations are widely used in the industry as well as their familiarity of it among investing professional and financial advisor, especially the Sharpe ratio. These ratios standardised the performance numbers, by expressing the returns as a function of the level or risk taken. This standardisation allows the study to compare results (risk adjusted) across all the funds. The Sharpe ratio is a very good metric to use, in of comparing performance records of the various fund within the same asset class or strategies. As shown in figure 6 and 7, the performance distribution of the funds is bell-shaped. Therefore, it is very tractable mathematically, has no arbitrary parameters and has simple economic properties. The Treynor ratio indicates what the excess return per unit of systematic risk of. It is this risk that cannot be diversified away. It is one of the advantages of a fund of funds, that an investor has.

In Chapter 4, the performances of the various test portfolios were calculated according to the above measures, irrespective of the portfolio construction method.

The detailed explanation of the portfolio construction process for the four test portfolios is provided in Section 3.7 below. A brief explanation of how the Sharpe- and Treynor ratios were

used in a portfolio construction process is warranted. The Sharpe ratio was used in construction of two test portfolios, namely the Sharpe weighting methodology portfolio and the equal weight test portfolio.

Funds eligible for selection were ranked according to the Sharpe ratio. For the equal weight test portfolio**,** only 10 funds were selected from all the eligible funds (Section 3.6). To facilitate the selection process, the highest-ranking funds according to the Sharpe ratio were selected an included at equal weight (10%). The Sharpe weighting methodology portfolio (Sharpe test portfolio) used the same rankings but assigned weights proportionately to the total of the Sharpe ratios of the top 10 funds. The fund having the highest Sharpe ratio was assigned the highest exposure by dividing its Sharpe ratio by the total Sharpe ratio of the top 10, and the 10^{th} ranked fund, in turn, had the lowest exposure level as its Sharpe ratio contributed the smallest share to the total share ratio of the top 10 funds. Following this method, the weightings changed for each year.

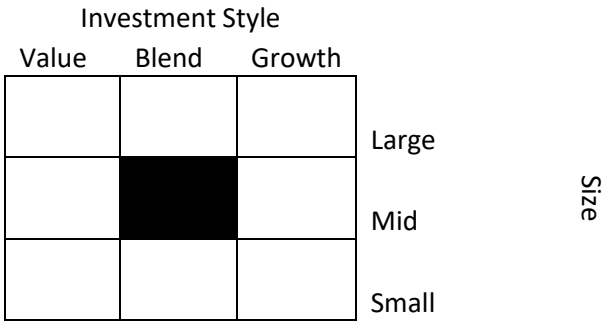
The Treynor ratio was only used in the construction of the Treynor weighting methodology portfolio (Treynor test portfolio). In constructing this portfolio, the eligible funds were ranked according to their Treynor ratios. The top 10 ranked funds were selected for inclusion and weights were assigned proportionately.

For the price momentum test portfolio, the 10 best performing funds were selected based on absolute performance. The performance measurements were based on the difference in NAV or price of the fund.

From the summary above of the different portfolio construction methods, it is clear that fund performance plays a central role in the selection process of a fund of funds portfolio. The above ratios were all based on the top line performance numbers of the eligible funds. This can be perceived as different forms of price momentum investing. That said, performance numbers are the only reliable objective metric a fund of funds manager can use in assessing a fund. Other attributes like investment styles, which are often used in the construction of a fund of funds portfolio, are subjective. The problem with style analysis lies in the determination of each fund's investment philosophy. The determination is highly subjective, with the added complexity that no investment process or philosophy is identical. Fund of funds managers end up with fund classifications encompassing a wide spectrum of investment styles from deep-value-investing to growth and quality. Fund of funds managers can use data providers like Morningstar (a data provider specialising in fund data and top-level fund analysis) to get a more objective assessment. Morningstar analyses each fund in terms of style characteristics and projects that result in a Morningstar Style Box. The analysis is done through a bottom-up

approach. Each underlying security's style is determined within a fund, which is then rolled up to determine the overall investment style of the fund. The figure below indicates a nine square grid with three stock investment styles, namely value, blend and growth. The Blend is a combination of value and growth. On the vertical axis, the size factor is indicated from large to small.

Figure 7: Morningstar style grid.



Source: Morningstar

The selection task then remains very challenging, as such systems add another level of complexity by assessing not only whether the fund has a value style or growth style, also whether the fund invests in large market capitalisation or small/low market capitalisation shares (Figure 7).

If one could sort the eligible funds list according to style, then the manager still needs to select one or more funds from each style bucket. On what bases will the manager then select a fund from each style bucket? To reduce the subjectivity in this study, fund selection according to style was excluded.

3.5 Time period

The Financial Advisory and Intermediary Services Act 37 of 2002 (FAIS) mandates that a disclaimer be added to all collective investment schemes (CIS) funds' minimum disclosure document which states that "The value of participatory interests may go up or down and past performance is not necessarily an indication of future performance". Fund returns are not constant and show variability over time, driven by various factors like the current market regime and different manager investment styles. This implies that results of back testing based on historic performance may not repeat itself. This raises the question on the effectiveness of backward-looking data in applications to portfolio positioning for future periods.

Testing was conducted over various time periods, with the first two periods being two distinct periods of 5 years each. These two 5-year periods were chosen to reflect the typical investment period of 3- to-5-years for a fund classified under ASISA's South Africa multi asset

high equity category (balanced fund). The two 5-year periods were from 1 January 2011 to 31 December 2015 and from 1 January 2016 to 31 December 2020. The testing period indicates if a certain weighting scheme produces consistent results irrespective of the market regime and underlying fund's investment style. In addition to the two main test periods, other periods were also assessed as the Covid-19 pandemic gave this study a unique opportunity to test the various portfolio weighting methods in a severe market downturn and then the subsequent market recovery. Following this, the market experienced levels of very high inflation not seen since 2007. This period of high levels of inflation provides a window to study how the different weighting methods perform in this type of environment.

3.6 Choices of funds

The study selected funds that are registered under the Collective Investment Schemes Control Act 45 of 2002 (CISCA), as it is the main source for a fund of funds manager to select funds and construct a portfolio. A manager can select various funds registered in terms of CISCA from multiple categories that are not classified as a fund of funds. Under current legislation, a fund of funds cannot invest in another fund of funds (FSCA Board Notice 80 of 2012). Thus, the study focused on non-fund of funds available under the ASISA South African multi asset high equity category. These funds can invest in a wide spectrum of assets which include equity, property, cash, and bonds. The manager has the freedom to increase and decrease the risk of a balanced fund as he or she sees fit. In other words, a manager can derive alpha from security selection as well as asset allocation. These funds do have to abide by certain investment limits:

a. Maximum effective equity exposure (including international equity) of 75%
b. Maximum effective property exposure (including international property) of 25% (ASISA fund classification 2021)

In addition to the above, Regulation 28 of the Pension Funds Act 24 of 1965 (Reg 28) also imposes exposure limits. Balanced funds do not have to comply to Reg 28, but to be included in a client's provident or pension portfolio, the fund does need to comply with Reg 28. Regulation 28 dictates the exposure limits regarding offshore investments. In February 2022, the Minister of Finance proposed a change to the offshore limits as set out in Reg 28, which was later adopted, and the South African Reserve Bank announced it in a circular in 2022 (Exchange Control Circular no. 10/2022). The maximum exposure in terms of offshore investments is now set at 45% (previously the limit was at 30%) with an additional 10% for Africa. These changes were not expected to have any effect on the outcome of the study, save for the impact it had on the post Covid-19 testing period. An important implication of the changes to Reg 28 is that managers have more room in terms of asset allocation, as Reg 28

historically limited managers to allocate a large part of the portfolio offshore. This study excluded the asset allocation effect in terms of a fund of funds manager, because the study used balanced funds to construct a fund of funds portfolio and not a building block approach.

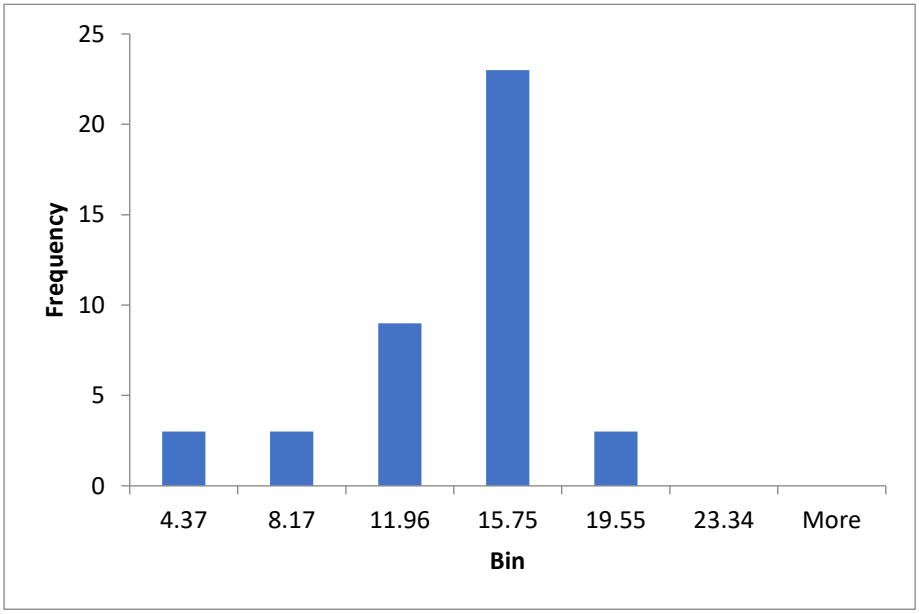
Data was sourced from Morningstar Direct for funds over the decade from 1 January 2011 to 31 December 2022 and were divided in two distinct 5-year periods starting from 1 January 2011 to 31 December 2015 and from 1 January 2016 to 31 December 2020. Furthermore, the study also analysed the post Covid-19 period from 1 January 2020 to 30 November 2022. Performances were measured in terms of total return, which includes interest and dividends.

Due to the restriction that a fund of funds cannot invest in another fund of funds, fund of funds managers has a limited pool of eligible funds to choose from. To assess the performance distribution and determine whether it aligns with the mean, a more detailed analysis of the data is necessary. This analysis is crucial, especially for metrics like the Sharpe ratio, which relies on the assumption of a normal distribution in the underlying data sample. The Sharpe ratio serves as a significant metric for constructing and evaluating different weighting methodologies.

The first period, from 2011 to 2015, was analysed for the South African multi asset high equity category. For this period, there were only 79 active funds for the full 5-year period. To construct a fund of funds portfolio, only non-fund of funds can be used. This reduced the list of eligible funds to only 41. These funds as a group had an average performance of 11.96%, which is almost identical to the entire peer group's average performance of 11.95%. Most of the funds performed around the mean. There were 32 funds out of the 41 funds that were within 1 standard deviation of the mean, 23 funds lay just beyond the peer group average of 11.96 and below 1-sigma[4]* at 15.75%.

[4] Sigma is a statistical measurement of variability, for this study 1-sigma represents 1 standard deviation.

Figure 8: Performance distribution of non-fund of funds for the 5-year period ending 31 Dec 2015.

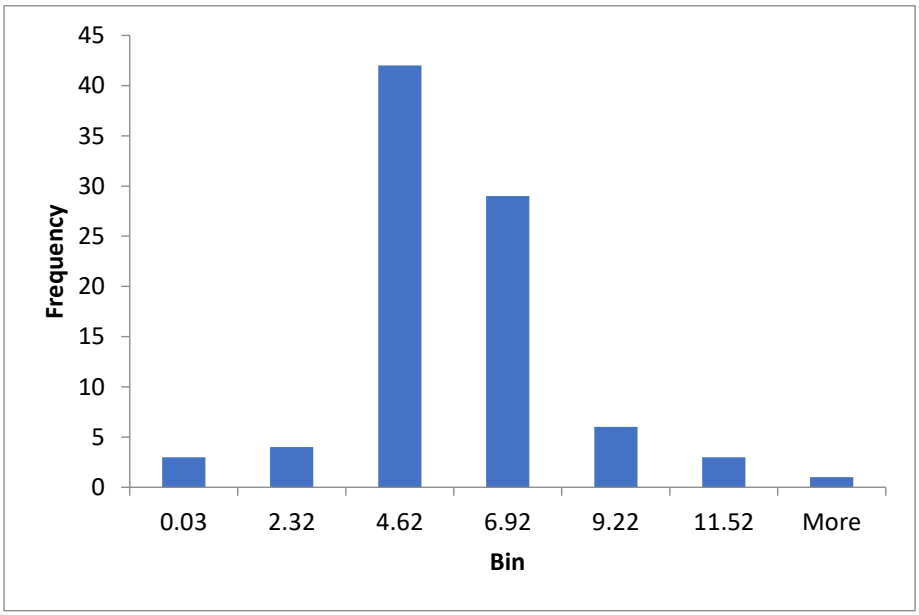


Bin	*Frequency*
4.37	3
8.17	3
11.96	9
15.75	23
19.55	3
23.34	0
More	0

Source: Morningstar

Similar results were found for the subsequent 5-year period. The number of funds in this period increased substantially from 41 in the previous 5-year period to 88 funds according to Morningstar data. Due to adverse market conditions, the 5-year group performance was notably lower, with the 88 funds only averaging 4.62% and the broader peer group 4.47%. The distribution of performances was also concentrated around the mean of 4.62%, with 71 funds being within 1 standard deviation.

Figure 9: Performance distribution of non-fund of funds for the 5-year period ending 31 Dec 2020.



Bin	*Frequency*
0.03	3
2.32	4
4.62	42
6.92	29
9.22	6
11.52	3
More	1

Source: Morningstar

3.7 Portfolio construction strategies

From the data analysis above, the data exhibited a normal distribution, with a large number of fund performances lying within one standard deviation of the mean. Therefore, the study could use the standard deviation as a risk measure in different portfolio construction methods. The study constructed various test portfolios using different methodologies to determine which weighting regime is the optimal. The first test portfolio tested the commonly used equal weight methodology. The second portfolio made use of the Sharpe ratio as the basis of portfolio construction. The third portfolio was based on the Treynor value. Finally, a fourth portfolio was constructed by employing a price momentum-based strategy.

These four portfolio construction methods or strategies selected only non-fund of funds, as indicated above. Funds eligible for selection were measured at the beginning of each period based on the previous 3-year performance numbers and the portfolios were rebalanced at the beginning of each year. Take the Sharpe weighting method portfolio (Sharpe test portfolio) as an example. In determining the holdings for the 1st period on 1 January 2011, the Sharpe ratio was calculated for all the eligible funds over a 3-year period from 1 January 2008 to 31 December 2010. The Sharpe ratios were then ranked from the largest to the smallest, with the top 10 funds being selected for the portfolio. Weights were assigned proportionately to their Sharpe value, with the fund having the largest Sharpe ratio being assigned the largest proportionate weight. These positions were set to remain unchanged for the calendar year. At the beginning of the new year, say 2012, the process was repeated. The Sharpe ratios were calculated and ranked again for all the eligible funds over a 3-year period (1 January 2009 to 31 December 2011). The top 10 funds were selected and assigned proportionate weights.

Since all four portfolio construction methods aimed to keep the top 10 funds (according to Sharpe, Treynor or price momentum) in the fund of funds, the ideal weighting regime was tested by means of a price momentum strategy.

A 3-year period was used to calculate the Sharpe- and Treynor ratios, because a 3-year period is considered the minimum investment for a balanced fund in the South African multi asset high equity category. Extending the period to 5 years may exclude some new funds that could be beneficial for the portfolio. A balance needed to be struck between having a long performance track record and the number of available funds.

The next sections explain in detail how each test portfolio was constructed and how each measure used was calculated. As a summary, the table below indicates the important aspects of each weighting method tested.

Table 3: Summary of the main aspects of each portfolio construction method.

	Equal weight Portfolio	Sharpe test portfolio	Treynor test portfolio	Price momentum test portfolio
Selection method	Sharpe ratio	Sharpe ratio	Treynor	Absolute Performance
Number of funds selected	10	10	10	10
Weights assigned	Equal	Proportionately	Proportionately	Proportionately
Portfolio re-weighting	Yearly	Yearly	Yearly	Quarterly

3.7.1 Equal weighting test portfolio

In most fund of funds portfolios, the underlying funds are selected with little to no regard for the risk each fund contributes to the fund of funds' total risk level. A common risk measure is the standard deviation, which is one of the key components of the Sharpe ratio. The Sharpe ratio was the basis for the second test portfolio, which attempted to incorporate a risk component in the overall portfolio construction process. However, as a risk measure, the Sharpe ratio has several practical limitations which may affect the results, such as standard deviation. It is used as a common measure of risk which implies that the distribution of the returns is normal. Several studies suggest that many return series are not normally distributed (Mistry & Shah, 2013:10). Another limitation is that the average return of a security is considered to be the expected return. Equally weighing the assets within the portfolio eliminates some of the shortcomings of the Sharpe ratio as it does not rely on expected returns and can be considered more robust compared to value-weighted or price-weighted methods (Malladi & Fabozzi, 2017:188)

The equal weight strategy is a propositional method that gives identical importance to each security or fund within a portfolio.

$$EQ_a = \frac{1}{N}, \tag{3.1}$$

where

N = number of securities.

The analysis below indicates that funds within the ASISA South African multi asset high equity category tends to equal weight holdings or securities within the portfolio, but not fully. This study was stricter and followed a robust equal weight regime in constructing the equal-weighted test portfolio. The results of how the equal weight test portfolio performed were then compared to the peer group average performance.

By using the method that Block and French (2002) used to determine whether a mutual fund is market weighted or equity weighted, it could be determined whether a fund of funds portfolio is, to some extent, equally weighted. The metrics were applied to both 5-year periods, 2011 to 2015 and 2016 to 2020. Underlying securities exposure for each fund was observed at the end of each 5-year period.

The weight w_i of an individual security S_i as a portion of a portfolio of size N is

$$w_i = S_i \sum_{i=1}^{N} S_i. \tag{3.2}$$

For any portfolio, the total deviation *de* of observed portfolio weights from hypothetically perfect equal weight is:

$$de = \sum_{i=1}^{N} |w_i - 1/N|. \tag{3.3}$$

The maximum possible total deviation de_{max} is:

$$de_{MAX} = 1 + \frac{N-2}{N}. \tag{3.4}$$

In this case, the measure of equal weight of a portfolio will be the total observed portfolio deviation from the equal weight ideal (Equation 3.4) as a portion of the maximum possible deviation (Equation 3.5), expressed as a difference from 1. Following this process, the equally weighted measure M_{ew} is therefore:

$$M_{ew} = 1 - \frac{de}{de_{MAX}}. \tag{3.5}$$

A perfectly equal weighted portfolio will have a M_{ew} of 1. The less a portfolio is equally weighted, the lower the number M_{ew} will be.

Using Equation 3.5, the composition of weighting measures was determined for the fund of funds outlined in Section 3.4. In the first 5-year period from 2011 to 2015, a total number of 38 fund of funds (Appendix B1) were analysed, with the median fund of funds containing 7 funds. The equally weighted measure (M_{ew}) was 0.65, suggesting that managers favoured a more equally weighted portfolio construction regime over this period.

For the subsequent 5-year period from 2016 to 2020, a total of 59 funds were analysed, with the median portfolio containing 8 funds. This analysis yielded similar results as in the previous

5-year period, as the equally weighted measure (M_{ew}) was recorded at 0.68 (Appendix B2), indicating that managers still favoured equal weighting within a fund of funds.

The above analysis indicates that an equal weighting regime is a common portfolio construction technique used by fund of funds managers. To evaluate the research question: "Is the current weighting regime of the underlying funds in a fund of funds portfolio the optimal way of constructing these portfolios?", an equal weight test portfolio was constructed. This equal weighted test portfolio was the basis for comparisons relative to the other weighting methods.

3.7.2 Sharpe weighting methodology portfolio

A fund of funds manager would analyse the eligible funds on various metrics to decide which fund to include. Most often, performance is the first metric analysed. However, this view does not consider the amount of risk taken on with a single security or an entire portfolio. William Sharpe postulated in his 1966 paper titled "Mutual Fund Performance", the now widely used Sharpe ratio. This ratio incorporates both risk and return, enabling an investor to measure the excess expected return that is generated for the extra volatility endured for holding riskier assets (Lo, 2003:37). This portfolio builds on MPT and the CAPM that can be used to determine the value of the market portfolio, whereas the Sharpe ratio is derived from CAPM and is used to evaluate the value of a portfolio of assets (Yang, 2021:5).

The Sharpe ratio is expressed as:

$$S_a = \frac{E(Rp) - rf}{\sigma p}, \tag{3.6}$$

where

$E(Rp)$ = expected return of the portfolio

r_f = risk free rate

σp = standard deviation of the excess return

Funds with higher Sharpe ratios were considered for inclusion in the fund of funds portfolio as these funds have superior risk adjusted returns.

The first test portfolio evaluated whether a portfolio constructed using the Sharpe ratio would deliver superior returns. This portfolio consisted of the 10 funds that had the highest Sharpe ratios. The weight of each of these holdings was assigned proportionately to the sum of the top 10 funds. The fund having the highest Sharpe ratio had the highest exposure level and was determined by dividing that fund's Sharpe ratio by the sum of the top 10 funds' Sharpe ratios. For the 10th fund, the exposure level was the lowest as it's Sharps ratio was smallest

relative to the sum of the top 10. The process was repeated for each year, thus the exposure levels changed each year. The Sharpe ratio was calculated over a 3-year time period, closely matching the minimum investment period for a balanced fund in the ASISA South African multi asset high category. At the beginning of each period, the portfolio was constructed and remained so for that year. For example, in the first test period starting on 1 January 2011, the study calculated the Sharpe ratio for all eligible funds over the previous 3-year period, from 1 January 2008 to 31 December 2010. Then the study selected the top 10 funds according to their Sharpe ratio and weigh proportionately. On 1 January 2012, the process repeated itself, by calculating the Sharpe ratio for all the eligible funds for a 3-year period from 1 January 2009 to 31 December 2011. The outcome of this round's calculations determined the portfolio for the 2012 calendar year. This process was followed for all time periods being assessed in the study.

3.7.3 Treynor weighting methodology portfolio

The Sharpe- and Treynor ratios are used to evaluate risk adjusted returns. While the Sharpe ratio helps investors understand an investment's return relative to its risk, the Treynor ratio explores the excess return for each unit of risk. More importantly, it compares the performance against a different benchmark. This is achieved by substituting the standard deviation of the Sharpe ratio with the beta of the security or fund. A securities beta can be defined as the security's performance per unit of systematic risk, in other words it is a measure of market volatility of a security compared to the market. In this study, the market was set at the peer group average.

Treynor developed a composite performance measure that would apply to investors irrespective of their risk preferences. It builds on capital market theory, where he introduced a risk-free asset that can be combined with the various portfolios on the indifference curve. The combination a risk-free asset and portfolio of risky assets forms a straight portfolio possibility line. Rational and risk-averse investors will always select a portfolio possibility line with a steeper slope, as that will place the investor on a higher indifference curve. The slope of the portfolio possibility line is denoted as:

$$T_a = \frac{E(Rp) - rf}{\beta}, \tag{3.7}$$

where

$E(Rp)$ = expected return of the portfolio

r_f = risk-free rate

β = beta of security

$$\beta_i = \frac{Cov(r_i, r_m)}{Var(r_m)}, \quad (3.8)$$

Cov = covariance

Var = variance

r_i = expected return on an asset i

r_m = average expected rate of return on the market

This ratio determined which portfolio within the South African multi asset high equity category had the highest T-value, indicating a steeper slope. Those funds with the steeper slopes were considered for inclusion in the fund of funds portfolio. The test portfolio comprised the 10 funds with the highest Treynor ratios. Exposure levels were assigned proportionately. The fund with the highest Treynor ratio had the highest exposure level and was determined by dividing that fund's Treynor ratio by the sum of the top 10 funds' Treynor ratios. For the 10th fund, the exposure level was lowest as it's Treynor ratio was smallest relative to the sum of the top 10. The Treynor ratio was calculated over a 3-year period, closely matching the minimum investment period for a balanced fund in the ASISA South African multi asset high category. At the beginning of each period, the portfolio was constructed and remained so for that year. For example, for the first test period starting on 1 January 2011, the study calculated the Treynor ratio for all eligible funds over the previous 3-year period from 1 January 2008 to 31 December 2010. The study then selected the top 10 funds according to their Treynor ratio and weigh proportionately. For 1 January 2012, the process repeated itself by calculating the Treynor ratio for all the eligible funds for a 3-year period from 1 January 2009 to 31 December 2011. The outcome of this round of calculations determined the portfolio for the 2012 calendar year. This process was followed for all time periods being tested in the study.

3.7.4 Price weighting methodology portfolio

The fourth test portfolio considered the momentum in the funds' net asset value (NAV) to decide on their inclusion into the fund of funds portfolio. NAV is commonly referred to as the price of a fund, hence the fourth test portfolio is referred to as the price momentum test portfolio. As with the previous strategies, this strategy can only be successful if the markets are informationally inefficient. If markets are informationally efficient, then the random walk of asset prices will make a price momentum strategy unfeasible as it will yield sub-par performances. Thus it is imperative that market efficiency assumptions like mean, variance

and covariance remain constant over time. These assumptions are also true for the Sharpe- and Treynor ratios.

The capital asset pricing model (CAPM) formulated by Sharpe in 1964, which is based on the portfolio theory postulated by Markowitz (1952), provides portfolio managers with a tool to construct a diversified portfolio using a set of risky and non-risky securities. The CAPM relies on set of core assumptions (mean, variance, and covariance) to remain constant over time. Several portfolio strategies have been derived using CAPM, with the underlying assumption that the mean, variance, and covariance remain constant over time. If these parameters do remain constant over time, a structure or backbone can be constructed for a multi asset portfolio like a balanced fund. Strategic asset allocation (SAA) is just one iteration of this.

Due to limitations like Regulation 28 of the Pension Funds Act 24 of 1965 and other limits ASISA imposes on balanced funds in South Africa, the scope to do active asset allocation is limited. Thus, balanced funds in South Africa have broadly similar asset allocations. This rigidity can have a negative effect on fund performance if the underlying CAPM assumptions suddenly change. Backhaus and Isiksal (2016) found that 60/40 portfolios (60% equities and 40% bonds), which have a static asset allocation, delivered sub-optimal risk-efficient portfolios. This is especially true in periods of large market downturns or corrections where correlations between asset classes increase substantially. This would suggest that the concept of static asset allocation is inadequate and calls for a more dynamic approach. What this also implies is that a portfolio manager can outperform the market, but according to the Efficient Market Hypothesis, the market is assumed to be informationally efficient and active management cannot add value over the long term.

In an efficient market, where asset price changes are random, the market portfolio offers the highest level of return per unit of risk because it captures the efficiency of the market. This implies that a balanced fund should not be able to outperform the peer group average on a risk adjusted basis. Active investment managers disagree and believe that the market can be beaten with superior market-timing and security selection skills. This notion appeals to fund of funds managers who believe that it is possible to achieve better results by selecting the best money manager and that asset class prices can deviate from their fair value.

A balanced fund is not only concerned about mispricing in the equity market, but also in other asset classes like bonds (corporate and government), cash and property. A top-down asset allocation analysis is done by balanced fund managers to determine whether the asset class is mispriced or not. The outcome of this top-down analysis determines the fund’s asset allocation. If markets are efficient, then a top-down analysis will not result in any

outperformance. Similarly, an analysis is needed on the investment style of each manager. In Section 3.4, the different investment styles according to Morningstar is laid out. Appendix A indicates each fund's investment style. An analysis of the investment styles for both periods from 2010 to 2015 and from 2016 to 2020 was conducted on the ASISA South Africa multi asset high equity sector. Risk adjusted performance was calculated for each portfolio using the Sharpe ratio, with the SteFI Composite Index set as the risk-free rate.

Table 4: Risk-adjusted performances for ASISA South Africa multi asset high equity fund from 2010-2015.

Investment Style	**Sharpe ratio**
Value – Large Cap	1.03
Value – Mid Cap	0.75
Blend – Large Cap	1.10
Blend – Mid Cap	1.03
Growth – Large Cap	1.31

Source: Morningstar, 2010-2015

A Sharpe ratio larger than 1 is viewed as favourable. Table 3 sets out the different Sharpe ratios for each investment style for the 2010 to 2015 period. It is only the Value – Mid Cap style that had a Sharpe ratio less than 1, suggesting that an active allocation among styles could have added value for a fund of funds portfolio. The subsequent 5 years from 2016 to 2020 yielded interesting results. Table 4 indicates that the Sharpe ratio for all styles were negative. Performance over that 5-year period was disappointing, with the peer group only achieving a return of 4.47%, below that of SteFI composite index which returned 6.97%.

Table 5: Risk-adjusted performances for ASISA South Africa multi asset high equity fund from 2015-2020.

Investment Style	**Sharpe ratio**
Value – Large Cap	-0.20
Value – Mid	-0.23
Blend – Large Cap	-0.27
Blend – Mid Cap	-0.29
Growth – Large Cap	-0.16

Source: Morningstar, 2016-2020

Volatility during this period increased substantially as measured by the standard deviation of the performance of each fund. The reason for the volatility increase was due to the selloff in risk assets during the Covid-19 pandemic lockdowns. The quick adjustment in share prices speaks for market efficiency as new information became available to market participants. The negative Sharpe ratio also indicates that all investment styles underperformed the risk-free rate. This suggests that the manager should have made an active asset allocation call and

increased the allocation in cash or short-term interest-bearing instruments. The key takeaway is that balanced fund managers will be able to add value by implementing active management on both manager selection and asset allocation levels.

One strategy an active fund of funds manager can employ is a price momentum strategy, essentially buying the leading performing funds over a certain period. This strategy does come with its share of criticism, but markets have broadly accepted this strategy after the work of Jegadesh and Titman in 1993.

Momentum investors are attracted to assets whose price is on an upward trajectory in the hope that the upward movement continues. This is, however, contrary to normal investor psyche which prefers to invest in assets that are trading at depressed levels or below their intrinsic value. Momentum investors will continue to increase exposure to winning securities regardless of the valuation and price. Several authors have identified the price momentum factor, among which was Jegadeesh Narasimhan (Narasimhan, 1990) who identified the price momentum factor in 1990. Fama and French (2012) confirmed the results of Narasimhan (1990) in other markets around the world. According to Fama and French (2012), price momentum is also present in North America, Europe, and the Asia Pacific region.

The above studies mainly focused on equity indices, but the price momentum effect in a multi asset context is less known. This study analysed the price momentum effect in the ASISA South Africa multi asset high equity category. In a fund of funds portfolio, the underlying funds can be viewed as a single security, just like a share. At the end of each quarter, the 10 funds will be chosen with the highest momentum (MOM) value and where the MOM >1.

MOM is computed as follows:

$$MOM = \frac{Pa_t}{Pa_{(t-12)}}, \tag{3.9}$$

where

Pa_t = closing price of the fund

$Pa_{(t-12)}$ = closing price 12 months ago

A price momentum test portfolio was constructed in this study to ascertain if a price momentum-based strategy can add value for investors. Due to the nature of a price momentum strategy, rebalancing of a portfolio must be more frequent. One advantage of a fund of funds is that investing or disinvesting in a fund comes at a zero cost and any capital gains made on investments are not subject to Capital Gains Tax (CGT) (Taxation Laws Amendment Act 31 of 2013). For this study, the price momentum portfolio was rebalanced

each quarter by choosing the top 10 funds ranked according to their MOM value. In constructing the test portfolio for the first 5-year period from 2011 to 2015, performance was measured of all eligible funds over a 1-year time period, from 1 January 2009 to 31 December 2010. The funds with the highest performance (MOM) were selected. Exposure levels were assigned proportionately according to their MOM Value. The fund having the highest performance (MOM value) enjoyed the highest relative weight in the portfolio. This number is derived by dividing the MOM value by the sum of the top 10's MOM values. The 10^{th} fund has the lowest relative exposure, as its MOM value contributed the least to the overall MOM value. This process was repeated quarterly to capture the price momentum of funds that were performing strongly.

3.8 Conclusion

Portfolio construction is very important and can have a meaningful effect on portfolio performance, especially in a fund of funds portfolio. This study constructed various test portfolios to ascertain which method can be used to enhance total portfolio returns. These methods were a simple equal weighting scheme, a risk adjusted scheme measured by the Sharpe ratio, a Treynor-based weighting method measuring the portfolio performance relative to the benchmark, and finally, a price momentum-based strategy that favoured the inclusion of the most recent top performing funds in terms of their price or NAV.

CHAPTER 4: EMPIRICAL RESULTS

4.1 Introduction

The previous chapter set out the research design in terms of portfolio construction. The design defines the process of data collection procedures, research sites and selecting subjects (MacMillan & Schumacher 2001:166). The aim of this process was to provide results that can stand up to scrutiny and are credible. The framework links the research question and the implementation of the research strategy (Durrheim, 2004:29).

This chapter describes how the research subjected the data to statistical analysis. The analysis determined various relationships between variables. Testing was conducted over distinct time periods of 5 years, as it is the appropriate holding period for a fund classified under ASISA's South Africa multi asset high equity category (balanced fund). The study constructed various test portfolios using different methodologies. The first was based on the equal weights, the second on the Sharpe ratio, the third on the Treynor value, and finally, the fourth portfolio evaluated a price momentum-based strategy.

4.2 Market characteristics for the period from 2011 to 2022.

It is important to understand the general market conditions over the period from 2011 to 2022 to provide context of the analysed performance numbers.

Over the 5-year period from 1 January 2011 to 31 December 2015, markets were generally strong. South African equities recorded a 13% annualised return over this period, driving the balanced funds' returns within the ASISA South Africa multi asset high Category. The MSCI World index (net return), which is used as a proxy for offshore equities investments, recorded a return of 7.6% (annualised) in United States dollars and 27.6% (annualised) in rand terms. Offshore investments, from a South African perspective, performed exceptionally well as the rand depreciated from R6.63 to R15.47 against the United States (USA) dollar, a 133.4% (18.47% annualised) growth over the 5-year period. Inflation over the same period was mostly contained at 5.5% per year. Some funds within the ASISA South Africa multi asset high category have an absolute benchmark, tracking the South African consumer price index (CPI). Funds like Coronation Capital Plus' benchmark is CPI+4% and the Rezco Value Trend fund aims to achieve returns more than CPI+5% over a 3–5-year period. An inflation plus 4.5% equates to around 10% per annum over the period. The South Africa multi asset high category average achieved a return of 11.2% (annualised) outperforming the CPI+4.5% target. Due to the stability in SA inflation, the South African Reserve Bank kept interest rates stable, resulting in a moderate return for SA government bonds. Returns from the long end to the short end of the SA bond yield curve were similar, ranging from 5.6% for the 12-years plus to 6.4% for the

shorter-term SA bonds. Another asset class linked to inflation and interest rates are SA listed property, which had a very strong 5-year period, growing at 18.7% per annum.

Table 6: Market Performances for the 5-year period from 2011 to 2015.

Instrument	2011 – 2015	2011	2012	2013	2014	2015
(ASISA) South African MA High Equity	11.2%	5.3%	16.3%	18.0%	9.5%	7.7%
FTSE/JSE ALB 1-3 Yr TR ZAR	6.4%	8.9%	8.3%	4.4%	6.2%	4.1%
FTSE/JSE ALB 3-7 Yr TR ZAR	6.7%	10.2%	13.6%	1.4%	7.9%	0.9%
FTSE/JSE ALB 7-12 Yr TR ZAR	6.4%	10.3%	18.3%	-0.2%	8.3%	-3.2%
FTSE/JSE ALB 12+ Yr TR ZAR	5.6%	6.0%	18.7%	-0.7%	12.9%	-7.0%
FTSE/JSE All Bond TR ZAR	6.1%	8.9%	15.9%	0.6%	10.1%	-3.9%
FTSE/JSE All Property TR ZAR	18.7%	7.1%	35.4%	13.2%	26.0%	13.8%
FTSE/JSE All Share TR ZAR	13.0%	2.6%	26.7%	21.4%	10.9%	5.1%
MSCI World NR	27.6%	15.3%	21.7%	56.4%	15.9%	32.8%
MSCI World NR (USD)	7.6%	-5.5%	15.8%	26.7%	4.9%	-0.9%
USA dollar to the ZAR[1]	18.5%	22.0%	4.6%	24.0%	10.2%	33.8%

6. A positive number indicates that the rand depreciated against the USA dollar.

Source: MorningStar and iNet.

The second 5-year period (2016 -2020) was very disappointing for investors, who had to cope with lacklustre economic growth and the onset of a global pandemic. SA equities barely outperformed SA inflation of 4.6%, with the FTSE/JSE All Share Index only returning 6.4% from 2016 to 2020. SA Listed property was the big outlier with the FTSE/JSE All Property Index declining 11.3% (annualised). The sector was marred by years of elevated income distribution payments that were not supported by the underlying cash flows, resulting in an ever-weakening company fundamentals and balance sheets.

The sector was hard hit in 2020, with the FTSE/JSE All Property Index declining by 35.5%, precipitated by the onset of local and global lockdowns announced to curb the spread of the Covid-19 virus. These lockdowns severely limited people's movements, negatively affecting retail and office space. Some asset classes, like SA Government Bonds, performed strongly, as the South African Reserve Bank cut rates aggressively to stabilise the SA economy. The Monetary Policy Committee (MPC) of the South African Reserve Bank cut the REPO rate 5 times from 6.5% down to 3.5%. These cuts lowered the SA government bond yields, resulting in healthy returns. These lower rates were viewed by the market as a short- to medium-term solution to the economic downturn caused by the pandemic. The short- to medium-term bonds recorded much higher returns than the longer-duration bonds. Offshore equity markets in USA dollar terms advanced 12.2% over the period, with the rand to the USA dollar appreciating 5%. Investment choices were very difficult for balanced fund managers as most asset class performances delivered disappointing returns and those that were driving overall performances barely beat the CPI+4.5% target range of 9%.

Table 7: Market Performances for the 5-year period from 2016 to 2020.

Instrument	2016 – 2020	2016	2017	2018	2019	2020
(ASISA) South African MA High Equity	4.3%	1.3%	10.0%	-3.6%	9.5%	5.2%
FTSE/JSE ALB 1-3 Yr TR ZAR	9.6%	10.1%	9.6%	9.1%	7.5%	11.5%
FTSE/JSE ALB 3-7 Yr TR ZAR	11.9%	13.4%	11.3%	7.3%	11.5%	16.3%
FTSE/JSE ALB 7-12 Yr TR ZAR	11.2%	15.4%	11.1%	7.3%	12.0%	10.6%
FTSE/JSE ALB 12+ Yr TR ZAR	9.7%	17.4%	9.7%	7.7%	9.3%	4.6%
FTSE/JSE All Bond TR ZAR	10.4%	15.4%	10.2%	7.7%	10.3%	8.7%
FTSE/JSE All Property TR ZAR	-11.3%	-0.4%	14.6%	-25.0%	-0.4%	-35.5%
FTSE/JSE All Share TR ZAR	6.4%	2.6%	21.0%	-8.5%	12.0%	7.0%
MSCI World NR	11.0%	-5.1%	10.8%	6.1%	24.1%	21.7%
MSCI World NR (USD)	12.2%	7.5%	22.4%	-8.7%	27.7%	15.9%
USA dollar to the ZAR	-5.0%	-11.2%	-9.9%	15.9%	-2.5%	5.0%

A positive number indicates that the rand depreciated against the USA dollar.

Source: Morningstar and iNet.

4.3 Equal weight test portfolio results

The equal weight portfolios' exposures to each fund were allocated equally amongst the top 10 funds according to the Sharpe ratio, as denoted in Equation 3.6, and each years' holdings are set out in the tables below. These holdings constitute the equal weight portfolio. This straightforward weighting method performed remarkably well in the 5-year period up to 2015.

Table 8: Holdings used to construct the equal weight portfolio, 2011 to 2013.

2011	
Fund	**Weight**
Coronation Capital Plus	10.00%
Nedgroup Inv Managed R	10.00%
NGI Private Wealth Diversified Growth A	10.00%
Coronation Balanced Plus A	10.00%
Rezco Value Trend A	10.00%
Ninety One Opportunity R	10.00%
Palmyra BCI Balanced A	10.00%
Foord Balanced A	10.00%
Discovery Balanced	10.00%
Allan Gray Balanced A	10.00%

2012	
Fund	**Weight**
Ninety One Opportunity R	10.00%
Coronation Balanced Plus A	10.00%
Coronation Capital Plus	10.00%
PSG Balanced A	10.00%
Nedgroup Inv Managed R	10.00%
NGI Private Wealth Diversified Growth A	10.00%
Foord Balanced A	10.00%
Palmyra BCI Balanced A	10.00%
Discovery Balanced	10.00%
Allan Gray Balanced A	10.00%

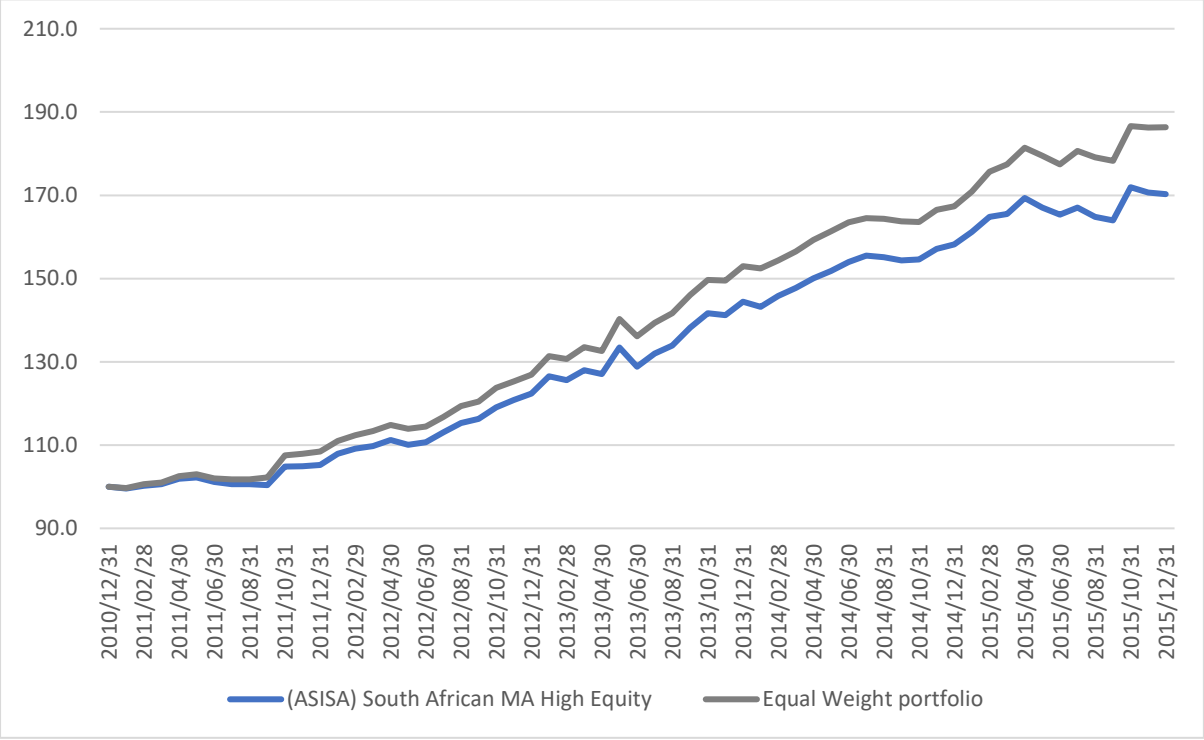
2013	
Fund	**Weight**
Afena Managed Prescient B3	10.00%
Rezco Value Trend A	10.00%
Ninety One Opportunity R	10.00%
FNB Multi Manager Balanced B1	10.00%
Coronation Capital Plus	10.00%
Foord Balanced A	10.00%
PSG Balanced A	10.00%
Coronation Balanced Plus A	10.00%
STANLIB Balanced B1	10.00%
Nedgroup Inv Core Diversified B	10.00%

Table 9: Holdings used to construct the equal weight portfolio, 2014 & 2015.

2014	
Fund	**Weight**
Rezco Value Trend A	10.00%
Rezco Managed Plus A	10.00%
FNB Multi Manager Balanced B1	10.00%
PSG Balanced A	10.00%
Coronation Balanced Plus A	10.00%
Afena Managed Prescient B3	10.00%
Ninety One Opportunity R	10.00%
Allan Gray Balanced A	10.00%
Foord Balanced A	10.00%
Coronation Capital Plus	10.00%

2015	
Fund	**Weight**
Rezco Value Trend A	10.00%
Rezco Managed Plus A	10.00%
Coronation Balanced Plus A	10.00%
Autus Prime Balanced A	10.00%
PSG Balanced A	10.00%
Seed Balanced Prescient A1	10.00%
M&G Balanced Fund A	10.00%
Personal Trust Managed	10.00%
Plexus Wealth BCI Balanced A	10.00%
FNB Multi Manager Balanced B1	10.00%

Figure 10: Cumulative performance of the equal weight portfolio and the peer group average for the 5-year period ending 2015.



Source: Morningstar

Table 10: Discrete yearly performances using equal weight portfolio and the peer group average.

Portfolio Name	2011 -2015[1]	2011	2012	2013	2014	2015
Equal weight test Portfolio	13.30%	8.40%	17.00%	20.60%	9.40%	11.40%
(ASISA) South African multi asset high equity	11.20%	5.26%	16.27%	18.03%	9.50%	7.66%
Alpha	2.10%	3.14%	0.73%	2.57%	-0.10%	3.74%

Annualised performance

Source: Morningstar

Performance over the 5-year period was also significant, outperforming the South Africa multi asset high equity category average by 1 605 basis points.

For the second 5-year period ending 2020, the following holdings were used to construct the equal weighting method portfolio.

Table 11: Holdings used to construct the using the equal weight test portfolio, 2016 to 2018.

2016	
Fund	**Weight**
Coronation Capital Plus	10.00%
Nedgroup Inv Managed R	10.00%
NGI Private Wealth Diversified Growth A	10.00%
Coronation Balanced Plus A	10.00%
Rezco Value Trend A	10.00%
Ninety One Opportunity R	10.00%
Palmyra BCI Balanced A	10.00%
Foord Balanced A	10.00%
Discovery Balanced	10.00%
Allan Gray Balanced A	10.00%

2017	
Fund	**Weight**
Ninety One Opportunity R	10.00%
Coronation Balanced Plus A	10.00%
Coronation Capital Plus	10.00%
PSG Balanced A	10.00%
Nedgroup Inv Managed R	10.00%
NGI Private Wealth Diversified Growth A	10.00%
Foord Balanced A	10.00%
Palmyra BCI Balanced A	10.00%
Discovery Balanced	10.00%
Allan Gray Balanced A	10.00%

2018	
Fund	**Weight**
Afena Managed Prescient B3	10.00%
Rezco Value Trend A	10.00%
Ninety One Opportunity R	10.00%
FNB Multi Manager Balanced B1	10.00%
Coronation Capital Plus	10.00%
Foord Balanced A	10.00%
PSG Balanced A	10.00%
Coronation Balanced Plus A	10.00%
STANLIB Balanced B1	10.00%
Nedgroup Inv Core Diversified B	10.00%

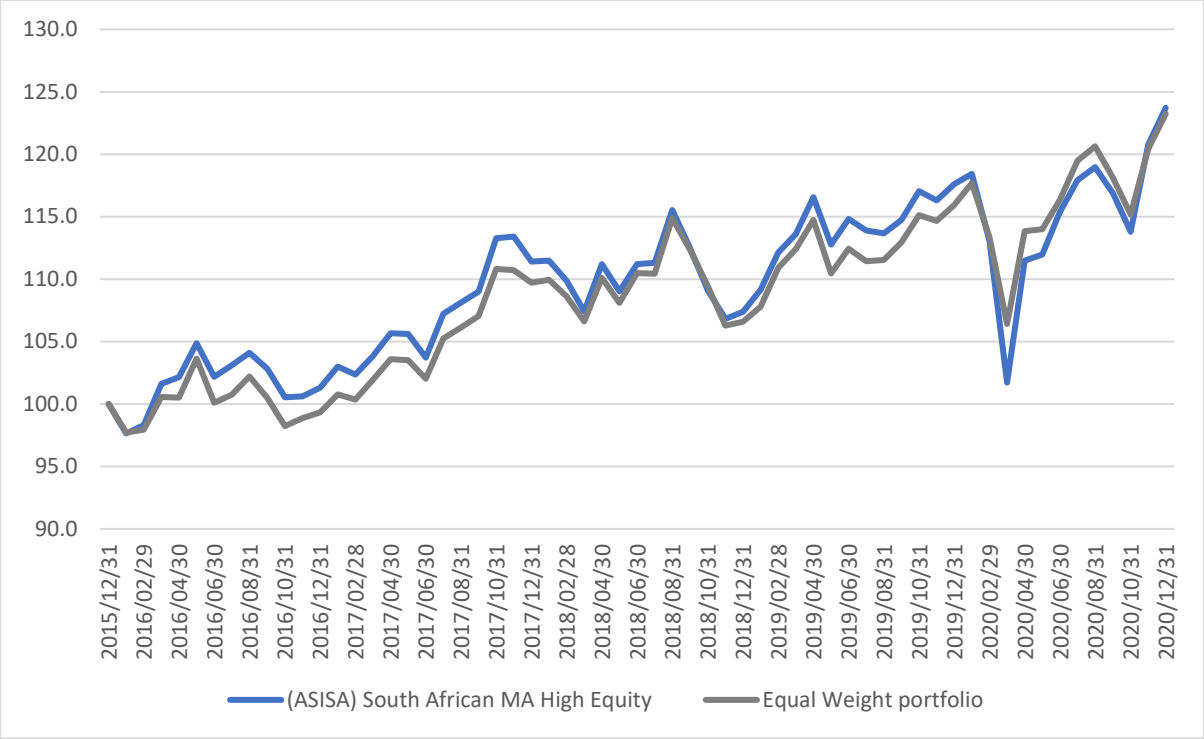
Table 12: Holdings used to construct the using the equal weight portfolio, 2019 & 2020.

2019	
Fund	**Weight**
Rezco Value Trend A	10.00%
Rezco Managed Plus A	10.00%
FNB Multi Manager Balanced B1	10.00%
PSG Balanced A	10.00%
Coronation Balanced Plus A	10.00%
Afena Managed Prescient B3	10.00%
Ninety One Opportunity R	10.00%
Allan Gray Balanced A	10.00%
Foord Balanced A	10.00%
Coronation Capital Plus	10.00%

2020	
Fund	**Weight**
Rezco Value Trend A	10.00%
Rezco Managed Plus A	10.00%
Coronation Balanced Plus A	10.00%
Autus Prime Balanced A	10.00%
PSG Balanced A	10.00%
Seed Balanced Prescient A1	10.00%
M&G Balanced Fund A	10.00%
Personal Trust Managed	10.00%
Plexus Wealth BCI Balanced A	10.00%
FNB Multi Manager Balanced B1	10.00%

The equal weight method did not deliver any positive alpha and offered investors the same level of return as the peer group average over the 5-year period.

Figure 11: Cumulative performance of the equal weighting test portfolio and the peer group average for the 5-year period ending 2020.



Source: Morningstar

Table 13: Discrete yearly performances of the equal weighting test portfolio and the peer group average.

Portfolio Name	2016 – 2020[1]	2016	2017	2018	2019	2020
Equal weight test portfolio	4.27%	-0.66%	10.44%	-2.85%	8.77%	6.30%
(ASISA) South African multi asset high equity	4.35%	1.30%	9.97%	-3.60%	9.52%	5.19%
Alpha	-0.08%	-1.97%	0.47%	0.78%	-0.75%	1.11%

Annualised performance

Source: Morningstar

4.4 Sharpe weighting methodology portfolio results

Using the Sharpe ratio as denoted in Equation 3.6, the Sharpe weighting methodology portfolio was constructed to determine whether this weighting method delivers above average returns both in absolute and risk adjusted terms.

Portfolios were created by selecting the top 10 funds ranked according to their Sharpe ratio. Each of the eligible funds' (non-fund of funds) Sharpe ratio was calculated over a 3-year period. The Sharpe weighting methodology portfolio was rebalanced for the beginning of each year according to the method in Section 3.6. The tables below indicates the new holdings and exposure levels for that year.

Table 14: Holdings used to construct the Sharpe test portfolio, 2011 to 2013.

2011	
Fund	**Weight**
Allan Gray Balanced A	2.42%
Coronation Balanced Plus A	12.49%
Coronation Capital Plus	14.95%
Discovery Balanced	5.01%
Foord Balanced A	6.10%
Nedgroup Inv Managed R	14.53%
NGI Private Wealth Diversified Growth A	13.35%
Ninety One Opportunity R	9.91%
Palmyra BCI Balanced A	9.25%
Rezco Value Trend A	11.99%

2012	
Fund	**Weight**
Allan Gray Balanced A	8.10%
Coronation Balanced Plus A	11.21%
Coronation Capital Plus	10.53%
Discovery Balanced	9.13%
Foord Balanced A	9.21%
Nedgroup Inv Managed R	10.18%
NGI Private Wealth Diversified Growth A	9.60%
Ninety One Opportunity R	12.53%
Palmyra BCI Balanced A	9.13%
PSG Balanced A	10.38%

2013	
Fund	**Weight**
Afena Managed Prescient B3	13.91%
Coronation Balanced Plus A	8.78%
Coronation Capital Plus	9.64%
FNB Multi Manager Balanced B1	10.12%
Foord Balanced A	9.58%
Nedgroup Inv Core Diversified B	7.50%
Ninety One Opportunity R	10.77%
PSG Balanced A	8.95%
Rezco Value Trend A	12.24%
STANLIB Balanced B1	8.52%

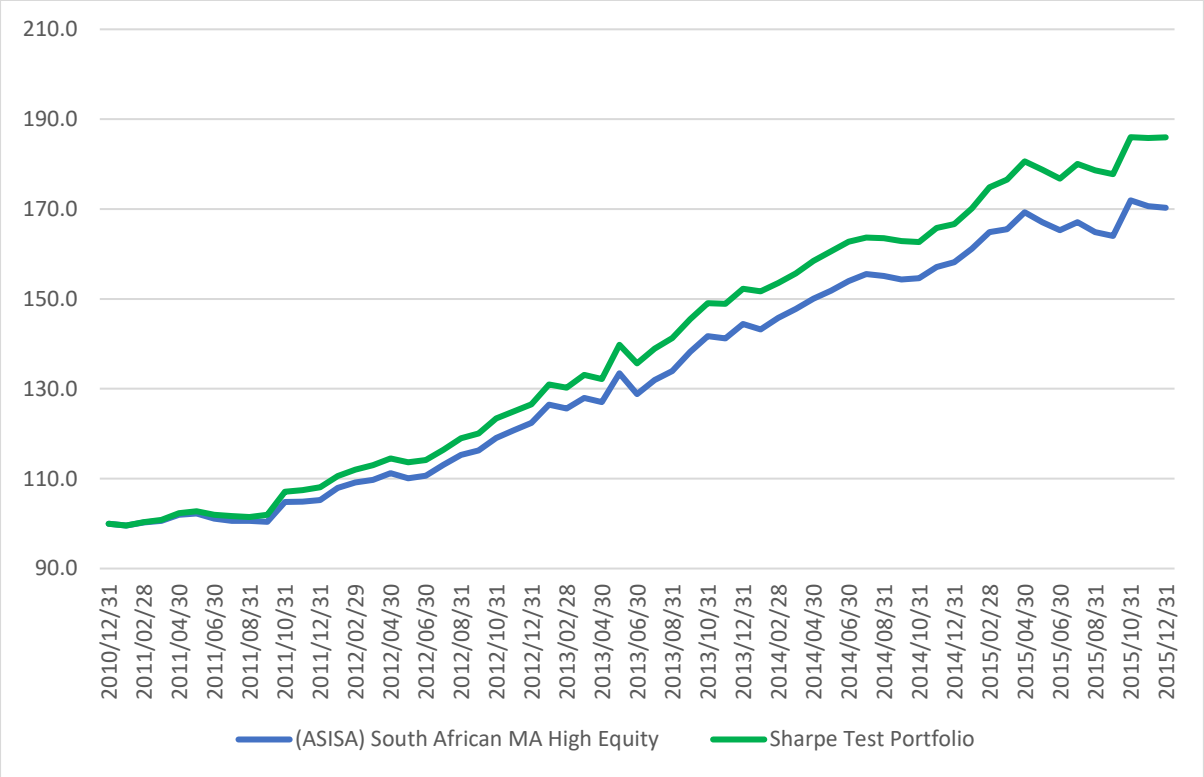
Table 15: Holdings used to construct the Sharpe test portfolio, 2014 & 2015.

2014	
Fund	**Weight**
Afena Managed Prescient B3	9.38%
Allan Gray Balanced A	9.10%
Coronation Balanced Plus A	9.62%
Coronation Capital Plus	8.50%
FNB Multi Manager Balanced B1	10.62%
Foord Balanced A	8.94%
Ninety One Opportunity R	9.37%
PSG Balanced A	10.09%
Rezco Managed Plus A	11.19%
Rezco Value Trend A	13.20%

2015	
Fund	**Weight**
Autus Prime Balanced A	9.82%
Coronation Balanced Plus A	9.90%
FNB Multi Manager Balanced B1	8.99%
M&G Balanced Fund A	9.57%
Personal Trust Managed	9.50%
Plexus Wealth BCI Balanced A	9.27%
PSG Balanced A	9.79%
Rezco Managed Plus A	11.24%
Rezco Value Trend A	12.28%
Seed Balanced Prescient A1	9.65%

The portfolio using the Sharpe test portfolio outperformed the South Africa multi asset high equity category average by a substantial 1 567 basis points in the first 5-year period, as indicated by Figure 12 and Table 16.

Figure 12: Cumulative performance of the Sharpe test portfolio and the peer group average for the 5-year period ending 2015.



Source: Morningstar

Table 16: Discrete annual performances of the Sharpe test portfolio and the peer group average.

Portfolio Name	2011 -2015[1]	2011	2012	2013	2014	2015
Sharpe test portfolio	13.21%	8.44%	17.05%	20.35%	9.44%	11.58%
(ASISA) South African multi asset high equity	11.23%	5.26%	16.27%	18.03%	9.50%	7.66%
Alpha	1.98%	2.85%	0.78%	2.32%	-0.06%	3.92%

Annualised performance

Source: Morningstar

To analyse the following 5-year period from 2016 to 2020 the following holdings were used to construct the Sharpe test portfolio. The tables below indicate the fund composition at the beginning of each year.

Table 17: Holdings used to construct the Sharpe test portfolio, 2016 to 2018.

2016	
Fund	**Weight**
Allan Gray Balanced A	8.93%
Autus Prime Balanced A	11.51%
Coronation Balanced Plus A	8.71%
Discovery Balanced	8.75%
M&G Balanced Fund A	8.26%
Ninety One Managed R	10.30%
Personal Trust Managed	9.79%
Rezco Managed Plus A	12.74%
Rezco Value Trend A	12.01%
Seed Balanced Prescient A1	9.00%

2017	
Fund	**Weight**
Allan Gray Balanced A	11.80%
Discovery Balanced	7.33%
FNB Multi Manager Balanced B1	6.81%
M&G Balanced Fund A	6.68%
Ninety One Managed R	16.43%
Ninety One Opportunity R	8.36%
Personal Trust Managed	8.16%
Plexus Wealth BCI Balanced A	15.49%
PSG Balanced A	11.62%
Seed Balanced Prescient A1	7.33%

2018	
Fund	**Weight**
AF Investments Performer Managed A	4.63%
Allan Gray Balanced A	16.75%
Discovery Balanced	5.34%
Element Balanced SCI C	8.80%
M&G Balanced Fund A	5.09%
Ninety One Managed R	30.13%
Ninety One Opportunity R	6.14%
Personal Trust Managed	4.65%
Plexus Wealth BCI Balanced A	5.49%
PSG Balanced A	12.99%

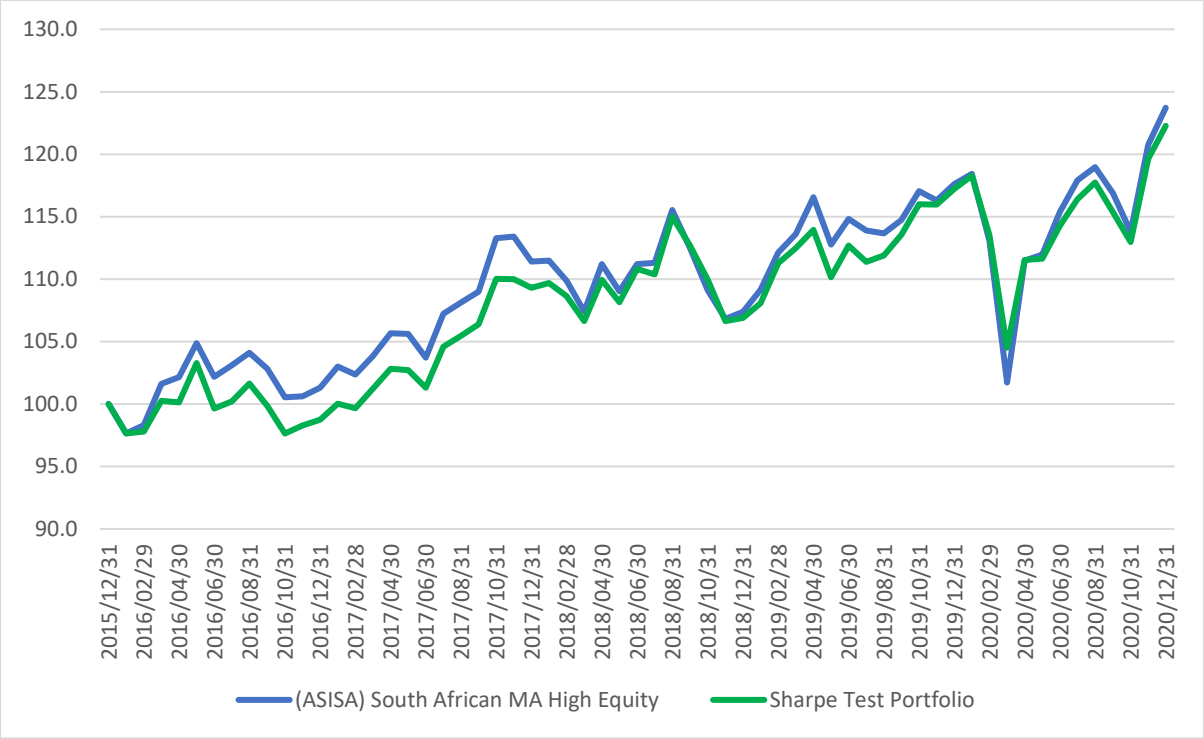
Table 18: Holdings used to construct the Sharpe test portfolio, 2019 & 2020.

2019	
Fund	**Weight**
ABSA Managed C	2.21%
Allan Gray Balanced A	5.13%
Camissa Balanced A	16.63%
Element Balanced SCI C	26.27%
Element Islamic Balanced SCI C	28.92%
M&G Balanced Fund A	1.40%
Ninety One Managed R	5.23%
Old Mutual Balanced R	1.35%
Palmyra BCI Balanced A	1.83%
PSG Balanced A	11.02%

2020	
Fund	**Weight**
Camissa Balanced A	22.45%
Discovery Balanced	2.35%
Element Balanced SCI C	14.67%
Element Islamic Balanced SCI C	14.67%
Melville Douglas STANLIB Balanced B1	8.53%
Nedgroup Inv Managed R	5.91%
Ninety One Managed R	15.69%
Ninety One Opportunity R	4.36%
Rezco Managed Plus A	3.48%
Rezco Value Trend A	1.76%

In the next 5-year period ending 2020, the alpha generated from the Sharpe test portfolio all but disappeared as the 5-year performance was equal to the peer group average.

Figure 13: Cumulative performance of the Sharpe test portfolio and the peer group average for the 5-year period ending 2020.



Source: Morningstar

Table 19: Discrete yearly performances of the Sharpe test portfolio and the peer group average.

Portfolio Name	2016 – 2020[1]	2016	2017	2018	2019	2020
Sharpe test portfolio	4.10%	-1.26%	10.70%	-2.21%	9.67%	4.31%
(ASISA) South African multi asset high equity	4.35%	1.31%	9.97%	-3.60%	9.52%	5.19%
Alpha	-0.25%	-2.57%	0.73%	1.40%	0.15%	-0.88%

Annualised performance

Source: Morningstar

The initial performance assessment indicated that a portfolio using the Sharpe ratio as a fund selection and weighting tool outperformed the peer group average by 198 basis points in the 5-year period ending 31 December 2015. In the second 5-year period ending 31 December 2020, the portfolio underperformed by 144 basis points, as indicated by Figure 13 and Table 19.

4.5 Treynor weighting methodology portfolio results

Using the Treynor equation as denoted in Equation 3.7, the Treynor weighting methodology portfolio was created. For each year, the Treynor portfolio was rebalanced to reflect the changes in performances and risk metrics.

Portfolios were created by selecting the top 10 funds ranked according to their Treynor ratio. Each of the eligible funds' (non-fund of funds) Treynor ratio were calculated over a 3-year

period. The Treynor weighting methodology portfolio was then rebalanced for each year (beginning of each year) according to the method in Section 3.7. The tables below indicate the new holdings and exposure levels for those years.

Table 20: Holdings used to construct the Treynor test portfolio, 2011 to 2013.

2011	
Fund	**Weight**
Coronation Balanced Plus A	12.92%
Coronation Capital Plus	15.51%
Discovery Balanced	4.80%
Foord Balanced A	6.00%
M&G Balanced Fund A	1.79%
Nedgroup Inv Managed R	14.93%
NGI Private Wealth Diversified Growth A	13.84%
Ninety One Opportunity R	10.045
Palmyra BCI Balanced A	9.40%
Rezco Value Trend A	10.77%

2012	
Fund	**Weight**
Allan Gray Balanced A	8.43%
Coronation Balanced Plus A	10.74%
Coronation Capital Plus	10.64%
Discovery Balanced	8.56%
Foord Balanced A	8.77%
Nedgroup Inv Managed R	12.07%
NGI Private Wealth Diversified Growth A	9.12%
Ninety One Opportunity R	11.96%
Palmyra BCI Balanced A	8.66%
PSG Balanced A	11.05%

2013	
Fund	**Weight**
Afena Managed Prescient B3	15.53%
Allan Gray Balanced A	7.62%
Coronation Balanced Plus A	8.39%
Coronation Capital Plus	9.84%
FNB Multi Manager Balanced B1	9.62%
Foord Balanced A	8.88%
Ninety One Opportunity R	10.36%
PSG Balanced A	9.60%
Rezco Value Trend A	12.33%
STANLIB Balanced B1	7.82%

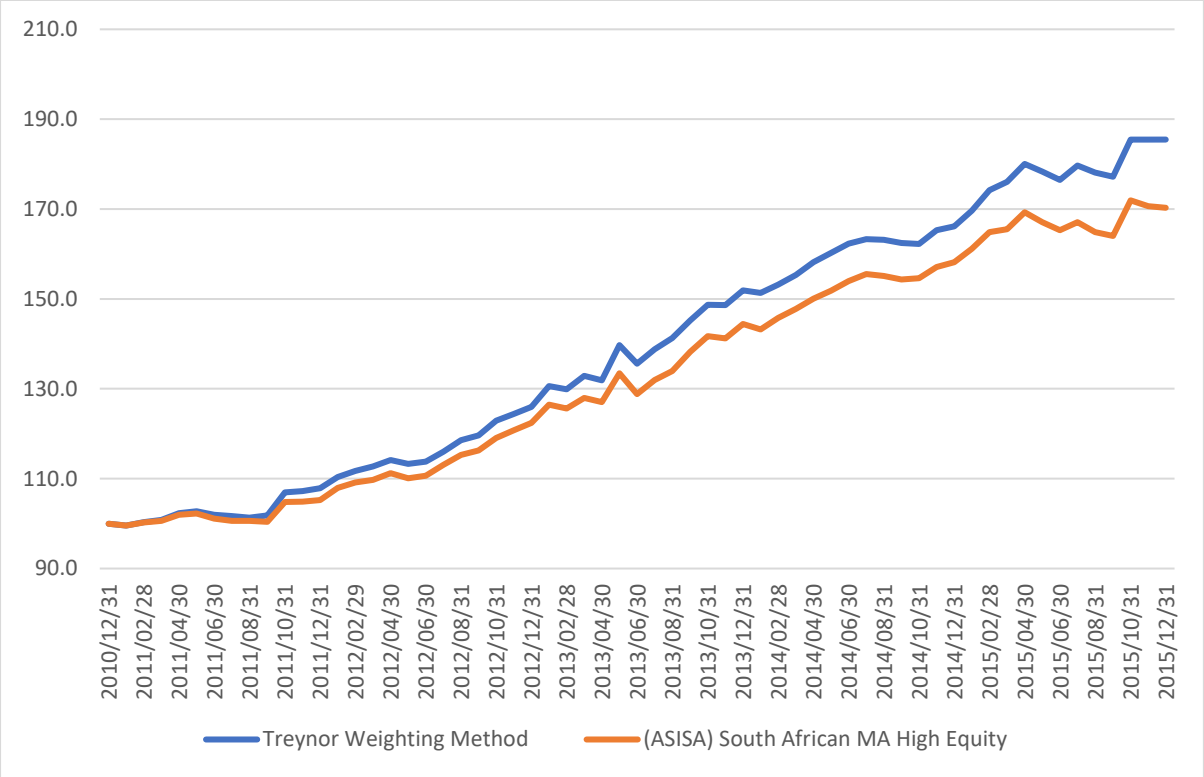
Table 21: Holdings used to construct the Treynor test portfolio, 2014 & 2015.

2014	
Fund	**Weight**
Afena Managed Prescient B3	10.90%
Allan Gray Balanced A	9.29%
Coronation Balanced Plus A	9.26%
Coronation Capital Plus	8.36%
FNB Multi Manager Balanced B1	9.94%
Foord Balanced A	8.32%
Ninety One Opportunity R	9.23%
PSG Balanced A	10.06%
Rezco Managed Plus A	11.30%
Rezco Value Trend A	13.35%

2015	
Fund	**Weight**
Autus Prime Balanced A	9.75%
Coronation Balanced Plus A	9.29%
M&G Balanced Fund A	8.92%
NGI Private Wealth Diversified Growth A	9.07%
Personal Trust Managed	8.83%
Plexus Wealth BCI Balanced A	9.57%
PSG Balanced A	9.78%
Rezco Managed Plus A	12.01%
Rezco Value Trend A	13.21%
Seed Balanced Prescient A1	9.58%

Over the first five-year period from 2011 to 2015, which was measured over a calendar year, Treynor weighting methodology outperformed the South Africa multi asset high equity category average by 1 517 basis points.

Figure 14: Cumulative performance of the Treynor test portfolio and the peer group average for the 5-year period ending 2015.



Source: Morningstar

Table 22: Discrete annual performances of the Treynor test portfolio and the peer group average.

Portfolio Name	2011 -2015[1]	2011	2012	2013	2014	2015
Treynor test portfolio	13.15%	7.91%	16.73%	20.62%	9.35%	11.63%
(ASISA) South African multi asset high equity	11.23%	5.26%	16.27%	18.03%	9.50%	7.66%
Alpha	1.92%	2.65%	0.47%	2.58%	-0.15%	3.97%

Annualised performance

Source: Morningstar

The Treynor test portfolio outperformed over all the discrete periods (Table 22), except in 2014, were the Treynor method underperformed by 15 basis points.

As noted above, performance outcomes in the subsequent 5-year period ending 2020 were substantially different, characterised by weak returns from risk assets like local and global equities. The lower overall fund performances led to substantial changes in the portfolio composition from 2017 onwards compared to previous periods.

To analyse the following 5-year period from 2016 to 2020, the following holding were used to construct the Treynor test portfolio. The tables below indicate the fund composition at the beginning of each year.

Table 23: Holdings used to construct the Treynor test portfolio, 2016 to 2018.

2016	
Fund	**Weight**
Allan Gray Balanced A	8.86%
Autus Prime Balanced A	11.46%
Momentum Focus 7 Fund of Funds A	8.00%
Ninety One Managed R	10.28%
Personal Trust Managed	8.84%
Plexus Wealth BCI Balanced A	8.17%
PSG Balanced A	8.01%
Rezco Managed Plus A	14.37%
Rezco Value Trend A	13.57%
Seed Balanced Prescient A1	8.44%

2017	
Fund	**Weight**
Allan Gray Balanced A	11.80%
Discovery Balanced	6.92%
FNB Multi Manager Balanced B1	6.24%
M&G Balanced Fund A	6.09%
Ninety One Managed R	18.12%
Ninety One Opportunity R	8.67%
Personal Trust Managed	7.56%
Plexus Wealth BCI Balanced A	16.05%
PSG Balanced A	11.69%
Seed Balanced Prescient A1	6.85%

2018	
Fund	**Weight**
ABSA Managed C	4.07%
Allan Gray Balanced A	14.89%
Discovery Balanced	4.50%
Element Balanced SCI C	15.23%
M&G Balanced Fund A	4.15%
Ninety One Managed R	29.88%
Ninety One Opportunity R	5.81%
Personal Trust Managed	3.88%
Plexus Wealth BCI Balanced A	5.33%
PSG Balanced A	12.26%

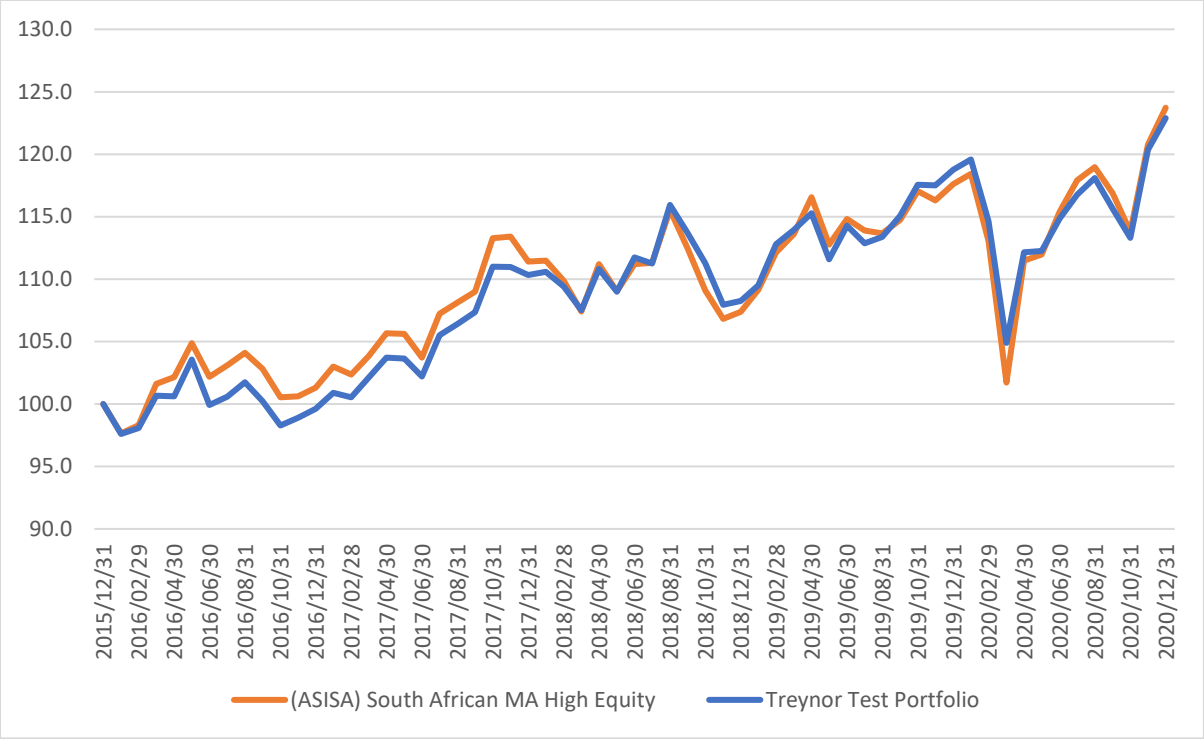
Table 24: Holdings used to construct the Treynor test portfolio, 2019 to 2020.

2019	
Fund	**Weight**
Allan Gray Balanced A	4.60%
Camissa Balanced A	14.67%
Element Balanced SCI C	32.01%
Element Islamic Balanced SCI C	30.05%
M&G Balanced Fund A	1.69%
Nedgroup Inv Core Diversified B	1.43%
Ninety One Managed R	3.52%
Old Mutual Balanced R	1.74%
PSG Balanced A	9.17%
SIM Balanced R	1.11%

2020	
Fund	**Weight**
Camissa Balanced A	21.08%
Discovery Balanced	1.96%
Element Balanced SCI C	29.75%
Element Islamic Balanced SCI C	14.39%
Melville Douglas STANLIB Balanced B1	7.34%
Nedgroup Inv Managed R	4.77%
Ninety One Managed R	14.41%
Ninety One Opportunity R	2.95%
Rezco Managed Plus A	1.78%
STANLIB MM Balanced B1	1.57%

Performances from the Treynor test portfolio was disappointing alongside the broader peer group for the 5-year period ending 2020 and were not able to outperform the CPI+4.5% target. The Treynor test portfolio also underperformed the South Africa multi asset high equity category average by an annualised 14 basis points per year.

Figure 15: Cumulative performance of the Treynor test portfolio and the peer group average for the 5-year period ending 2020.



Source: Morningstar

Table 25: Discrete yearly performances of the Treynor test portfolio and the peer group average.

Portfolio Name	2016 – 2020[1]	2016	2017	2018	2019	2020
Treynor test portfolio	4.60%	-0.38%	10.70%	-1.87%	9.63%	5.28%
(ASISA) South African multi asset high equity	4.21%	1.30%	9.97%	-3.60%	9.52%	5.19%
Alpha	-0.14%	-1.69%	0.77%	1.74%	0.11%	0.09%

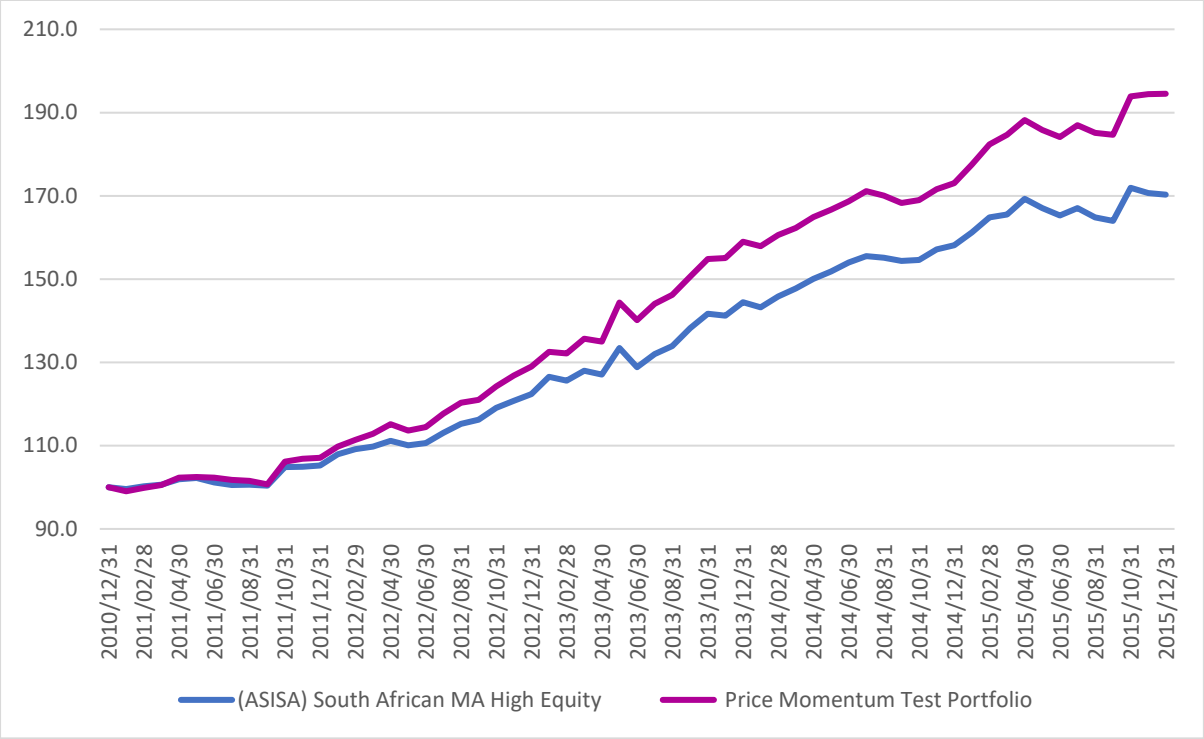
Annualised performance

Source: Morningstar

4.6 Price momentum test portfolio results

The price momentum weighting method differed from the other methods discussed above. Risk was not considered in this method, but rather absolute performance. Balanced funds with the highest performance over the preceding 12-months were selected and these performances also determined their exposure levels within the price momentum portfolio. The fund with the highest performance over the last year was allocated the highest weight and the fund with the lowest performance of the selected 10 funds had the lowest weight. In other words, the exposure level of a fund within the price momentum test portfolio was proportionate to the combined performance of the top 10 funds ($fund\ weight = \frac{w^i}{\Sigma(w^n)}$). Another key difference was that each process of selecting the 10 best performing balanced funds was done quarterly and the price momentum test portfolio was rebalanced for each quarter.

Figure 16: Cumulative performance of the price momentum test portfolio and the peer group average for the 5-year period ending 2015.



Source: Morningstar

Table 26: Discrete annual performances of the price momentum test portfolio and the peer group average.

Portfolio Name	2011 -2015[1]	2011	2012	2013	2014	2015
Price momentum test portfolio	14.23%	7.09%	20.48%	23.21%	8.86%	12.41%
(ASISA) South African multi asset high equity	11.23%	5.26%	16.27%	18.03%	9.50%	7.66%
Alpha	3.00%	1.83%	4.21%	5.18%	-0.64%	4.75%

Annualised performance

Source: Morningstar

Over the 5-year period ending 2015, the price momentum test portfolio outperformed the South Africa multi asset high equity category by 2 423 basis points, as indicated by Figure 16 and Table 26.

The next 5-year period saw the price momentum test portfolio generally performing well, except in 2020, with the peer group average outperforming the price momentum test portfolio by 420 basis points, as indicated in Table 27. This resulted in an overall underperformance of 48 basis points for the 5-year period, as indicated in Figure 17.

Figure 17: Cumulative performance of the price momentum test portfolio and the peer group average for the 5-year period ending 2020.

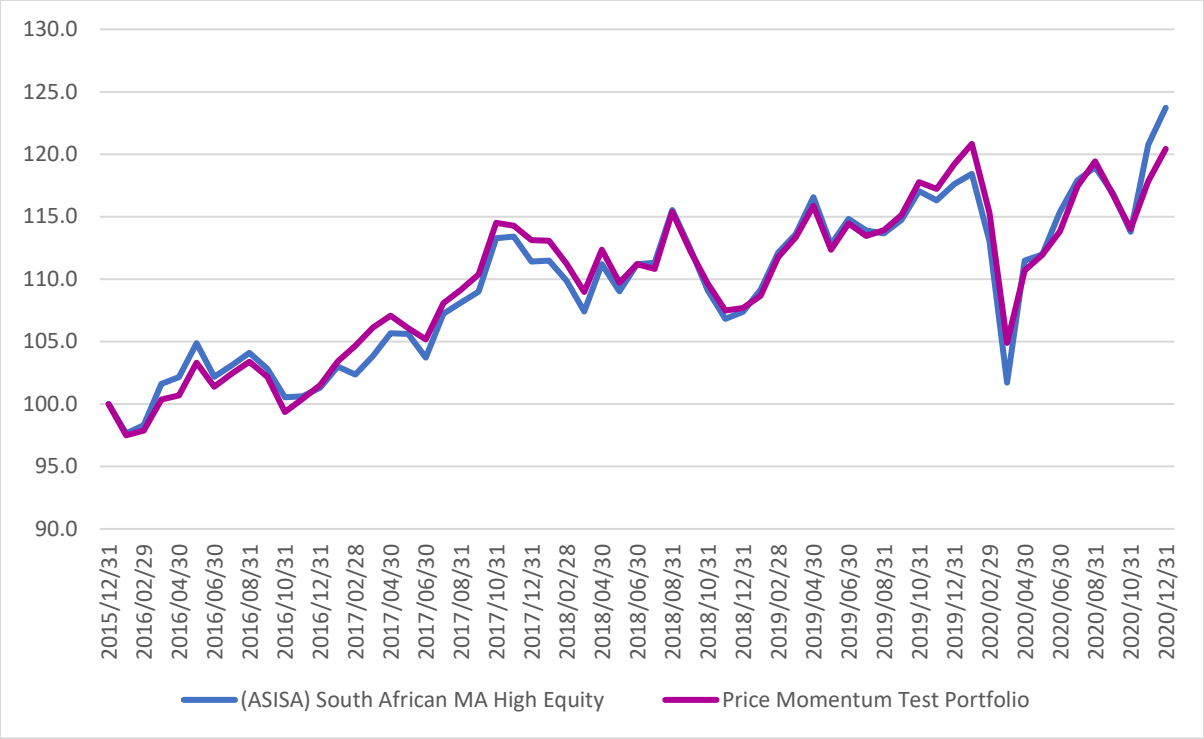


Table 27: Discrete yearly performances of the using price momentum test portfolio and the peer group average.

Portfolio Name	2016 – 2020[1]	2016	2017	2018	2019	2020
Price momentum test portfolio	3.79%	1.51%	11.44%	-4.80%	10.68%	1.03%
(ASISA) South African multi asset high equity	4.35%	1.31%	9.97%	-3.60%	9.52%	5.19%
Alpha	-0.56%	0.20%	1.48%	-1.20%	1.16%	-4.16%

Annualised performance

Source: Morningstar

4.7 Performance summary from 2011 to 2020

The first 5-year period ending December 2015 was characterised by strong performances for risk assets like South African equities and global equities. It is these assets that propelled the average balanced fund's strong returns, as these funds were predominantly comprised of equities. The table below provides selected risk statistics and performance numbers for the period. What the analysis found was that the different weighting test portfolios delivered mixed results when the risk measures, as indicated by the standard deviation, were compared to the South Africa multi asset high equity category. The results in Table 28 indicate that the price momentum test portfolio had a higher standard deviation, indicating more risk. When considering the absolute performance of the four weighting methods, all four portfolio construction regimes outperformed their peer group average. This resulted in much better risk-adjusted metrics as measured by the Sharpe- and Treynor ratios relative to their peers. Superior risk-adjusted returns, as measured by the Sharpe- and Treynor ratios, were driven

by the higher absolute returns and not by lower risk measures like standard deviation for the Sharpe ratio and beta for the Treynor ratio. Both the standard deviation and betas of the different test portfolios were close to those of the South Africa multi asset high equity category average. Therefore, on risk-adjusted basis, all four test portfolios outperformed the South Africa multi asset high equity category average. One important characteristic of this 5-year period is the fact that markets were generally positive. The subsequent periods had a much different return profile.

Table 28: Risk statistics for the 5-year period ending 2015.

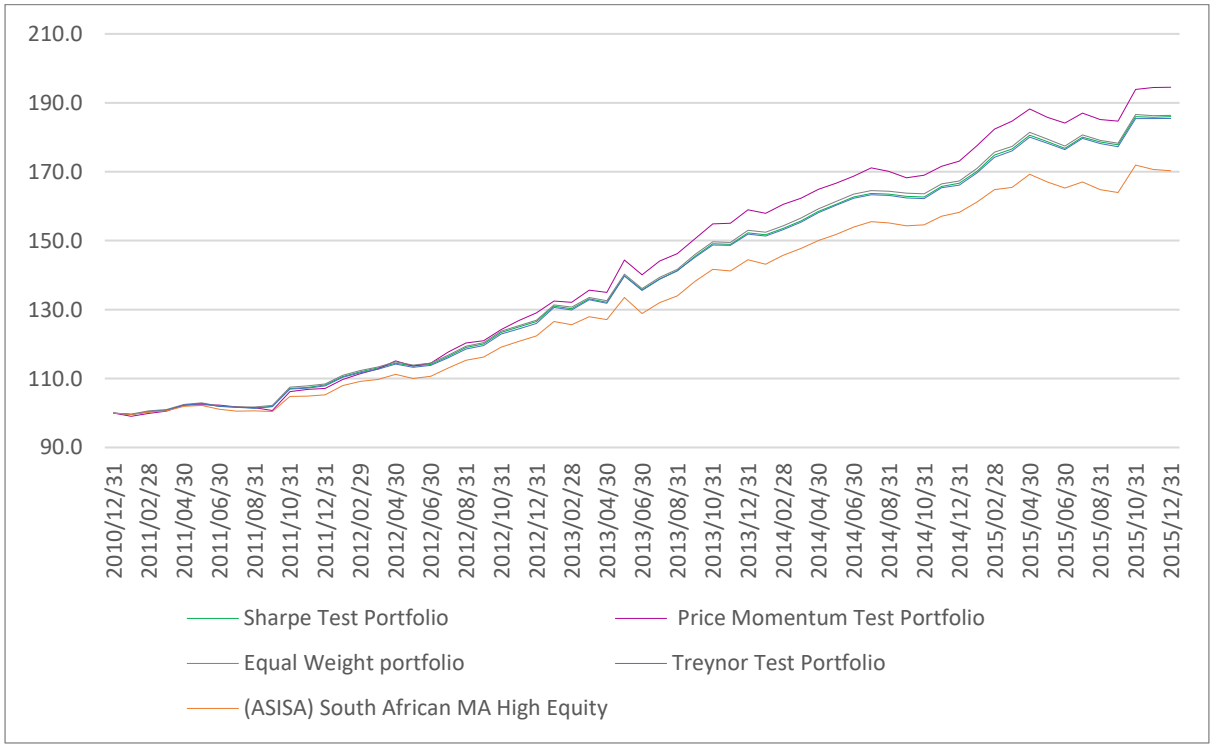
Portfolio Name	Standard deviation	Beta	Risk–free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	6.40	0.99	5.77%	13.27%	1.17	7.61	0.67
Price momentum test portfolio	7.04	1.07	5.77%	14.24%	1.20	7.91	1.17
Sharpe test portfolio	6.30	0.97	5.77%	13.22%	1.18	7.72	0.73
Treynor test portfolio	6.29	0.96	5.77%	13.16%	1.18	7.67	0.74
(ASISA) South African multi asset high equity	6.39	1.00	5.77%	11.24%	0.86	5.48	

Performances were measured on a daily basis and annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

Figure 18: Cumulative performance of the various weighting methodologies and the peer group average for the 5-year period ending 2015.



Source: Morningstar

Even though the 5-year period ending 2020 was positive for most asset classes, the South Africa multi asset high equity category average substantially underperformed the risk-free-rate, as measured by SteFI. Table 29 indicates the effect of a 40.05% cumulative risk-free rate over that 5-year period compared to the meagre return of both the South Africa multi asset high sector and the test portfolios of low to mid 20%. This gave investors sub-optimal returns and they would have been better off in income-generating assets. Asset class volatility was much higher in this 5-year period compared to the previous, as measured by the standard deviation. The price momentum test portfolio struggled, underperforming the South Africa multi asset high equity category average as well as the other three test portfolios. On a risk-adjusted basis, the momentum test portfolio also had the weakest Sharpe- and Treynor ratios, as well as the largest downside deviation ratio. What this indicates is that the price momentum test portfolio can underperform when there is no clear market direction, as was the case in the 5-year period ending 2020. Both risk-adjusted measures indicated this and downside deviation results confirmed this.

Table 29: Risk statistics for the 5-year period ending 2020.

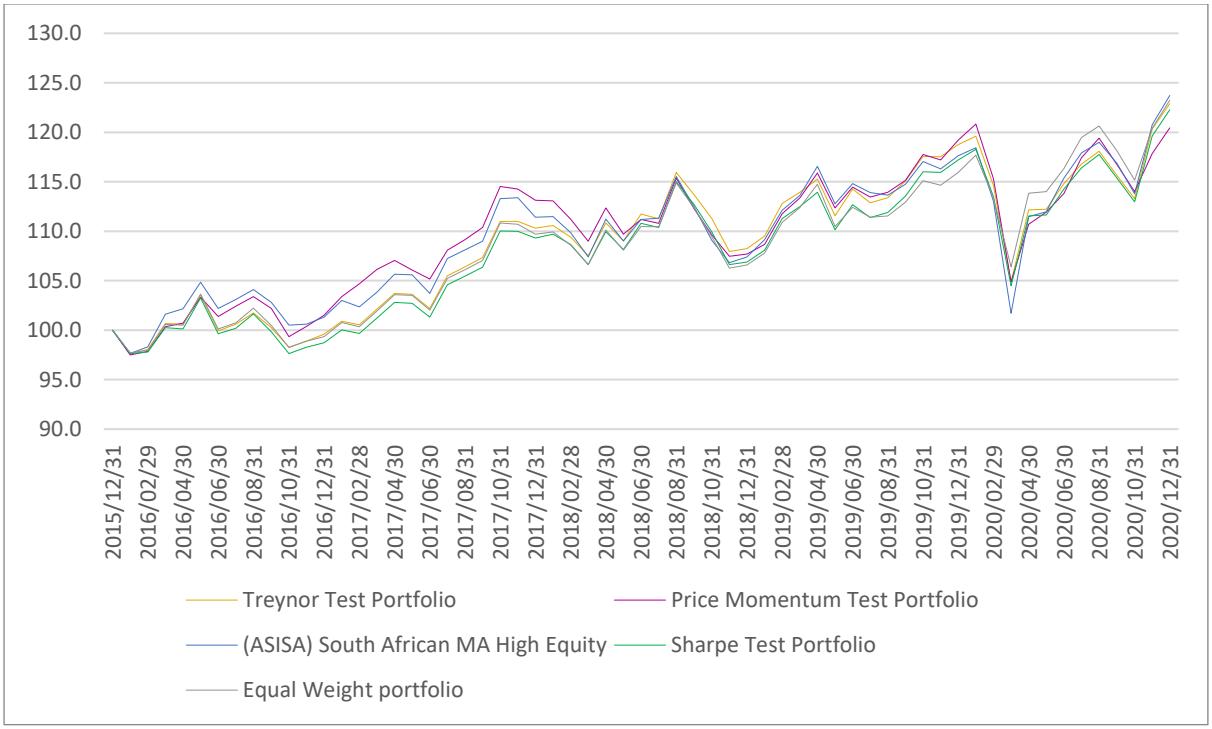
Portfolio Name	Standard deviation	Beta	Risk-free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	8.69	0.84	6.97%	4.27%	-0.31	-3.22	1.78
Price momentum test portfolio	9.25	0.86	6.97%	3.79%	-0.34	-3.68	3.09
Sharpe test portfolio	8.90	0.86	6.97%	4.10%	-0.32	-3.33	1.65
Treynor test portfolio	8.99	0.87	6.97%	4.21%	-0.31	-3.18	1.65
(ASISA) South African multi asset high equity	10.10	1.00	6.97%	4.35%	-0.26	- 2.62	

Performances were measured on a daily basis and annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

Figure 19: Cumulative performance of the various weighting methodologies and the peer group average for the 5-year period ending 2020.



Source: Morningstar

4.8 Performances during the Covid-19 Pandemic

During 2020, the world suffered the start of a global health crisis which would have a profound effect on every facet of life. Financial markets had a violent and sudden reaction to this exogenous shock to the measures taken by governments around the world to curb the spread of the Covid-19 virus. The lockdown measures effectively shut down large parts of the economy, especially the service sector. As a result, most economies entered into a recession. To mitigate the negative effects, monetary policy was loosened, and new fiscal policies were passed by parliament.

No asset class was spared when the market started to sell off. The FTSE/JSE All share index lost 33% in less than a quarter, bottoming on 19 March 2020. The South Africa multi asset high equity category also suffered and lost an average of 20.66%, only to bottom a few days later on the 23rd of March 2020. Overall, the four weighting methods performed well, as summarised in Table 30. The four test portfolios outperformed both in absolute and risk-adjusted measures relative to the South Africa multi asset high equity category. On a risk-adjusted basis, as measured by the Sharpe- and Treynor ratios, the Treynor test portfolio marginally underperformed the peer group average. More concerning was that the Treynor test portfolio exhibited higher downward risk as measured by the downside standard deviation in Table 30. The downside standard deviation is a measure of downside risk. It focuses on

returns that fall below the minimum threshold. In this study, the objective or threshold was the performance of the South Africa multi asset high equity category average. Even though all four test portfolios had superior absolute performance over this period, which was beneficial for the investor, over certain short-term (weekly) periods, the test portfolios did underperform to the return objective.

The price momentum test portfolio captured the downward price momentum and delivered the weakest absolute performance, losing 18.11% over this period compared to the other three methods up to 23 March 2020. Both the Sharpe- and Treynor ratios indicated that the Treynor test portfolio performed the poorest compared to the other strategies, implying that the return for each 1% of risk taken was higher than the other strategies. What the four different weighting methods showed in the first quarter of 2020, is that investing in the sector average does lead to suboptimal performance for investors.

Table 30: Performance statistics of the four weighting methods during the markets sell-off from 2019/12/31 to 2020/03/23.

Portfolio Name	Standard deviation	Beta	Risk-free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	2.88	0.78	1.57%	- 14.07%	- 5.43	- 19.99	1.60
Price momentum test portfolio	3.48	0.95	1.57%	- 18.11%	- 5.66	- 20.70	1.41
Sharpe test portfolio	3.05	0.83	1.57%	- 16.55%	- 5.93	- 21.71	1.79
Treynor test portfolio	3.10	0.85	1.57%	- 17.47%	- 6.13	- 22.41	2.23
(ASISA) South African multi asset high equity	3.63	1.00	1.57%	- 20.66%	- 6.12	- 22.23	3.63

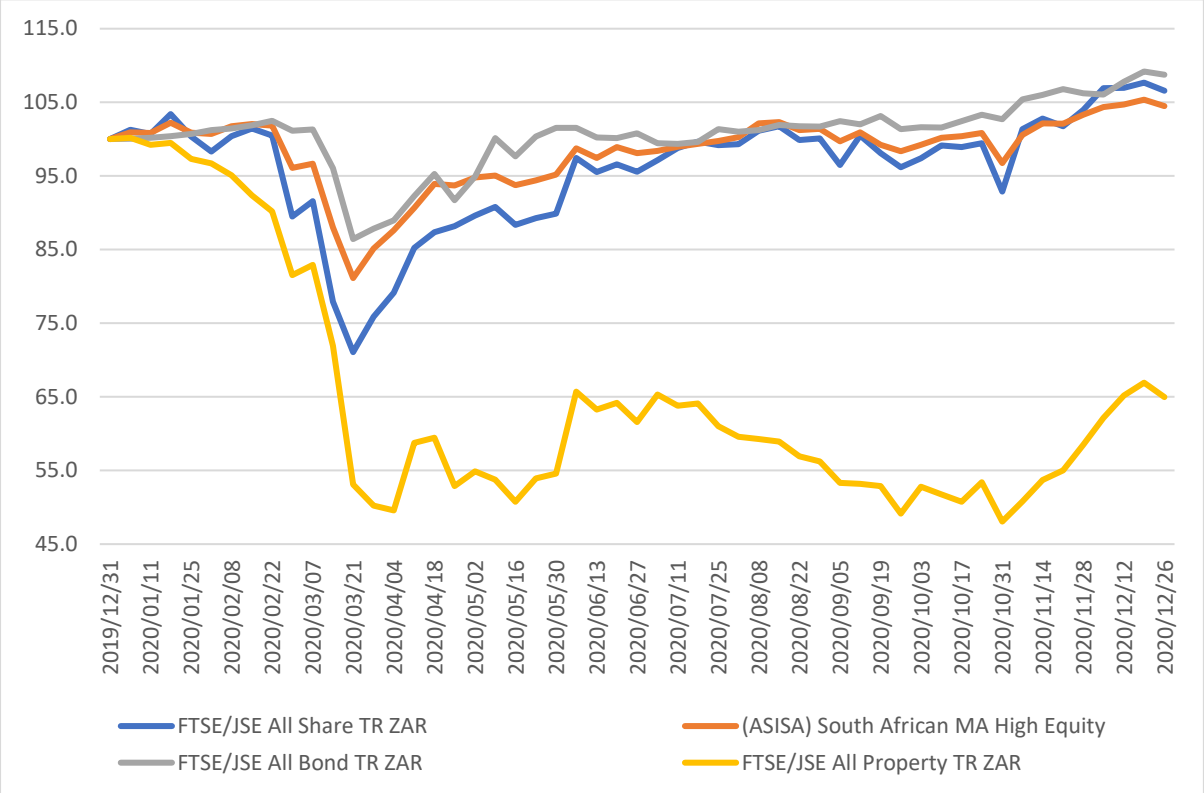
Performances were measured on a daily basis, not annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

However, the sector average led the subsequent market recovery. The markets made a V-shaped recovery, as depicted in Figure 20, after they started pricing in the steps that governments put in place around the world to curb the pandemic. Monetary policy adjustments in the form of substantial rate cuts were implemented and fiscal policy measures were in the form of direct grants or cash to citizens. The extent of these steps did vary widely from country to country, but almost all governments took the same measures in a co-ordinated effort. This gave impetus for the market to recover.

Figure 20: Asset class performances at the start of Covid-19 pandemic.



Source: Morningstar

Equity markets shot up in the last week of March 2020 and continued to recover to year end. Table 31 indicates the extent of the recovery for the test portfolio of between 20.96% and 22.96%. The South Africa multi asset high equity category recovered its losses to end the year positively, but importantly, it outperformed all off the test portfolios over the last three quarters of 2020, as indicated in Table 31.

Table 31: Performance statistics of the four weighting methods during the market recovery from 2020/03/23 to 2020/12/31

Portfolio Name	Standard deviation	Beta	Risk-free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	1.43	0.79	3.8%	21.68%	12.55	22.61	0.45
Price momentum test portfolio	1.33	0.64	3.8%	20.96%	12.87	26.80	0.78
Sharpe test portfolio	1.43	0.83	3.8%	22.75%	12.87	22.93	0.36
Treynor test portfolio	1.54	0.85	3.8%	22.96%	12.66	22.56	0.34
(ASISA) South African multi asset high equity	1.74	1.00	3.8%	29.66%	14.86	25.85	

Performances were measured on a daily basis not annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

Table 32:Performance statistics of the four weighting methods from 2019/12/31 to 2020/12/31

Portfolio Name	Standard deviation	Beta	Risk-free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	14.05	0.77	5.38%	5.82%	0.03	0.57	0.44
Price momentum test portfolio	15.54	0.82	5.38%	0.64%	-0.30	-5.81	0.74
Sharpe test portfolio	14.90	0.82	5.38%	4.02%	-0.09	-1.65	0.35
Treynor test portfolio	15.28	0.84	5.38%	3.21%	-0.14	-2.57	0.33
(ASISA) South African multi asset high equity	17.88	1.00	5.38%	4.73%	-0.04	-0.65	-N/A

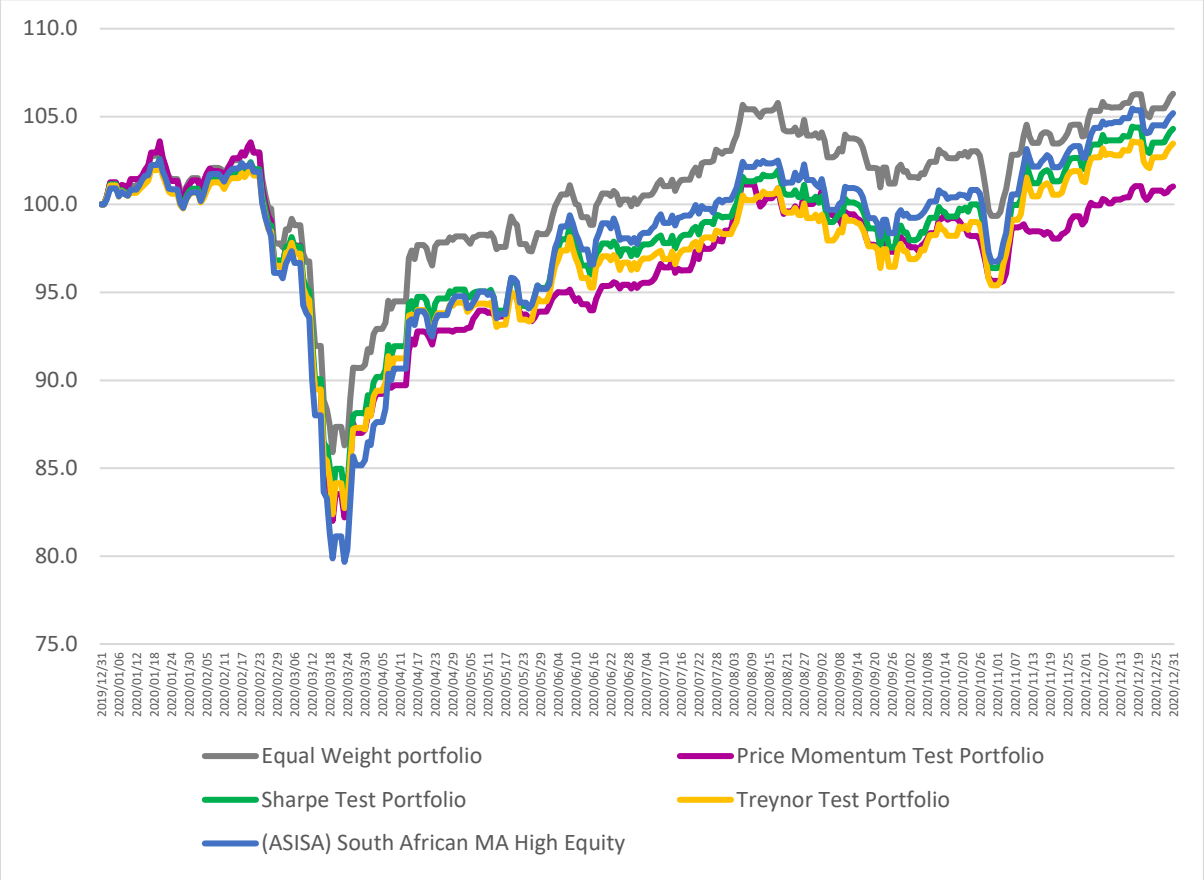
Performances were measured on a daily basis, annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

For the Calander year 2020, it was only the equal weight test portfolio that outperformed the South Africa multi asset high equity category average, as indicated in Figure 21. Risk-adjusted measures indicated that the price momentum test portfolio performed the worst in 2020 (Table 32). The reason for the underperformance of the price momentum test portfolio can be attributed to the rebalancing, which took place at the end of March. It included funds that had performed better over the preceding 12 months, implying that they had less exposure to growth assets like shares. These funds would naturally be less risky, and it would also explain why the price momentum test portfolio did not participate that well in the subsequent recovery period where risk assets like equities outperformed other asset classes.

Figure 21: Cumulative performance of the different weighting methods and the peer group average for 2020.



Source: Morningstar

In conclusion, the four weighting methods protected the investor in the initial sell-off of the market, but failed to participate in the recovery period. The South Africa multi asset high equity category average exhibited higher risk, as measured by standard deviation, compared to the four test portfolios in 2020. This explains the larger drawdowns of the peer group average in March and the strong subsequent recovery. For the year, it was only the equal weight test portfolio that managed to outperform the South Africa multi asset high equity category average in both absolute and risk-adjusted terms. The price momentum test portfolio performed worst, eking out only 65 basis points in absolute performance and delivering the weakest risk-adjusted returns.

4.9 Performances in rising global rates environment.

Markets continued to recover after the 2020 Covid-19 turmoil on the back of a sustained reduction in lock-down measures, but as soon as one global problem was under control, the next crisis arose in the form of global inflation. Loose monetary policy, large fiscal spending and supply chain problems resulted in higher prices for goods and services as aggregate demand recovered back to normal levels. Governments and central banks around the world

reacted to this by launching a co-ordinated effort to halt rising inflation by raising interest rates and, to a lesser extent, cut fiscal spending. This resulted in highly volatile markets in 2021 and 2022. The study used this opportunity to assess the four weighting methods to determine if they can deliver superior returns for investors in a volatile but rising equity market.

Table 33: Performance statistics of the four weighting methods during rising interest rate environment 2020/12/31 to 2022/11/30.

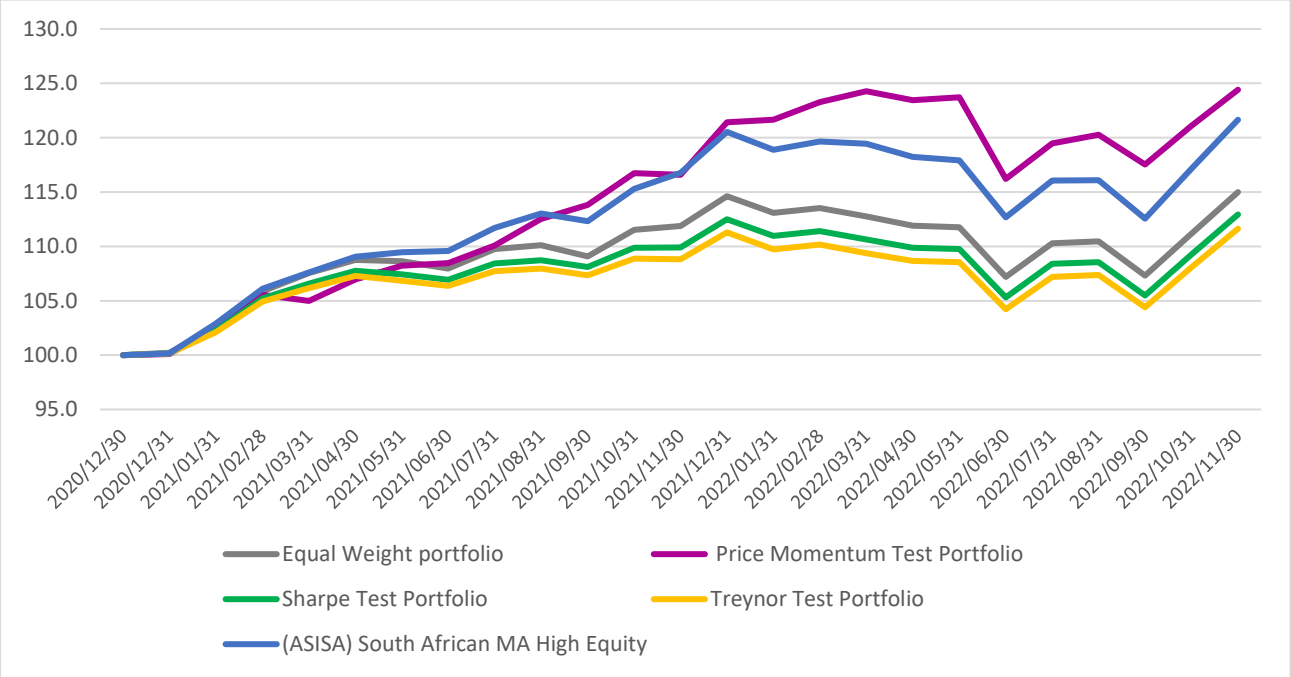
Portfolio Name	Standard deviation	Beta	Risk-free rate	Return	Sharpe	Treynor	Downside deviation
Equal weighting portfolio	8.31	0.92	4.41%	7.56%	0.38	3.43	0.14
Price momentum test portfolio	8.68	0.91	4.41%	12.07%	0.88	8.41	0.34
Sharpe test portfolio	8.15	0.90	4.41%	6.55%	0.26	2.39	0.15
Treynor test portfolio	8.05	0.88	4.41%	5.91%	0.19	1.69	0.17
(ASISA) South African multi asset high equity	8.92	1.00	4.41%	10.77%	0.71	6.35	

Performances were measured on a daily basis and annualised.

Standard deviation, downside standard deviation and beta were measured on a weekly basis.

Source: Morningstar

Figure 22: Cumulative performance of the different weighting methods and the peer group average from 2020/12/31 to 2022/11/30.



Overall performances of the four weighting methods were disappointing, as depicted in Figure 22 and Table 33, with the equal weight test portfolio, Treynor test portfolio and Sharpe test portfolio underperforming the South Africa multi asset high equity category average in both absolute and risk-adjusted terms. The price momentum test portfolio showed remarkable improvement from 2020, outperforming the South Africa multi asset high equity category average on all measures, but still having a higher downside deviation. What Table 33 also

indicates is that the peer group average performed very well; it was paired with higher relative risk though. The standard deviation of the peer group average was higher than the four test portfolios, but the investor was compensated for the higher risk, as measured by the Sharpe ratio, with higher returns. The South Africa multi asset high equity category average had the second-best Sharpe ratio and outperformed the equal-, Treynor- and Sharpe test portfolios by a healthy margin.

4.10 Results

On the face of it, the test results seem to differ substantially over the different time periods. No weighting methodology was found to be outright superior. The equal weighted portfolio, which is the common weighting method followed by fund of funds managers, performed average on a risk-adjusted basis. Given certain market conditions and time frames, certain weighting regimes performed well, beating the other methods. A case in point is the price momentum test portfolio. In a 'normal' rising market in the 5-year period ending 2015, where risk assets recorded positive returns above the risk-free rate, the price momentum test portfolio clearly outperformed. It had the highest absolute return as well as superior risk-adjusted returns as measured by Sharpe- and Treynor ratios. In the subsequent periods, the price momentum test portfolio's relative performance was mixed. The strategy struggled to keep up when risk-asset prices grew at low levels in the period from 2016 to 2020. It was even worse during a market correction, highlighted by the Covid-19 downturn as it substantially underperformed the other weighting methods on an absolute basis. On a risk-adjusted basis (as measured by the Sharpe- and Treynor ratios) performances held up, suggesting that the performance per unit of risk did not differ that much compared to the other weighting methods. The price momentum test portfolio favours fewer volatile markets and risk assets that provide positive returns. The price momentum test portfolio can capture the prevailing market trend. This is evident in Tables 34 and 35. In periods where there is a clear positive market direction, like 2011-2015 and the post Covid-19 pandemic recovery period, the price momentum test portfolio tends to perform very strongly.

Table 34: Ranking of the different weighing methods, based on the Treynor ratio.

Portfolio Name	2011-2015	2016-2020	1st Quarter 2020	Last 3 quarters of 2020	2021- Nov 2022	2011- Nov 2022
Equal weighting portfolio	4.00	2.00	1.00	3.00	2.00	1.00
Price momentum test portfolio	1.00	4.00	2.00	1.00	1.00	2.00
Sharpe test portfolio	2.00	3.00	3.00	2.00	3.00	3.00
Treynor test portfolio	3.00	1.00	4.00	4.00	4.00	4.00

Beta and downside deviation were measured relative to the South Africa multi asset high equity category average.

Source: Morningstar, own calculations.

A higher rank indicates a higher Treynor ratio

Tables 34 and 35 indicate the relative ranking of each weighting method over the different testing periods. These rankings are derived from the Sharpe- and Treynor ratio measurements, which were based on the performance of each weighting method over the different time periods. Higher Sharpe- and Treynor ratios relative to the others gave a top ranking. A lower ranking in the table below indicated better Sharpe- and Treynor numbers. The Sharpe ratio evaluates how much excess return is generated by a unit of risk (standard deviation) taken, while the Treynor ratio indicates what the level of excess return is for each unit of systematic risk (beta) taken.

Table 35: Ranking of the different weighing methods based on the Sharpe ratio.

Portfolio Name	2011-2015	2016-2020	1st Quarter 2020	Last 3 quarters of 2020	2021- Nov 2022	2011- Nov 2022
Equal weighting portfolio	4.00	2.00	1.00	4.00	2.00	1.00
Price momentum test portfolio	1.00	4.00	2.00	2.00	1.00	2.00
Sharpe test portfolio	2.00	3.00	3.00	1.00	3.00	3.00
Treynor test portfolio	3.00	1.00	4.00	3.00	4.00	4.00

Beta and downside deviation were measured relative to the South Africa multi asset high equity category average.

Source: Morningstar, own calculations.

A higher rank indicates a higher Treynor ratio.

The Treynor test portfolio delivered sub-par results over the majority of the periods tested, failing to deliver superior absolute returns compared to the other test portfolios. Also, it substantially underperformed the peer group average in a rising inflationary environment (Jan 2021 to Nov 2022), where the Treynor test portfolio delivered a return of only 11.63% compared to the peer group average of 21.65%. Tables 34 and 35 indicate that the Sharpe test portfolio was the third-best performing portfolio over the entire test period from 2011 to 2022 based on the Treynor ratio, and 4th according to the Sharpe ratio.

Table 36: Absolute performance of the different weighting methods.

Portfolio Name	2011-2015	2016-2020	1st Quarter 2020	Last 3 quarters of 2020	2021- Nov 2022
Equal weighting portfolio	86.33%	23.24%	-14.09%	21.68%	15.00%
Price momentum test portfolio	94.52%	20.43%	-18.11%	20.96%	24.41%
Sharpe test portfolio	85.96%	22.27%	-16.55%	22.75%	12.94%
Treynor test portfolio	85.47%	22.89%	-17.47%	22.96%	11.63%
(ASISA) South African multi asset high equity	70.30%	23.72%	-20.66%	29.66%	21.65%

Source: Morningstar, non-annualised performance numbers.

Table 36 indicates the absolute performance of the different weighting methods. What is clear is that, when volatility of returns for the different asset classes increases, the different weighting methods start to underperform the peer group. Case in point is illustrated in the

above table. In periods of relatively low volatility, as in 2011 to 2015, the four weighting methods outperformed the peer group. As soon as price volatility increases, then the different weighting methods start to underperform. This is evident in the period between 2016 to 2020, the post Covid-19 recovery period (last three quarters of 2020) and the inflationary period thereafter from 2021 to 2022. One interesting observation is that in a bear market, as observed in the Covid-19 sell-off period in the first quarter of 2020, the four different weighting methods outperformed the peer group average by some margin. For the more risk-adverse investor, this downside protection characteristic may be very appealing.

The results of this study suggest that the fund of funds manager can either build a portfolio and assign equal weights or follow a price momentum strategy. Both of these weighting regimes are superior in terms of absolute and risk-adjusted performances, compared to the Sharpe weighting Method and Treynor weighting Method.

The study set out to determine whether the current equal weighting method most fund of funds managers is using is the optimal weighting regime. After analysing four different weighting methods, the study suggests that the only two realistic choices in terms of risk and return are the equal weighting method and the price momentum strategy. It can be argued that the other three methods are also a form of price momentum investing as the main determinant for inclusion was based on the historical performance numbers. The Sharpe- and Treynor weighting methods were constructed using the highest Sharpe and Treynor ratios. Fund performance was the main input in both ratios. Standard deviation and beta were derived from the variances in performances. Performance numbers are the only objective data point a fund of funds manager have, and doing any analysis based solely on performance introduces an element of momentum.

4.11 Conclusion

In most fund of funds portfolios, the underlying funds are selected with little to no regard for the risk each fund contributes to the fund of funds' total risk level. It is assumed, for practical reasons, that each fund selected carries roughly the same risk and therefore the risk is largely excluded in the fund construction process.

Most fund of funds portfolio managers simply assign equal weights to each fund, especially when using multi-asset funds like a balanced fund in constructing a fund of funds. The research question was derived from the problem statement and is as follows: is the current weighting regime of the underlying funds in a fund of funds portfolio the optimal way of constructing these portfolios?

To test this research question, different weighting regimes were constructed, namely the Treynor weighting method, Sharpe weighting method, equal weighting method and the momentum strategy. This was done to assess the research objectives, namely to:

1. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned equal weightings in terms of the Sharpe ratio.
2. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to a price momentum strategy.
3. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Treynor methodology.
4. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Sharpe methodology.

The study evaluated all four weighting regimes over distinct time periods. The first was a 5-year period from 2011–2015, which was characterised by strong performances from most asset classes. The second period was from 2016–2020, were the main asset classes struggled to outperform CPI+4.4%. Additionally, the study stress tested the four weighting methods under a black swan condition, namely Covid-19 in 2020. Furthermore, the study analysed how these weighting methods performed in a high inflation and later an increasing interest rate environment from 2020 to 2022.

In analysing the above test results, it was found that, during a growth period with low market volatility (2011–2015), all four weighting methods outperformed the South Africa multi asset high equity category average on an absolute and risk-adjusted basis. The equal weight portfolio delivered the second-best absolute return among the four regimes. As soon as market returns were low or slightly negative, the four weighting methods struggled to keep up with the peer group on an absolute and risk-adjusted basis. However, when risk assets were in a bear market or market correction territory, the four weighting methods performed very well, beating the peer group average on both an absolute and risk-adjusted basis. In the first quarter of 2020, equity markets entered correction territory, only to bottom on the 23rd of March. The equal weight portfolio only lost 14.09% over that time, beating not only the other three weighting methods, but also the peer group average, which lost 20.66%. An interesting finding in the subsequent recovery period and inflationary period after that, is that the four weighting methods underperformed the peer group average.

There are two weighting methods that performed best overall. They were the price momentum and equal weighting methods. An optimal portfolio should be constructed using one of these methods. Due to the unique methodology of the price momentum strategy, it would not be

possible to use both equal weight and price momentum methodologies in one portfolio simultaneously. A portfolio manager can change the weighting method as market conditions dictate.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The aim of the study was to interrogate the current practice applied by fund of funds managers to employ an equal weighting method when constructing a fund of funds portfolio comprising a series of balanced funds.

A fund of funds manager who uses balanced funds to construct a portfolio usually is not concerned which asset class to overweight or underweight. The underlying fund typically makes the asset allocation decision. The four main asset classes to consider are equity, property, bonds, and cash. The literature study explored the development of the different asset classes which are typically used in a balanced fund. It also delved into the origins of a mutual fund and how it evolved over time to the investment vehicles we see today. The history describes why these pooled vehicles were created in the first place, which was to mitigate risk through diversification. In the latter part of Chapter 2, the study focused on the evolution of portfolio construction theory as first postulated by Roy (1952) and Markowitz (1952). William Sharpe expanded on Roy and Markowitz's work and introduced the finance community to the Capital Asset Pricing Model (CAPM). This work emphasises that risk in portfolio construction plays a pivotal role and should not be underestimated.

To test the research question, the study designed various testing methodologies, as reported in Chapter 3. These weighting methods were assessed over different time periods. Each of these time periods covered different market conditions, allowing the study to test the characteristics and performance of each weighting method under different conditions. A short summary of the performance of each weighting method over these time periods is given in the latter part of Chapter 4.

This chapter consists of a summary of the main aspects of the study, starting with the research problem, research question and objectives, followed by a summary of the literature study and the key findings and conclusions. Lastly, the chapter ends with the recommendations for future study in this field.

5.2. Summary of the problem statement, research question and research objective

Most often the funds in a fund of funds portfolio are assigned equal weights, with little or no regard to risk that each of the selected funds carry. Also, the combined risk of the selected funds in a portfolio context are usually not considered. Roy (1952) and Markowitz (1952) suggest that risk and correlation must be considered when constructing a portfolio, so simply

assigning a random weight may lead to the underperformance of a fund of funds portfolio (Rubinstein, 2002:1043). The question arose: is equally weighting portfolio constituents the optimal weighting method in the overall portfolio construction process or are there other methods that can be employed more effectively?

To test the research question, the following objectives were set:

1. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned equal weightings in terms of the Sharpe ratio.
2. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to a price momentum strategy.
3. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Treynor methodology.
4. Measure the risk weighted performance of a fund of funds portfolio where the underlying assets are assigned weights according to the Sharpe methodology.

The saying goes “do not put all your eggs in one basket” and this is so true of investments. The modern equivalent saying is “diversification is the only free lunch”. From the literature, it is evident that humankind found it beneficial through the ages to use more than one “basket” to protect assets. In so doing, humankind inadvertently diversified their investments or asset base. Harry Markowitz, in his 1999 paper (Markowitz, 1999:5), mentions the merchant of Venice, who spread out his shipments among different ships. The merchant understood that he could not eliminate a certain risk but could reduce the impact such a risk can have on the goods he shipped.

5.3. Summary of the literature study and history of different asset classes.

The pooling of funds dates to the 17th century and since then evolved from a contract of survival or a tontine, to modern mutual funds. In the 18th century, the focus shifted to risk management with the introduction of negotiaties, which focused on risk diversification. Until 1924, most funds were close ended, but this all changed with the establishment of the Massachusetts Investors Trust. In 1962, the first fund of funds was established in South Africa, providing investors with diversification and flexibility.

The South African financial industry dates back to 1793 with the first state-owned bank. The Johannesburg Stock Exchange (JSE) was founded in 1887 and, from the start, it played a pivotal role in a listing of mutual funds. These two funds were property unit trusts, listed in 1969. A few years earlier, in 1965, the first South African unit trust was launched, which aimed to provide investors with a professionally managed and diversified financial product.

Even though risk management is important in a regulatory framework, returns are the focus for portfolio managers. Anticipating expected returns are done via a theoretical framework like capital asset pricing model (CAPM) and Fama and French's three-factor model. However, human behaviour can affect the efficiency of the market, as suggested by the adaptive market hypothesis (AMH). The industry is moving towards an asset liability approach to closer match the return expectations of investors. This is done within the current regulations, which impose limits on asset exposures, leading managers to adopt a strategic and tactical asset allocation framework to manage risk and maximise return.

5.4. Summary of the research design and the methodology

The strategic asset allocation is very much concerned about expected return, with little to no regard to risk, especially in a balanced fund. From the literature, it is clear that risk should also be considered when constructing a balanced portfolio. The most common portfolio construction method is using equal weights, and this may not be the most efficient way. To evaluate the research question, performance data of balanced funds were used within ASISA South Africa multi asset high equity category. The study subjected the data to statistical analysis. Testing was conducted over distinct 5-year periods, as it is the appropriate holding period for a fund classified under ASISA's South Africa multi asset high equity category (balanced fund). The study constructed various test portfolios using different methodologies. First, the study made use of the Sharpe ratio as the basis of portfolio construction (Sharpe test portfolio). The second portfolio was based on the Treynor value (Treynor test portfolio), and the third portfolio was constructed by applying equal weights to each holding (equal weighting test portfolio). Finally, a fourth portfolio was constructed by employing a price momentum strategy (momentum test portfolio).

To simulate the real world, portfolios were re-weighted yearly for the Treynor, Sharpe and equal weighted methods and quarterly for the momentum strategy. Testing periods were selected to simulate some of the different types of market conditions a portfolio may encounter. The first period commenced on 1 Jan 2011 and ended on 31 Dec 2015 and was characterised by rising asset prices. From 2016 to 2020, the market exhibited a sideways movement with risk asset values only being slightly higher at the end of the 5-year period. Covid-19 gave this study an opportunity to assess how the portfolios performed when markets were subjected to an exogenous shock. After the recovery period from Covid-19, economies and financial markets faced a new threat in the form of inflation. The test portfolios' final test was how they would perform in a rising rate environment.

Performances were measured using various metrics, which were absolute performance, standard deviation, Sharpe ratio and, finally, the Treynor ratio. The study focused on Sharpe- and Treynor ratios as these ratios measure excess return in terms of risk.

5.5. Summary of empirical results.

The study evaluated all four weighting regimes over distinct time periods, each period characterised by a different economic environment. No weighting methodology was found to be outright superior. The equal weighted portfolio, which is the common weighting method followed by fund of funds managers, performed average on a risk-adjusted basis.

Table 37: Absolute performance of the different weighting methods.

Portfolio Name	2011-2015	2016-2020	1st Quarter 2020	Last 3 quarters of 2020	2021- Nov 2022
Equal weighting portfolio	86.33%	23.24%	-14.09%	21.68%	15.00%
Price momentum test portfolio	94.52%	20.43%	-18.00%	20.96%	24.41%
Sharpe test portfolio	87.61%	22.27%	-16.75%	22.75%	12.94%
Treynor test portfolio	85.49%	22.89%	-17.62%	22.96%	11.63%
(ASISA) South African multi asset high equity	70.30%	23.72%	-20.33%	29.66%	21.65%

Source: Morningstar, non-annualised performance numbers

The first period was a 5-year period from 2011 to 2015, which was characterised by strong performances from most asset classes. The second period was from 2016 to 2020, were the main asset classes struggled to outperform CPI+4.4%. Additionally, the study stress tested the four weighting methods under a black swan condition, namely Covid-19. Furthermore, the study analysed how these weighting methods performed in a high inflation and later an increasing interest rate environment.

In analysing the above test results, it was found that, during a growth period with low market volatility (2011 – 2015), all four weighting methods outperformed the South Africa multi asset high equity category average on an absolute and risk-adjusted basis. The equal weight portfolio delivered the second-best absolute return among the four regimes. Risk-adjusted returns as measured by the Sharpe and Treynor ratios suggested that other weighting methods were superior.

As soon as market returns were low or slightly negative, as observed in the period from 2016 to 2020, the four weighting methods struggled to keep up with the peer group on an absolute and risk-adjusted basis. However, when risk assets were in a bear market or market correction territory, the four weighting methods performed very well, beating the peer group average on both an absolute and risk-adjusted basis. In the first quarter of 2020, equity markets entered correction territory only to bottom on the 23rd of March. The equal weight test portfolio only lost

14.07% over that time, beating not only the other three weighting methods, but also the peer group average, which lost 20.66%. An interesting finding regarding the subsequent recovery period and the inflationary period after that, is that the four weighting methods underperformed on an absolute basis. The equal weight test portfolio performed well in an inflationary environment, compared to the other three weighting methods on a risk-adjusted bases.

In conclusion, there were two weighting methods that performed best overall. They were the momentum and equal weighting methods. An optimal portfolio should be constructed using one of these methods. Due to the unique methodology of the momentum test portfolio, it would not be possible to simultaneously use both equal and momentum methodologies in one portfolio. A portfolio manager can change the weighting method as market conditions dictate.

5.6. Recommendations for further study

Research in portfolio construction with the focus on holdings exposure levels within a South African fund of funds portfolio is lacking. The study set out to complete the initial or basic research first, in order to provide future researchers, the platform for more complex studies. These findings can shape the direction of future research areas. Therefore, the study suggests that research be conducted into more complex weighting methods like minimum correlation portfolio, most diversified portfolio, risk parity portfolio and minimum tail dependent portfolio. These studies can provide additional insights into portfolio construction methods that in the future can benefit the retail client invested in these fund of funds portfolios.

5.7. Conclusions

With reference to the problem statement and the research question as defined in Chapter 1, there were two weighting methods that performed best overall, namely the price momentum and equal weighting methods. An optimal portfolio should be constructed using one of these methods. Due to the unique methodology of the price momentum test portfolio, it would not be possible to use both equal weight and price momentum methodologies in one portfolio concurrently. A portfolio manager can change the weighting method as market conditions dictate. In normal market conditions, the Sharpe weighting methodology portfolio performed as well as the price momentum and equal weight test portfolios, but in an inflationary environment it underperformed. The Treynor weighting method, which also incorporates risk, failed to impress and was the worst performer amongst the four test portfolios. One notable finding was that, in a market correction or downturn, all four test portfolios outperformed peer group average. The converse was also found to be true; when the market subsequently recovered, all four test portfolios underperformed compared to the ASISA's South Africa multi asset high equity category average. There is no weighting method that will consistently deliver

outperformance, but there are two methods that will likely deliver constantly high risk-adjusted returns.

Additional research is needed in this area to get a better understanding of portfolio construction methods of a funds a funds portfolio to provide investors with better risk-adjusted outcomes.

Appendices

Appendix A

Table A1 below indicates each fund within the South Africa multi asset high equity category that existed for the full 5-year period from 2010 to 2015.

(ASISA) South African multi asset high equity **2010/12/01** **2015/12/31** **SteFI**

Fund	Inception Date	Oldest Share Class	Return (Annualized)	FoF	Standard Deviation	Risk-free rate	Style
Ninety One Managed R	1994/02/09	Yes	15.43	FALSE	6.499261	5.77	Value – Large Cap
Old Mutual Balanced R	1994/03/01	Yes	12.83	FALSE	6.516804	5.77	Value – Mid
STANLIB Balanced B1	1994/08/01	Yes	13.57	FALSE	5.920608	5.77	Blend – Large Cap
Momentum Balanced R	1995/02/01	Yes	12.90	FALSE	6.040613	5.77	Blend – Large Cap
SIM Balanced R	1995/02/01	Yes	12.31	FALSE	6.467595	5.77	Blend – Mid Cap
Coronation Balanced Plus A	1996/04/15	Yes	14.42	FALSE	6.723522	5.77	Blend – Mid Cap
Ninety One Opportunity R	1997/05/02	Yes	14.11	FALSE	5.440225	5.77	Growth – Large Cap
Nedgroup Inv Managed R	1997/11/17	Yes	1.27	FALSE	9.524469	5.77	Value – Mid
STANLIB Inflation Plus 5% A	1999/01/04	Yes	7.39	FALSE	4.097722	5.77	Blend – Mid Cap
Sanlam Multi Mgd Balanced FoF A	1999/03/01	Yes	12.25	TRUE	6.729622	5.77	Value – Mid
PSG Balanced A	1999/06/01	Yes	12.92	FALSE	5.995176	5.77	Value – Mid
M&G Balanced Fund A	1999/08/02	Yes	14.44	FALSE	6.516214	5.77	Blend – Large Cap
Allan Gray Balanced A	1999/10/01	Yes	14.10	FALSE	6.266333	5.77	Value – Large Cap
Oasis Balanced A	2001/03/12	Yes	11.05	FALSE	6.41094	5.77	Value – Mid
Old Mutual Multi-Managers Bal FoF A	2001/06/05	Yes	11.33	TRUE	5.548734	5.77	Blend – Large Cap
Coronation Capital Plus	2001/07/02	Yes	10.70	FALSE	5.127037	5.77	Blend – Mid Cap
Marriott Balanced FoF A	2001/10/01	Yes	12.13	TRUE	4.619378	5.77	Blend – Large Cap
STANLIB MM Balanced B1	2002/01/02	Yes	12.50	FALSE	6.312404	5.77	Value – Large Cap
AF Investments Balanced FoF	2002/05/22	Yes	13.97	TRUE	6.319721	5.77	Value – Mid
Foord Balanced A	2002/08/30	Yes	14.41	FALSE	6.25727	5.77	Blend – Large Cap
Prescient Absolute Balanced B3	2003/07/01	Yes	9.91	FALSE	6.430073	5.77	Blend – Large Cap
SIS Inflation Plus 4-6 FoF	2003/07/01	Yes	14.85	TRUE	7.30793	5.77	Blend – Large Cap
NGI Private Wealth Diversified Growth A	2004/05/01	Yes	13.81	FALSE	7.1016	5.77	Blend – Large Cap
Nedgroup Inv XS Diversified FoF A	2004/09/01	Yes	10.45	TRUE	5.589211	5.77	Blend – Mid Cap
Select Manager BCI Balanced FoF A	2004/09/01	Yes	11.93	TRUE	6.360697	5.77	Blend – Large Cap
Rezco Value Trend A	2004/09/30	Yes	18.71	FALSE	6.625234	5.77	Growth – Large Cap
Naviga BCI Balanced Growth FoF A	2004/10/01	Yes	9.43	TRUE	5.333083	5.77	Blend – Mid Cap
IFM Dynamic FoF	2004/12/17	Yes	12.21	TRUE	7.182719	5.77	Blend – Large Cap
ABSA Prudential FoF	2005/02/16	Yes	8.62	TRUE	5.737546	5.77	Value – Large Cap
Kanaan BCI Balanced FoF	2005/02/16	Yes	9.79	TRUE	5.2648	5.77	Blend – Large Cap
Dotport BCI Prudential FoF A	2005/05/19	Yes	11.43	TRUE	5.808498	5.77	Blend – Mid Cap
Lynx Prime Balanced FoF A1	2005/07/01	Yes	12.27	TRUE	5.592266	5.77	Blend – Large Cap
Sharenet BCI Aggressive FoF A1	2005/07/01	Yes	10.51	TRUE	5.110999	5.77	Blend – Large Cap

STANLIB Mod Aggressive FoF B1	2005/07/25	Yes	10.44	TRUE	7.96908	5.77	Growth – Large Cap
Flagship IP Balanced Fund A	2005/09/09	Yes	9.84	FALSE	8.238672	5.77	Value – Large Cap
Autus Prime Balanced A	2006/01/03	Yes	16.65	FALSE	6.733887	5.77	Blend – Large Cap
MET Odyssey Balanced FoF A	2006/01/03	Yes	14.56	TRUE	7.147636	5.77	Blend – Large Cap
Custodian BCI Balanced A	2006/02/01	Yes	11.68	FALSE	6.376517	5.77	Blend – Large Cap
Cadiz BCI Balanced A	2006/02/27	Yes	9.19	FALSE	7.47409	5.77	Blend – Large Cap
SIM Mgd Aggressive FoF B1	2006/08/18	Yes	14.33	TRUE	7.095454	5.77	Blend – Large Cap
Personal Trust Prudent FoF A	2006/09/01	Yes	11.34	TRUE	6.020985	5.77	Blend – Mid Cap
SIM Mgd Moderate Aggr FoF B1	2006/10/26	Yes	13.29	TRUE	5.754042	5.77	Blend – Large Cap
Nedgroup Inv Select Growth FoF A	2006/11/01	Yes	10.75	TRUE	5.937658	5.77	Value – Mid
Sage SCI Long Term Solution FoF A	2006/11/01	Yes	12.05	TRUE	5.679551	5.77	Value – Mid
Select BCI Balanced A	2006/11/01	Yes	10.76	FALSE	6.146212	5.77	Blend – Large Cap
AS Forum BCI Aggressive FoF	2006/11/02	Yes	14.45	TRUE	7.59479	5.77	Value – Mid
ABSA Multi Managed Growth FoF A	2007/02/08	Yes	9.49	TRUE	6.360573	5.77	Value – Mid
PSG Wealth Moderate FoF B	2007/07/02	Yes	12.58	TRUE	6.151493	5.77	Blend – Mid Cap
Personal Trust Managed	2007/08/01	Yes	15.09	FALSE	6.43268	5.77	Blend – Large Cap
Skyblue BCI Cumulus Moderate FoF A	2007/10/02	Yes	12.48	TRUE	5.535946	5.77	Blend – Large Cap
Southern Charter BCI Growth FoF A	2007/10/26	Yes	14.36	TRUE	6.419485	5.77	Value – Large Cap
FNB Multi Manager Balanced B1	2007/11/01	Yes	13.80	FALSE	5.271634	5.77	Value – Mid
Momentum Best Blend Balanced FoF B1	2007/11/01	Yes	14.86	TRUE	7.764957	5.77	Growth – Large Cap
Discovery Balanced	2007/11/06	Yes	14.54	FALSE	7.029726	5.77	Blend – Large Cap
Melville Douglas STANLIB Balanced B1	2008/01/02	Yes	14.32	FALSE	7.637877	5.77	Blend – Large Cap
CS BCI Prudential FoF A	2008/03/03	Yes	12.67	TRUE	5.162911	5.77	Blend – Large Cap
Ampersand SCI CPI Plus 6 FoF B1	2008/05/12	Yes	11.60	TRUE	6.954726	5.77	Blend – Large Cap
Seed Balanced Prescient A1	2008/07/31	Yes	13.85	FALSE	5.78815	5.77	Blend – Large Cap
ADB BCI Flexible Prudential FoF A	2008/11/04	Yes	11.70	TRUE	5.880014	5.77	Blend – Large Cap
Afena Managed Prescient B3	2009/04/14	Yes	10.39	FALSE	7.254354	5.77	Value – Mid
Warwick BCI Balanced A	2009/06/01	Yes	11.81	FALSE	6.854806	5.77	Blend – Large Cap
Plexus Wealth BCI Balanced A	2009/06/25	Yes	13.68	FALSE	6.438145	5.77	Blend – Mid Cap
ABSA MM Absolute Return Prudential C	2009/08/03	Yes	7.99	FALSE	3.339022	5.77	Value – Mid
Nedgroup Inv Core Diversified B	2009/09/01	Yes	14.30	FALSE	6.359044	5.77	Blend – Large Cap
Element Balanced SCI C	2009/11/12	Yes	6.36	FALSE	6.727874	5.77	Value – Mid
ABSA Managed C	2010/02/26	Yes	13.32	FALSE	6.231989	5.77	Value – Mid
Oasis Crescent Balanced High Eq FoF B	2010/04/06	Yes	9.45	TRUE	7.425907	5.77	Value – Mid
Element Islamic Balanced SCI C	2010/04/28	Yes	4.24	FALSE	7.292255	5.77	Value – Mid
Rezco Managed Plus A	2010/08/02	Yes	17.00	FALSE	6.165615	5.77	Blend – Mid Cap
Sanlam Multi Mgd Aggressive FoF B1	2010/08/02	Yes	12.83	TRUE	7.539527	5.77	Value – Mid
Sanlam Multi Mgd Moderate Aggr FoF B1	2010/08/02	Yes	12.68	TRUE	6.10864	5.77	Value – Mid
Sanlam Multi Mgd Moderate FoF B1	2010/08/02	Yes	11.62	TRUE	5.099263	5.77	Blend – Mid Cap
RECM Balanced A	2010/10/01	Yes	-0.04	FALSE	9.688886	5.77	Value – Mid
Efficient BCI Prudential High FoF A	2010/11/30	Yes	9.04	TRUE	6.382416	5.77	Blend – Large Cap

Noble PP BCI Wealth Creator FOF A1	2010/12/01	Yes	11.92	TRUE	5.130201	5.77	Blend – Large Cap
Kruger Ci Balanced FoF B1	2012/12/10	Yes	12.32	TRUE	5.321329	5.77	Value – Mid
Analytics Ci Balanced FoF A	2013/10/21	Yes	12.02	TRUE	6.824722	5.77	Blend – Large Cap
NFB Ci Managed A	2013/10/21	Yes	12.57	FALSE	5.393031	5.77	Blend – Large Cap
Sanlam Private Wealth Balanced	2014/11/03	Yes	12.25	FALSE	6.245866	5.77	Blend – Large Cap

Ave of group	11.95
Standard Deviation of display group	2.96
Count	79

Table A2 below indicates each fund within the South Africa multi asset high equity category that existed the full 5-year period from 2015 to 2020.

(ASISA) South African multi asset high equity **2015/12/01 2020/12/31** **SteFI**

Fund	Inception Date	Oldest Share Class	Return (Annualised)	Standard Deviation	Risk-free rate	Sharpe Ratio	Style
Ninety One Managed R	1994/02/09	Yes	7.72	7.377437	6.97	0.10	Value – Large Cap
Old Mutual Balanced R	1994/03/01	Yes	4.26	10.706479	6.97	-0.25	Value – Mid
STANLIB Balanced B1	1994/08/01	Yes	5.09	9.21588	6.97	-0.20	Blend – Large Cap
SIM Balanced R	1995/02/01	Yes	4.00	11.393911	6.97	-0.26	Blend – Mid Cap
Coronation Balanced Plus A	1996/04/15	Yes	5.51	11.487036	6.97	-0.13	Blend – Mid Cap
Ninety One Opportunity R	1997/05/02	Yes	6.47	8.084446	6.97	-0.06	Growth – Large Cap
Nedgroup Inv Managed R	1997/11/17	Yes	4.77	11.070935	6.97	-0.20	Value – Mid
Northstar SCI Managed A1	1998/03/01	Yes	4.31	8.557003	6.97	-0.31	Blend – Large Cap
Sanlam Multi Mgd Balanced FoF A	1999/03/01	Yes	4.50	10.784842	6.97	-0.23	Value – Mid
PSG Balanced A	1999/06/01	Yes	3.05	14.332257	6.97	-0.27	Value – Mid
M&G Balanced Fund A	1999/08/02	Yes	4.24	11.403738	6.97	-0.24	Blend – Large Cap
Allan Gray Balanced A	1999/10/01	Yes	5.18	10.959266	6.97	-0.16	Value – Large Cap
Oasis Balanced A	2001/03/12	Yes	2.43	7.869486	6.97	-0.58	Value – Mid
Old Mutual Multi-Managers Bal FoF A	2001/06/05	Yes	4.58	10.701979	6.97	-0.22	Blend – Large Cap
Coronation Capital Plus	2001/07/02	Yes	4.95	8.406103	6.97	-0.24	Blend – Mid Cap
Marriott Balanced FoF A	2001/10/01	Yes	3.62	6.842715	6.97	-0.49	Blend – Large Cap
STANLIB MM Balanced B1	2002/01/02	Yes	5.34	10.986799	6.97	-0.15	Value – Large Cap
AF Investments Balanced FoF	2002/05/22	Yes	4.81	10.659984	6.97	-0.20	Value – Mid
Foord Balanced A	2002/08/30	Yes	4.35	10.235924	6.97	-0.26	Blend – Large Cap
STANLIB MM Medium-High Equity FoF B1	2003/06/06	Yes	4.72	10.931292	6.97	-0.21	Blend – Large Cap
Prescient Absolute Balanced B3	2003/07/01	Yes	4.02	11.031599	6.97	-0.27	Blend – Large Cap
SIS Inflation Plus 4-6 FoF	2003/07/01	Yes	5.14	11.58372	6.97	-0.16	Blend – Large Cap
NGI Private Wealth Diversified Growth A	2004/05/01	Yes	2.88	10.637044	6.97	-0.38	Blend – Large Cap
Momentum Focus 7 Fund of Funds A	2004/07/01	Yes	2.96	12.343147	6.97	-0.33	Value – Mid
Nedgroup Inv XS Diversified FoF A	2004/09/01	Yes	1.88	10.195942	6.97	-0.50	Blend – Mid Cap
Select Manager BCI Balanced FoF A	2004/09/01	Yes	3.45	10.924479	6.97	-0.32	Blend – Large Cap
Rezco Value Trend A	2004/09/30	Yes	4.41	8.402272	6.97	-0.30	Growth – Large Cap
ABSA Prudential FoF	2005/02/16	Yes	4.50	9.211012	6.97	-0.27	Value – Large Cap
Kanaan BCI Balanced FoF	2005/02/16	Yes	0.46	7.431826	6.97	-0.88	Blend – Large Cap
Dotport BCI Prudential FoF A	2005/05/19	Yes	2.48	8.891289	6.97	-0.50	Blend – Mid Cap
Lynx Prime Balanced FoF A1	2005/07/01	Yes	3.86	8.365567	6.97	-0.37	Blend – Large Cap
Flagship IP Balanced Fund A	2005/09/09	Yes	3.36	11.597542	6.97	-0.31	Value – Large Cap
Autus Prime Balanced A	2006/01/03	Yes	2.52	10.541609	6.97	-0.42	Blend – Large Cap
Custodian BCI Balanced A	2006/02/01	Yes	1.30	10.112466	6.97	-0.56	Blend – Large Cap
Cadiz BCI Balanced A	2006/02/27	Yes	2.69	10.897242	6.97	-0.39	Blend – Large Cap

SIM Mgd Aggressive FoF B1	2006/08/18	Yes	5.91	12.204723	6.97	-0.09	Blend – Large Cap
Personal Trust Prudent FoF A	2006/09/01	Yes	5.04	9.806949	6.97	-0.20	Blend – Mid Cap
SIM Mgd Moderate Aggr FoF B1	2006/10/26	Yes	6.11	10.54082	6.97	-0.08	Blend – Large Cap
Nedgroup Inv Select Growth FoF A	2006/11/01	Yes	3.47	11.350565	6.97	-0.31	Value – Mid
Select BCI Balanced A	2006/11/01	Yes	4.42	10.865293	6.97	-0.23	Blend – Large Cap
AS Forum BCI Aggressive FoF	2006/11/02	Yes	3.44	11.118769	6.97	-0.32	Value – Mid
Olympiad BCI Managed FoF	2006/12/04	Yes	3.36	4.466462	6.97	-0.81	Growth – Large Cap
ABSA Multi Managed Growth FoF A	2007/02/08	Yes	4.61	10.19397	6.97	-0.23	Value – Mid
PSG Wealth Moderate FoF B	2007/07/02	Yes	4.02	10.491305	6.97	-0.28	Blend – Mid Cap
Personal Trust Managed	2007/08/01	Yes	4.80	9.039704	6.97	-0.24	Blend – Large Cap
Skyblue BCI Cumulus Moderate FoF A	2007/10/02	Yes	3.24	9.496455	6.97	-0.39	Blend – Large Cap
Southern Charter BCI Growth FoF A	2007/10/26	Yes	5.22	11.178585	6.97	-0.16	Value – Large Cap
FNB Multi Manager Balanced B1	2007/11/01	Yes	5.08	9.882656	6.97	-0.19	Value – Mid
Discovery Balanced	2007/11/06	Yes	4.49	11.090463	6.97	-0.22	Blend – Large Cap
Melville Douglas STANLIB Balanced B1	2008/01/02	Yes	5.36	9.296947	6.97	-0.17	Blend – Large Cap
CS BCI Prudential FoF A	2008/03/03	Yes	4.27	9.031059	6.97	-0.30	Blend – Large Cap
Ampersand SCI CPI Plus 6 FoF B1	2008/05/12	Yes	-0.21	11.446819	6.97	-0.63	Blend – Large Cap
Seed Balanced Prescient A1	2008/07/31	Yes	3.53	12.099457	6.97	-0.28	Blend – Large Cap
ADB BCI Flexible Prudential FoF A	2008/11/04	Yes	4.99	11.336083	6.97	-0.18	Blend – Large Cap
Warwick BCI Balanced A	2009/06/01	Yes	2.60	9.255351	6.97	-0.47	Blend – Large Cap
Plexus Wealth BCI Balanced A	2009/06/25	Yes	-0.60	11.065291	6.97	-0.68	Blend – Mid Cap
STANLIB MM High Equity FoF A	2009/07/01	Yes	3.58	11.594698	6.97	-0.29	Value – Large Cap
ABSA MM Absolute Return Prudential C	2009/08/03	Yes	4.25	5.689399	6.97	-0.48	Value – Mid
Nedgroup Inv Core Diversified B	2009/09/01	Yes	5.10	10.674404	6.97	-0.18	Blend – Large Cap
Element Balanced SCI C	2009/11/12	Yes	7.71	11.086698	6.97	0.07	Value – Mid
ABSA Managed C	2010/02/26	Yes	3.93	11.05275	6.97	-0.27	Value – Mid
Oasis Crescent Balanced High Eq FoF B	2010/04/06	Yes	4.95	8.053957	6.97	-0.25	Value – Mid
AF Investments Performer Managed A	2010/04/07	Yes	5.28	10.549556	6.97	-0.16	Blend – Large Cap
Element Islamic Balanced SCI C	2010/04/28	Yes	9.17	7.531599	6.97	0.29	Value – Mid
Rezco Managed Plus A	2010/08/02	Yes	4.14	8.844004	6.97	-0.32	Blend – Mid Cap
Sanlam Multi Mgd Aggressive FoF B1	2010/08/02	Yes	5.95	11.744797	6.97	-0.09	Value – Mid
Sanlam Multi Mgd Moderate Aggr FoF B1	2010/08/02	Yes	5.30	10.784295	6.97	-0.16	Value – Mid
Sanlam Multi Mgd Moderate FoF B1	2010/08/02	Yes	5.47	8.078077	6.97	-0.19	Blend – Mid Cap
Noble PP BCI Wealth Creator FOF A1	2010/12/01	Yes	4.14	5.294492	6.97	-0.53	Blend – Large Cap
Alusi Managed B	2011/02/01	Yes	3.61	9.441409	6.97	-0.36	Blend – Large Cap
Citadel Balanced H4 B1	2011/04/01	Yes	4.40	8.650661	6.97	-0.30	Blend – Large Cap
Camissa Balanced A	2011/05/03	Yes	8.31	11.880397	6.97	0.11	Blend – Mid Cap
Camissa Islamic Balanced A	2011/05/03	Yes	7.57	9.434905	6.97	0.06	Growth – Large Cap
27four Shari'ah Balanced FoF B3	2011/05/09	Yes	5.04	7.890932	6.97	-0.24	Blend – Mid Cap
NewFunds MAPPS Growth ETF	2011/05/25	Yes	3.85	12.252444	6.97	-0.25	Blend – Large Cap
Simplisiti BCI Managed Protector FoF A	2011/09/01	Yes	4.60	10.650666	6.97	-0.22	Value – Mid
3B BCI Prudential FoF 3B1	2011/09/06	Yes	3.95	11.342711	6.97	-0.27	Value – Mid
4D BCI Moderate FoF A	2011/09/23	Yes	3.83	8.802594	6.97	-0.36	Value – Mid
Nedgroup Inv Balanced A	2011/10/11	Yes	5.86	10.054817	6.97	-0.11	Value – Mid
ABAX Balanced Prescient B3	2011/12/30	Yes	6.76	11.643297	6.97	-0.02	Value – Mid
Bridge Balanced A	2012/03/01	Yes	-2.16	10.423967	6.97	-0.88	Value – Mid
Counterpoint SCI Managed P&G A	2012/03/01	Yes	-3.06	13.70639	6.97	-0.73	Value – Mid
Pinnacle Wealth Balanced Prscnt FOF A1	2012/03/09	Yes	6.15	9.926158	6.97	-0.08	Blend – Mid Cap

CS BCI Aggressive Prudential FoF A	2012/05/02	Yes	4.10	10.733668	6.97	-0.27	Blend – Large Cap
27four Asset Select FoF B3	2012/05/03	Yes	4.67	10.257218	6.97	-0.22	Blend – Large Cap
Sanlam Living Planet B1	2012/05/14	Yes	6.76	9.428509	6.97	-0.02	Blend – Large Cap
PPS Balanced FoF B	2012/07/02	Yes	5.63	9.888578	6.97	-0.14	Blend – Mid Cap
Sygnia CPI + 6% B	2012/08/15	Yes	5.78	10.634134	6.97	-0.11	Blend – Large Cap
Graviton SCI Balanced B1	2012/09/03	Yes	4.65	10.771815	6.97	-0.22	Blend – Large Cap
Counterpoint SCI Balanced Plus B	2012/11/01	Yes	2.72	8.81264	6.97	-0.48	Blend – Large Cap
SMMI Prudential Balanced 1 B1	2012/12/14	Yes	6.98	10.813253	6.97	0.00	Blend – Large Cap
Sasfin BCI Prudential B	2013/01/02	Yes	5.21	7.612994	6.97	-0.23	Value – Large Cap
Long Beach Managed Prescient B3	2013/03/07	Yes	12.35	15.361535	6.97	0.35	Growth – Large Cap
Starfunds.ai BCI Balanced FoF A	2013/04/02	Yes	2.35	8.988131	6.97	-0.51	Value – Mid
FedGroup Aggressive FoF C1	2013/05/06	Yes	3.99	10.610059	6.97	-0.28	Blend – Large Cap
H4 Diversified B1	2013/05/22	Yes	6.44	9.076969	6.97	-0.06	Blend – Large Cap
Ashburton Balanced A	2013/06/18	Yes	3.34	9.569662	6.97	-0.38	Value – Mid
Sygnia Skeleton Balanced 70 A	2013/06/26	Yes	5.98	9.947563	6.97	-0.10	Blend – Large Cap
Centaur BCI Balanced A1	2013/07/01	Yes	9.22	12.060154	6.97	0.19	Value – Mid
Hollard Prime Strategic Assertive FoF E	2013/09/01	Yes	5.65	8.644806	6.97	-0.15	Blend – Large Cap
Obsidian SCI Balanced B4	2013/10/01	Yes	6.27	11.141993	6.97	-0.06	Value – Mid
PPS Institutional Multi Asset Flex B	2013/10/09	Yes	3.77	12.129387	6.97	-0.26	Value – Mid
Analytics Ci Balanced FoF A	2013/10/21	Yes	3.48	10.119604	6.97	-0.34	Blend – Large Cap
NFB Ci Managed A	2013/10/21	Yes	6.68	8.333626	6.97	-0.04	Blend – Large Cap
Satrix Balanced Index C	2013/10/21	Yes	6.26	10.983416	6.97	-0.06	Blend – Large Cap
Aylett Balanced Prescient B3	2013/11/01	Yes	9.36	10.794786	6.97	0.22	Value – Mid
Foord Domestic Balanced B	2014/01/02	Yes	3.72	9.621501	6.97	-0.34	Blend – Mid Cap
Deton Prime Managed FoF A	2014/01/23	Yes	3.58	10.73603	6.97	-0.32	Blend – Large Cap
IP Active Beta A	2014/02/26	Yes	5.17	8.684748	6.97	-0.21	Value – Mid
Capita BCI Balanced A	2014/03/05	Yes	2.01	12.639692	6.97	-0.39	Blend – Mid Cap
Adviceworx Old Mutual Infl + 4-5% FoF B1	2014/04/01	Yes	5.03	9.197719	6.97	-0.21	Blend – Large Cap
Gryphon Prudential Fund B	2014/04/01	Yes	10.21	6.732704	6.97	0.48	Blend – Large Cap
Optimum BCI Managed Growth A	2014/04/01	Yes	3.91	11.229955	6.97	-0.27	Value – Mid
BCI Best Blend Balanced C	2014/05/15	Yes	2.15	12.786187	6.97	-0.38	Blend – Mid Cap
Prescient Balanced B3	2014/05/26	Yes	6.78	10.491937	6.97	-0.02	Blend – Large Cap
APS Ci Managed Growth A1	2014/07/01	Yes	4.14	11.757971	6.97	-0.24	Blend – Large Cap
Cinnabar SCI Balanced Plus FoF	2014/07/29	Yes	3.59	8.714521	6.97	-0.39	Value – Large Cap
SA Asset Management BCI Managed A	2014/08/14	Yes	1.42	8.945671	6.97	-0.62	Blend – Large Cap
Emperor IP Balanced B	2014/09/01	Yes	4.14	12.427296	6.97	-0.23	Value – Mid
FG SCI Neptune Growth FoF A	2014/09/01	Yes	5.75	10.833062	6.97	-0.11	Value – Mid
Perpetua SCI Balanced E	2014/09/19	Yes	3.81	11.14517	6.97	-0.28	Blend – Large Cap
Sanlam Private Wealth Balanced	2014/11/03	Yes	3.72	9.621802	6.97	-0.34	Blend – Large Cap
Celtis BCI Managed FoF A	2014/11/05	Yes	5.29	9.607776	6.97	-0.17	Blend – Large Cap
Rebalance BCI Balanced FoF A	2014/11/05	Yes	3.03	10.805257	6.97	-0.36	Blend – Large Cap
Ci SA Managed A	2014/11/25	Yes	4.51	8.158309	6.97	-0.30	Blend – Mid Cap
Bovest BCI Managed FoF A	2014/12/08	Yes	4.85	9.559789	6.97	-0.22	Blend – Large Cap
Trésor SCI Balanced B1	2015/01/15	Yes	2.74	10.449529	6.97	-0.40	Blend – Large Cap
ClucasGray Equilibrium Prescient A1	2015/01/16	Yes	5.40	10.177576	6.97	-0.15	Value – Mid
Multi Asset IP Balanced Plus B1	2015/01/22	Yes	5.68	9.818024	6.97	-0.13	Blend – Large Cap
Anchor BCI Managed A	2015/02/02	Yes	2.80	10.971253	6.97	-0.38	Blend – Large Cap
Methodical BCI Balanced A	2015/02/09	Yes	4.32	10.052126	6.97	-0.26	Blend – Large Cap
API BCI Managed FoF	2015/02/11	Yes	3.14	11.349372	6.97	-0.34	Blend – Mid Cap
Corion Prime Growth A	2015/03/02	Yes	3.23	9.917907	6.97	-0.38	Blend – Mid Cap
Old Mutual Core Balanced B2	2015/03/02	Yes	5.20	10.900555	6.97	-0.16	Blend – Large Cap
STANLIB MM Shari'ah Balanced FoF B4	2015/03/25	Yes	6.27	8.857384	6.97	-0.08	Value – Mid
PFPS Ci Balanced FoF B	2015/04/01	Yes	4.39	9.830227	6.97	-0.26	Blend – Large Cap
Moore Ci Growth FoF B	2015/04/15	Yes	3.74	9.417283	6.97	-0.34	Blend – Large Cap
Old Mutual Multi-Managers Agg Bal FoF B4	2015/07/31	Yes	5.12	11.499945	6.97	-0.16	Blend – Large Cap
Quattro Ci Growth FoF B	2015/09/01	Yes	3.15	9.837206	6.97	-0.39	Blend – Large Cap

Wealthworks Prime Managed FoF A	2015/09/11	Yes	4.48	9.016523	6.97	-0.28	Blend – Large Cap
AssetMix Ci Balanced B	2015/10/01	Yes	4.02	9.111299	6.97	-0.32	Blend – Large Cap
PPS Balanced Index Tracker B	2015/10/20	Yes	4.54	11.033582	6.97	-0.22	Growth – Large Cap
Assetbase CPI +6% Prescient FoF A1	2015/11/02	Yes	2.43	10.996432	6.97	-0.41	Blend – Large Cap
Pbi BCI Balanced FoF A	2015/11/13	Yes	4.91	9.999956	6.97	-0.21	Blend – Large Cap
Discovery Agg Dynamic Asset Opt FoF A	2015/11/23	Yes	5.66	10.246449	6.97	-0.13	Value – Large Cap
Amity BCI Managed Select Fund of Funds A	2015/11/30	Yes	3.68	12.34315	6.97	-0.27	Blend – Large Cap
Investec BCI Balanced High Equity B	2015/11/30	Yes	2.74	10.72446	6.97	-0.39	Blend – Large Cap
ABSA Multi Managed Core Growth B	2017/12/04	Yes	4.84	11.013613	6.97	-0.19	Blend – Large Cap

Ave of group	4.47
Standard Deviation of display group	1.95659615
Count	148

Appendix B

Table B1 below indicates al the fund of funds in the ASISA South Africa multi asset high equity category for the 5-year period between 2010 and 2015.

Funds for the period 2010 -2015			
Fund of Fund	**De[5]**	**deMax**	**Mew**
Sanlam Multi Mgd Balanced FoF A	0.11	1.50	0.92
Old Mutual Multi-Managers Bal FoF A	0.62	1.82	0.66
Marriott Balanced FoF A	0.89	1.60	0.44
AF Investments Balanced FoF	0.02	1.33	0.99
SIS Inflation Plus 4-6 FoF	0.76	1.83	0.59
Nedgroup Inv XS Diversified FoF A	0.64	1.82	0.65
Select Manager BCI Balanced FoF A	0.72	1.83	0.61
Naviga BCI Balanced Growth FoF A	0.77	1.75	0.56
IFM Dynamic FoF	0.69	1.33	0.48
ABSA Prudential FoF	0.59	1.82	0.67
Kanaan BCI Balanced FoF	0.32	1.82	0.82
Dotport BCI Prudential FoF A	0.47	1.87	0.75
Lynx Prime Balanced FoF A1	0.50	1.75	0.71
Sharenet BCI Aggressive FoF A1	0.62	1.78	0.65
STANLIB Mod Aggressive FoF B1	0.61	1.78	0.66
MET Odyssey Balanced FoF A	0.86	1.83	0.53
SIM Mgd Aggressive FoF B1	0.97	1.88	0.48
Personal Trust Prudent FoF A	0.19	1.60	0.88
SIM Mgd Moderate Aggr FoF B1	0.89	1.88	0.52
Nedgroup Inv Select Growth FoF A	0.01	1.50	0.99
Sage SCI Long Term Solution FoF A	0.63	1.80	0.65
AS Forum BCI Aggressive FoF	0.61	1.88	0.67
ABSA Multi Managed Growth FoF A	0.81	1.78	0.54
PSG Wealth Moderate FoF B	0.01	1.67	0.99
Skyblue BCI Cumulus Moderate FoF A	0.49	1.71	0.72
Southern Charter BCI Growth FoF A	0.52	1.83	0.72
Momentum Best Blend Balanced FoF B1	0.68	1.86	0.63
CS BCI Prudential FoF A	0.31	1.86	0.83
Ampersand SCI CPI Plus 6 FoF B1	0.84	1.60	0.47
ADB BCI Flexible Prudential FoF A	0.54	1.82	0.70
Oasis Crescent Balanced High Eq FoF B	1.25	1.78	0.30
Sanlam Multi Mgd Aggressive FoF B1	1.01	1.83	0.45
Sanlam Multi Mgd Moderate Aggr FoF B1	0.82	1.60	0.49
Sanlam Multi Mgd Moderate FoF B1	0.69	1.50	0.54
Efficient BCI Prudential High FoF A	0.84	1.67	0.50
Noble PP BCI Wealth Creator FOF A1	0.48	1.85	0.74

[5] Reference equation 3.5

Kruger Ci Balanced FoF B1	0.34	1.60	0.79
Analytics Ci Balanced FoF A	0.92	1.71	0.47

Median	0.65
Mean	0.65
Nr of Funds	38
Standard Deviation	0.17

Table B2 below indicates al the fund of funds in the ASISA South Africa multi asset high equity category for the 5-year period between 2016 and 2020.

Funds for the period 2010 -2015			
Fund of Fund	**De[6]**	**deMax**	**Mew**
Sanlam Multi Mgd Balanced FoF A	0.30	1.60	0.81
Old Mutual Multi-Managers Bal FoF A	0.56	1.85	0.70
Marriott Balanced FoF A	0.43	1.71	0.75
AF Investments Balanced FoF	0.60	1.60	0.63
STANLIB MM Medium-High Equity FoF B1	0.80	1.71	0.53
SIS Inflation Plus 4-6 FoF	0.69	1.83	0.62
Nedgroup Inv XS Diversified FoF A	0.66	1.85	0.64
Select Manager BCI Balanced FoF A	0.41	1.80	0.77
ABSA Prudential FoF	0.65	1.80	0.64
Kanaan BCI Balanced FoF	0.63	1.71	0.63
Dotport BCI Prudential FoF A	0.97	1.60	0.39
Lynx Prime Balanced FoF A1	0.45	1.75	0.75
SIM Mgd Aggressive FoF B1	0.87	1.80	0.52
Personal Trust Prudent FoF A	0.24	1.67	0.85
SIM Mgd Moderate Aggr FoF B1	0.80	1.80	0.56
Nedgroup Inv Select Growth FoF A	0.01	1.60	0.99
AS Forum BCI Aggressive FoF	0.25	1.80	0.86
Olympiad BCI Managed FoF	0.00	1.00	1.00
ABSA Multi Managed Growth FoF A	0.72	1.71	0.58
PSG Wealth Moderate FoF B	0.01	1.67	0.99
Skyblue BCI Cumulus Moderate FoF A	0.38	1.83	0.79
Southern Charter BCI Growth FoF A	0.32	1.85	0.83
CS BCI Prudential FoF A	0.26	1.83	0.86
Ampersand SCI CPI Plus 6 FoF B1	0.81	1.67	0.51
ADB BCI Flexible Prudential FoF A	0.50	1.85	0.73
STANLIB MM High Equity FoF A	0.81	1.67	0.52
Oasis Crescent Balanced High Eq FoF B	1.12	1.60	0.30

[6] Reference equation 3.5

Sanlam Multi Mgd Aggressive FoF B1	1.04	1.83	0.43
Sanlam Multi Mgd Moderate Aggr FoF B1	0.65	1.67	0.61
Sanlam Multi Mgd Moderate FoF B1	0.56	1.50	0.62
Noble PP BCI Wealth Creator FOF A1	0.88	1.67	0.47
27four Shari'ah Balanced FoF B3	0.79	1.85	0.57
Simplisiti BCI Managed Protector FoF A	0.82	1.82	0.55
3B BCI Prudential FoF 3B1	0.38	1.82	0.79
4D BCI Moderate FoF A	0.28	1.83	0.85
Pinnacle Wealth Balanced Prscnt FOF A1	0.20	1.78	0.89
CS BCI Aggressive Prudential FoF A	0.36	1.82	0.80
27four Asset Select FoF B3	0.36	1.85	0.81
PPS Balanced FoF B	0.47	1.33	0.65
Starfunds.ai BCI Balanced FoF A	0.29	1.67	0.83
FedGroup Aggressive FoF C1	0.11	1.50	0.93
Hollard Prime Strategic Assertive FoF E	0.71	1.71	0.58
Analytics Ci Balanced FoF A	1.04	1.71	0.39
Deton Prime Managed FoF A	0.73	1.67	0.56
Adviceworx Old Mutual Infl + 4-5% FoF B1	0.39	1.82	0.79
FG SCI Neptune Growth FoF A	0.49	1.85	0.73
Celtis BCI Managed FoF A	0.36	1.85	0.81
Rebalance BCI Balanced FoF A	0.55	1.83	0.70
Bovest BCI Managed FoF A	0.26	1.85	0.86
API BCI Managed FoF	0.52	1.00	0.48
STANLIB MM Shari'ah Balanced FoF B4	0.36	1.33	0.73
PFPS Ci Balanced FoF B	1.07	1.71	0.38
Moore Ci Growth FoF B	0.26	1.71	0.85
Old Mutual Multi-Managers Agg Bal FoF B4	0.75	1.85	0.59
Quattro Ci Growth FoF B	0.35	1.67	0.79
Wealthworks Prime Managed FoF A	0.57	1.75	0.67
Assetbase CPI +6% Prescient FoF A1	0.71	1.85	0.62
Pbi BCI Balanced FoF A	0.35	1.80	0.81
Discovery Agg Dynamic Asset Opt FoF A	1.04	1.71	0.39

Median	0.70
Mean	0.68
Nr of Funds	59
Standard Deviation	0.17

Appendix C

Tables in this section indicate which portfolios were used in construction of the price momentum portfolio for the periods from 2011 to 2022.

2011 – 1 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	11.74%
NGI Private Wealth Diversified Growth A	10.92%
Palmyra BCI Balanced A	10.76%
STANLIB Balanced B1	10.19%
Melville Douglas STANLIB Balanced B1	9.66%
Select BCI Balanced A	9.61%
Coronation Balanced Plus A	9.54%
Foord Balanced A	9.53%
PSG Balanced A	9.12%
STANLIB MM Balanced B1	8.92%

2011 – 2 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	13.22%
PSG Balanced A	10.42%
Palmyra BCI Balanced A	10.38%
STANLIB Balanced B1	9.93%
Coronation Balanced Plus A	9.68%
Melville Douglas STANLIB Balanced B1	9.65%
Rezco Value Trend A	9.49%
NGI Private Wealth Diversified Growth A	9.23%
Ninety One Managed R	9.05%
SIM Balanced R	8.94%

2011 – 3 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	13.70%
Melville Douglas STANLIB Balanced B1	11.23%
Palmyra BCI Balanced A	10.49%
STANLIB Balanced B1	10.45%
M&G Balanced Fund A	9.57%
ABSA Managed C	9.12%
NGI Private Wealth Diversified Growth A	9.04%
Select BCI Balanced A	8.85%
SIM Balanced R	8.82%
Coronation Balanced Plus A	8.73%

2011 – 4 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	18.39%
Ninety One Opportunity R	10.65%
Allan Gray Balanced A	10.22%
Rezco Value Trend A	9.22%
FNB Multi Manager Balanced B1	9.20%
PSG Balanced A	9.10%
Foord Balanced A	8.64%
Ninety One Managed R	8.52%
ABSA Managed C	8.06%
STANLIB Balanced B1	8.00%

2012 – 1 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	18.08%
Rezco Value Trend A	11.67%
Allan Gray Balanced A	10.74%
Ninety One Opportunity R	10.16%
FNB Multi Manager Balanced B1	9.93%
Foord Balanced A	8.56%
Rezco Managed Plus A	8.28%
Nedgroup Inv Managed R	7.65%
PSG Balanced A	7.53%
Element Balanced SCI C	7.40%

2012 – 2 Quarter	
Fund	**Weight**
Afena Managed Prescient B3	16.31%
Rezco Value Trend A	13.80%
FNB Multi Manager Balanced B1	10.27%
Rezco Managed Plus A	10.08%
Foord Balanced A	9.11%
Ninety One Opportunity R	8.61%
Melville Douglas STANLIB Balanced B1	8.37%
Ninety One Managed R	8.22%
Accorn BCI Balanced A	7.69%
Palmyra BCI Balanced A	7.54%

2012 – 3 Quarter	
Fund	**Weight**
Rezco Value Trend A	14.95%
Afena Managed Prescient B3	11.21%
Rezco Managed Plus A	11.01%
FNB Multi Manager Balanced B1	9.97%
Foord Balanced A	9.94%
Ninety One Managed R	9.67%
Ninety One Opportunity R	9.44%
Melville Douglas STANLIB Balanced B1	8.11%
Allan Gray Balanced A	7.99%
Accorn BCI Balanced A	7.70%

2012 – 4 Quarter	
Fund	**Weight**
Rezco Value Trend A	14.62%
Rezco Managed Plus A	10.24%
Melville Douglas STANLIB Balanced B1	10.21%
Foord Balanced A	9.82%
Accorn BCI Balanced A	9.55%
STANLIB Balanced B1	9.42%
Palmyra BCI Balanced A	9.22%
Nedgroup Inv Core Diversified B	9.06%
M&G Balanced Fund A	9.00%
Seed Balanced Prescient A1	8.87%

2013 – 1 Quarter	
Fund	**Weight**
Rezco Value Trend A	12.77%
Accorn BCI Balanced A	10.26%
Melville Douglas STANLIB Balanced B1	10.08%
STANLIB Balanced B1	9.90%
Rezco Managed Plus A	9.85%
Autus Prime Balanced A	9.72%
Nedgroup Inv Core Diversified B	9.66%
Foord Balanced A	9.46%
NGI Private Wealth Diversified Growth A	9.35%
M&G Balanced Fund A	8.95%

2013 – 2 Quarter	
Fund	**Weight**
Rezco Value Trend A	12.13%
Rezco Managed Plus A	10.73%
Coronation Balanced Plus A	10.24%
Autus Prime Balanced A	9.92%
Personal Trust Managed	9.77%
Foord Balanced A	9.72%
STANLIB Balanced B1	9.58%
M&G Balanced Fund A	9.35%
Melville Douglas STANLIB Balanced B1	9.31%
Nedgroup Inv Core Diversified B	9.26%

2013 – 3Q	
Fund	**Weight**
Rezco Value Trend A	12.53%
Rezco Managed Plus A	11.81%
Coronation Balanced Plus A	10.44%
Autus Prime Balanced A	10.41%
Personal Trust Managed	9.58%
M&G Balanced Fund A	9.40%
Melville Douglas STANLIB Balanced B1	9.13%
Foord Balanced A	9.13%
STANLIB Balanced B1	8.89%
NGI Private Wealth Diversified Growth A	8.67%

2013 – 4Q	
Fund	**Weight**
Rezco Managed Plus A	11.02%
Coronation Balanced Plus A	10.61%
Rezco Value Trend A	10.57%
Autus Prime Balanced A	10.44%
Personal Trust Managed	10.11%
Melville Douglas STANLIB Balanced B1	9.76%
NGI Private Wealth Diversified Growth A	9.68%
M&G Balanced Fund A	9.32%
PSG Balanced A	9.30%
Foord Balanced A	9.19%

2014 – 1 Quarter	
Fund	**Weight**
Rezco Managed Plus A	11.02%
Rezco Value Trend A	10.80%
Autus Prime Balanced A	10.55%
PSG Balanced A	10.40%
Coronation Balanced Plus A	10.27%
Personal Trust Managed	9.63%
M&G Balanced Fund A	9.55%
Allan Gray Balanced A	9.48%
Melville Douglas STANLIB Balanced B1	9.45%
Discovery Balanced	8.83%

2014 – 2 Quarter	
Fund	**Weight**
Autus Prime Balanced A	10.63%
Personal Trust Managed	10.43%
M&G Balanced Fund A	10.09%
Nedgroup Inv Managed R	10.06%
PSG Balanced A	9.91%
NGI Private Wealth Diversified Growth A	9.88%
RECM Balanced A	9.83%
Melville Douglas STANLIB Balanced B1	9.79%
Coronation Balanced Plus A	9.75%
Ninety One Managed R	9.63%

2014 – 3 Quarter	
Fund	**Weight**
Flagship IP Balanced Fund A	11.42%
Discovery Balanced	10.28%
Nedgroup Inv Core Diversified B	10.16%
NGI Private Wealth Diversified Growth A	10.10%
Personal Trust Managed	10.08%
ABSA Managed C	9.72%
Melville Douglas STANLIB Balanced B1	9.69%
RECM Balanced A	9.58%
Nedgroup Inv Managed R	9.52%
SIM Balanced R	9.44%

2014 – 4 Quarter	
Fund	**Weight**
Personal Trust Managed	10.96%
Plexus Wealth BCI Balanced A	10.57%
Nedgroup Inv Core Diversified B	10.54%
Allan Gray Balanced A	10.22%
M&G Balanced Fund A	10.12%
Melville Douglas STANLIB Balanced B1	9.72%
Seed Balanced Prescient A1	9.67%
ABSA Managed C	9.57%
Discovery Balanced	9.49%
Coronation Balanced Plus A	9.14%

2015 – 1 Quarter	
Fund	**Weight**
Plexus Wealth BCI Balanced A	14.31%
Seed Balanced Prescient A1	10.67%
Nedgroup Inv Core Diversified B	10.64%
NGI Private Wealth Diversified Growth A	9.79%
Personal Trust Managed	9.69%
Autus Prime Balanced A	9.25%
M&G Balanced Fund A	9.22%
Discovery Balanced	9.16%
Coronation Balanced Plus A	8.68%
PSG Balanced A	8.60%

2015 – 2 Quarter	
Fund	**Weight**
Plexus Wealth BCI Balanced A	12.39%
Counterpoint SCI Managed P&G A	11.84%
Centaur BCI Balanced A1	10.61%
Obsidian SCI Balanced B4	9.75%
Nedgroup Inv Balanced A	9.65%
ABAX Balanced Prescient B3	9.50%
Autus Prime Balanced A	9.47%
SMMI Prudential Balanced 1 B1	9.18%
Seed Balanced Prescient A1	9.03%
Discovery Balanced	8.59%

2015 – 3 Quarter	
Fund	**Weight**
Centaur BCI Balanced A1	11.59%
Counterpoint SCI Managed P&G A	11.59%
Plexus Wealth BCI Balanced A	11.42%
Autus Prime Balanced A	10.42%
ABAX Balanced Prescient B3	10.03%
Nedgroup Inv Balanced A	9.48%
Obsidian SCI Balanced B4	9.36%
SMMI Prudential Balanced 1 B1	9.32%
Discovery Balanced	8.55%
Seed Balanced Prescient A1	8.22%

2015 – 4 Quarter	
Fund	**Weight**
Autus Prime Balanced A	10.95%
Nedgroup Inv Balanced A	10.57%
Emperor IP Balanced B	10.53%
SMMI Prudential Balanced 1 B1	10.00%
Rezco Managed Plus A	10.00%
Long Beach Managed Prescient B3	9.83%
Ninety One Managed R	9.73%
Obsidian SCI Balanced B4	9.62%
Plexus Wealth BCI Balanced A	9.40%
Custodian BCI Balanced A	9.36%

2016 – 1 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	12.67%
Autus Prime Balanced A	11.09%
Ninety One Managed R	10.61%
Nedgroup Inv Balanced A	10.60%
Rezco Managed Plus A	10.09%
Emperor IP Balanced B	9.62%
Rezco Value Trend A	9.16%
SMMI Prudential Balanced 1 B1	8.96%
Custodian BCI Balanced A	8.96%
Ninety One Opportunity R	8.25%

2016 – 2 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	20.41%
Ninety One Managed R	11.74%
Allan Gray Balanced A	11.57%
Ninety One Opportunity R	11.49%
Gryphon Prudential Fund B	8.44%
Autus Prime Balanced A	8.23%
Aylett Balanced Prescient B3	7.54%
Nedgroup Inv Balanced A	7.46%
Rezco Managed Plus A	6.56%
Anchor BCI Managed A	6.56%

2016 – 3 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	21.64%
Ninety One Opportunity R	12.08%
Allan Gray Balanced A	11.35%
Ninety One Managed R	10.35%
Aylett Balanced Prescient B3	8.64%
Gryphon Prudential Fund B	7.96%
Custodian BCI Balanced A	7.29%
SMMI Prudential Balanced 1 B1	7.06%
Sasfin BCI Prudential B	6.82%
Obsidian SCI Balanced B4	6.80%

2016 – 4 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	15.44%
Element Islamic Balanced SCI C	10.80%
Allan Gray Balanced A	10.79%
Aylett Balanced Prescient B3	10.42%
Camissa Balanced A	9.74%
Centaur BCI Balanced A1	9.29%
Camissa Islamic Balanced A	8.77%
PSG Balanced A	8.69%
Element Balanced SCI C	8.15%
ABAX Balanced Prescient B3	7.92%

2017 – 1 Quarter	
Fund	**Weight**
Element Islamic Balanced SCI C	14.34%
Aylett Balanced Prescient B3	13.46%
Centaur BCI Balanced A1	11.35%
PSG Balanced A	10.54%
ABAX Balanced Prescient B3	9.37%
Camissa Balanced A	9.29%
Camissa Islamic Balanced A	8.87%
Element Balanced SCI C	7.93%
Perpetua SCI Balanced E	7.91%
Counterpoint SCI Managed P&G A	6.94%

2017 – 2 Quarter	
Fund	**Weight**
Element Balanced SCI C	18.33%
Centaur BCI Balanced A1	13.49%
Aylett Balanced Prescient B3	12.11%
Element Islamic Balanced SCI C	11.42%
PSG Balanced A	8.37%
Camissa Balanced A	8.31%
Palmyra BCI Balanced A	7.49%
ABAX Balanced Prescient B3	6.99%
Camissa Islamic Balanced A	6.83%
Counterpoint SCI Managed P&G A	6.67%

2017 – 3 Quarter	
Fund	**Weight**
Element Balanced SCI C	20.40%
Element Islamic Balanced SCI C	12.52%
Centaur BCI Balanced A1	11.40%
Aylett Balanced Prescient B3	10.65%
Camissa Balanced A	9.24%
PSG Balanced A	9.12%
Palmyra BCI Balanced A	7.25%
ABAX Balanced Prescient B3	6.92%
Camissa Islamic Balanced A	6.90%
ClucasGray Equilibrium Prescient A1	5.60%

2017 – 4 Quarter	
Fund	**Weight**
Element Balanced SCI C	19.80%
Element Islamic Balanced SCI C	13.12%
Centaur BCI Balanced A1	9.78%
Aylett Balanced Prescient B3	8.54%
Ninety One Managed R	8.53%
SMMI Prudential Balanced 1 B1	8.48%
Gryphon Prudential Fund B	8.15%
Palmyra BCI Balanced A	7.98%
ABSA Multi Managed Core Growth B	7.92%
Prescient Balanced B3	7.71%

2018 – 1 Quarter	
Fund	**Weight**
Element Balanced SCI C	13.12%
Satrix Balanced Index C	11.88%
NewFunds MAPPS Growth ETF	11.36%
Prescient Balanced B3	10.83%
Long Beach Managed Prescient B3	10.58%
PPS Balanced Index Tracker B	8.77%
SMMI Prudential Balanced 1 B1	8.59%
Centaur BCI Balanced A1	8.41%
Emperor IP Balanced B	8.24%
Melville Douglas STANLIB Balanced B1	8.21%

2018 – 2 Quarter	
Fund	**Weight**
Satrix Balanced Index C	11.61%
Aylett Balanced Prescient B3	11.14%
Prescient Balanced B3	10.41%
Emperor IP Balanced B	10.30%
Ninety One Managed R	10.02%
NewFunds MAPPS Growth ETF	9.82%
ClucasGray Equilibrium Prescient A1	9.75%
Melville Douglas STANLIB Balanced B1	9.48%
SMMI Prudential Balanced 1 B1	9.35%
Ci SA Managed A	8.12%

2018 – 3 Quarter	
Fund	**Weight**
Emperor IP Balanced B	12.70%
Aylett Balanced Prescient B3	11.12%
Gryphon Prudential Fund B	10.88%
Long Beach Managed Prescient B3	10.57%
ClucasGray Equilibrium Prescient A1	9.92%
Satrix Balanced Index C	9.67%
Ninety One Managed R	9.59%
H4 Diversified B1	8.62%
Prescient Balanced B3	8.52%
SMMI Prudential Balanced 1 B1	8.41%

2018 – 4 Quarter	
Fund	**Weight**
Aylett Balanced Prescient B3	13.73%
ClucasGray Equilibrium Prescient A1	10.77%
Gryphon Prudential Fund B	10.70%
Emperor IP Balanced B	10.43%
PSG Balanced A	9.53%
Counterpoint SCI Balanced Plus B	9.43%
Ninety One Opportunity R	9.25%
Melville Douglas STANLIB Balanced B1	8.94%
H4 Diversified B1	8.79%
Ninety One Managed R	8.43%

2019 – 1 Quarter	
Fund	**Weight**
Gryphon Prudential Fund B	14.62%
Aylett Balanced Prescient B3	12.22%
Element Islamic Balanced SCI C	11.05%
ABSA MM Absolute Return Prudential C	9.62%
ClucasGray Equilibrium Prescient A1	9.16%
Long Beach Managed Prescient B3	9.14%
Element Balanced SCI C	9.08%
Counterpoint SCI Balanced Plus B	8.49%
Nedgroup Inv Managed R	8.45%
ABAX Balanced Prescient B3	8.17%

2019 – 2 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	16.04%
Camissa Balanced A	10.24%
H4 Diversified B1	10.13%
Nedgroup Inv Balanced A	9.98%
Sanlam Private Wealth Balanced	9.35%
Counterpoint SCI Balanced Plus B	9.29%
Element Islamic Balanced SCI C	9.15%
Gryphon Prudential Fund B	9.00%
Ninety One Opportunity R	8.65%
ABAX Balanced Prescient B3	8.16%

2019 – 3 Quarter	
Fund	**Weight**
Camissa Balanced A	11.91%
Accorn BCI Balanced A	11.27%
Element Islamic Balanced SCI C	11.07%
Obsidian SCI Balanced B4	10.66%
H4 Diversified B1	10.59%
Select BCI Balanced A	9.82%
IP Active Beta A	9.00%
Satrix Balanced Index C	8.74%
Nedgroup Inv Managed R	8.50%
Element Balanced SCI C	8.44%

2019 – 4 Quarter	
Fund	**Weight**
Camissa Balanced A	12.43%
Gryphon Prudential Fund B	10.84%
Accorn BCI Balanced A	10.62%
Nedgroup Inv Balanced A	10.35%
Element Islamic Balanced SCI C	9.91%
Long Beach Managed Prescient B3	9.83%
Obsidian SCI Balanced B4	9.35%
Nedgroup Inv Managed R	9.32%
Select BCI Balanced A	8.72%
H4 Diversified B1	8.63%

2020 – 1 Quarter	
Fund	**Weight**
Camissa Balanced A	12.35%
Emperor IP Balanced B	11.08%
Rezco Managed Plus A	10.17%
Nedgroup Inv Balanced A	10.15%
Nedgroup Inv Managed R	9.62%
ABAX Balanced Prescient B3	9.61%
Obsidian SCI Balanced B4	9.55%
SMMI Prudential Balanced 1 B1	9.19%
Coronation Balanced Plus A	9.17%
Rezco Value Trend A	9.11%

2020 – 2 Quarter	
Fund	**Weight**
Gryphon Prudential Fund B	18.18%
Rezco Managed Plus A	15.63%
Rezco Value Trend A	14.58%
Ninety One Managed R	12.64%
Ninety One Opportunity R	8.15%
Sasfin BCI Prudential B	6.70%
Nedgroup Inv Balanced A	6.17%
Emperor IP Balanced B	6.11%
Autus Prime Balanced A	5.94%
Element Islamic Balanced SCI C	5.90%

2020 – 3 Quarter	
Fund	**Weight**
Gryphon Prudential Fund B	16.43%
Emperor IP Balanced B	11.91%
Rezco Managed Plus A	11.75%
Rezco Value Trend A	11.32%
Long Beach Managed Prescient B3	10.74%
Flagship IP Balanced Fund A	8.49%
Ninety One Opportunity R	7.62%
Ninety One Managed R	7.51%
Nedgroup Inv Balanced A	7.19%
Autus Prime Balanced A	7.04%

2020 – 4 Quarter	
Fund	**Weight**
Emperor IP Balanced B	16.61%
Gryphon Prudential Fund B	13.10%
Long Beach Managed Prescient B3	10.84%
Rezco Managed Plus A	10.67%
Rezco Value Trend A	10.56%
Flagship IP Balanced Fund A	10.38%
Autus Prime Balanced A	9.04%
Ninety One Opportunity R	7.07%
IP Active Beta A	5.94%
Alusi Managed B	5.80%

2021 – 1 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	18.29%
Emperor IP Balanced B	15.83%
Gryphon Prudential Fund B	13.65%
Flagship IP Balanced Fund A	8.43%
Centaur BCI Balanced A1	8.09%
Autus Prime Balanced A	7.81%
Sanlam Living Planet B1	7.80%
Nedgroup Inv Balanced A	7.15%
IP Active Beta A	6.57%
Ninety One Opportunity R	6.38%

2021 – 2 Quarter	
Fund	**Weight**
Long Beach Managed Prescient B3	11.84%
Aylett Balanced Prescient B3	11.11%
PSG Balanced A	10.71%
Centaur BCI Balanced A1	10.31%
PPS Institutional Multi Asset Flex B	9.79%
NewFunds MAPPS Growth ETF	9.57%
Emperor IP Balanced B	9.45%
ABAX Balanced Prescient B3	9.23%
Obsidian SCI Balanced B4	9.03%
Camissa Balanced A	8.94%

2021 – 3 Quarter	
Fund	**Weight**
Aylett Balanced Prescient B3	14.21%
PSG Balanced A	12.16%
Counterpoint SCI Managed P&G A	9.89%
Centaur BCI Balanced A1	9.66%
PPS Institutional Multi Asset Flex B	9.34%
Nedgroup Inv Managed R	9.22%
Camissa Balanced A	9.11%
Camissa Islamic Balanced A	8.90%
Obsidian SCI Balanced B4	8.89%
ABAX Balanced Prescient B3	8.62%

2021 – 4 Quarter	
Fund	**Weight**
Counterpoint SCI Managed P&G A	12.97%
PSG Balanced A	12.22%
Centaur BCI Balanced A1	10.34%
Aylett Balanced Prescient B3	10.08%
ClucasGray Equilibrium Prescient A1	9.23%
PPS Institutional Multi Asset Flex B	9.19%
Nedgroup Inv Managed R	9.15%
Obsidian SCI Balanced B4	9.04%
Camissa Islamic Balanced A	8.95%
ABSA Managed C	8.84%

2022 – 1 Quarter	
Fund	**Weight**
Aylett Balanced Prescient B3	13.86%
PSG Balanced A	11.25%
Counterpoint SCI Managed P&G A	10.80%
ABAX Balanced Prescient B3	10.50%
PPS Institutional Multi Asset Flex B	9.59%
ClucasGray Equilibrium Prescient A1	9.23%
Camissa Islamic Balanced A	8.96%
Centaur BCI Balanced A1	8.91%
ABSA Managed C	8.47%
Satrix Balanced Index C	8.43%

2022 – 2 Quarter	
Fund	**Weight**
Counterpoint SCI Managed P&G A	15.34%
PSG Balanced A	12.16%
Aylett Balanced Prescient B3	12.06%
PPS Institutional Multi Asset Flex B	10.13%
ABAX Balanced Prescient B3	9.42%
ClucasGray Equilibrium Prescient A1	9.30%
Satrix Balanced Index C	9.11%
Camissa Islamic Balanced A	7.54%
Centaur BCI Balanced A1	7.50%
ABSA Managed C	7.44%

2022 – 3 Quarter	
Fund	**Weight**
PPS Institutional Multi Asset Flex B	15.53%
ABAX Balanced Prescient B3	11.44%
Counterpoint SCI Managed P&G A	10.74%
Nedgroup Inv Managed R	10.68%
Aylett Balanced Prescient B3	10.42%
PSG Balanced A	10.21%
ClucasGray Equilibrium Prescient A1	8.19%
Gryphon Prudential Fund B	7.98%
Allan Gray Balanced A	7.68%
Oasis Balanced A	7.13%

2022 – 4 Quarter	
Fund	**Weight**
PPS Institutional Multi Asset Flex B	17.22%
Gryphon Prudential Fund B	12.69%
Aylett Balanced Prescient	11.81%
Nedgroup Inv Managed R	10.25%
ABAX Balanced Prescient B3	9.77%
Nedgroup Inv Balanced A	8.71%
Rezco Value Trend A	8.61%
Rezco Managed Plus A	7.41%
Sasfin BCI Prudential B	7.01%
Allan Gray Balanced A	6.52%

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