Do investment strategies based on previous performance yield higher returns? Evidence from South African bond funds

A Thesis

presented to

The Graduate School of Business

University of Cape Town

In partial fulfilment

of the requirements for the

Master of Commerce in Development Finance Degree

by

Monwabisi Myoli

December 2018

Supervised by: Lungelo Gumede

University of Cape Town

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

University of Cape Town

PLAGIARISM DECLARATION

Declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2. I have used the APA convention for citation and referencing. Each contribution to, and quotation in, this thesis from the work(s) of other people has been attributed, and has been cited and referenced.

3. This thesis is my own work.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

5. I acknowledge that copying someone else's assignment or essay, or part of it, is wrong, and declare that this is my own work.

Signature Signed by candidate

Monwabisi Myoli

ABSTRACT

This paper examines the performance and performance persistence of South African bond mutual funds. To my knowledge, this paper is among the first research papers to focus on South African bond mutual funds. I utilize the Sharpe Ratio, the modified Sharpe ratio, Jensen's alpha and the multi-index models to examine whether peformance is influenced by the performance measure used. In addition, I examine the impact of conditioning information variables on performance by further measuring performance using the conditional single-index and conditional multi-index models. To test for persistence, I use the contigency tables and cross-sectional regressions. I find empirical evidence to suggest that South African bond funds are not able to outperform the market. These findings are consistent across the Sharpe ratio, the unconditional single-index alphas and the unconditional multi-index alphas. When I consider the modified and conditional versions of these models, I conclude that the modified Sharpe ratio improves fund performance when compared to the original Sharpe ratio. Additionally, I conclude that incorporating conditional information variables does not offer significant improvements on the results. However, despite the observed underperformance, I note the improvement on alphas when these conditioning variables are considered. In examining performance persistence, I find evidence to suggest that, in the short-term, persistence is not sensitive to the persistence methodology used. However, I observe that persistence is rather sensitive to the performance model used. Over the longer-term, I find evidence to conclude that persistence is greatly sensitive to both the performance model used as well as the methodology used to test such persistence. My results suggest that the South African bond market is efficient and thereby in support of a passive management investment strategy. Nonetheless, my results urge for a need for bond funds to pay special attention to their trading costs in order to maximise returns for their investors.

TABLE OF CONTENTS

PLAGIARISM DECLARATION i
ABSTRACT ii
TABLE OF CONTENTS iii
LIST OF FIGURES AND TABLES v
GLOSSARY OF TERMS vi
ACKNOWLEDGEMENT vii
1 INTRODUCTION 1
1.1 Research Area 1
1.2 Problem Statement 5
1.3 Purpose and Significance of the Research 6
1.4 Research Questions and Scope 7
1.5 Outline of the study 7
2 LITERATURE REVIEW 8
2.1 Theoretical review 8
2.1.1 Efficient Market Hypothesis 8
2.1.2 Behavioural Finance 10
2.1.3 The Arithmetic of Active Management 12
2.1.4 Equilibrium Accounting 15
2.2 Empirical review 16
2.2.1 The evolution of pioneering studies 16
2.2.2 Performance of bond mutual funds 19
2.2.3 Conditioning information 22
2.2.4 Performance of South African mutual funds 23
2.3 Literature review summary 26
3 RESEARCH METHODOLOGY 28
3.1 Research Approach and Strategy 28
3.1.1 The Sharpe ratio and its modified version 29
3.1.2 Unconditional CAPM (Jensen's alpha) 30
3.1.3 Multi-index model 32
3.1.4 Conditional models 33
3.1.5 Performance persistence 34
3.2 Data Collection, Frequency and Choice of Data 36
3.2.1 Data 36
3.2.2 Conditioning information variables 37
3.3 Sampling 38
3.4 Data Analysis Methods 38

3.5 Research Reliability and Validity 39
3.6 Limitations 41
4 RESEARCH FINDINGS, ANALYSIS AND DISCUSSION 43
4.1 Fund performance evaluation 43
4.1.1 The Sharpe ratio and its modified version 43
4.1.2 The CAPM model (Jensen's alpha) and its conditional version 46
4.1.3 The multi-index model and its conditional version 48
4.2 Fund performance persistence 52
4.2.1 Performance persistence over short-term periods 52
4.2.2 Performance persistence over longer-term periods 60
5 RESEARCH CONCLUSIONS 64
6 RECOMMENDATIONS FOR FUTURE RESEARCH 68
REFERENCES 69
APPENDICES 77
Appendix A – Mutual fund data summary 77
Appendix B – Fund performance results 79
Appendix C – Performance persistence results 91

LIST OF FIGURES AND TABLES

Table 1: Summary statistics and mutual fund sample profile 77
Table 2: Model summary statistics 39
Table 2a: Model variable coefficients and p-values 40
Table 3: Correlation matrix among independent variable 41
Table 4: Summary performance results using the Sharpe ratio vs modified version 44
Table 5: Summary performance results using the CAPM vs conditional CAPM 47
Table 6: Summary performance results using the unconditional vs conditional Multi-Index Models 49
Table 7: Short-term performance persistence results using Contigency Tables across all six fund performance evaluation models 54
Table 8: Short-term performance persistence results using Cross-sectional Regression across unconditional and conditional alphas 58
Table 9: Longer-term performance persistence results using Contigency Tables across all six fund performance evaluation models 61
Table 10: Longer-term performance persistence results using Cross-sectional Regression across unconditional and conditional alphas 63
Table B1: Sharpe ratio performance results 79
Table B2: Modified Sharpe ratio performance results 81
Table B3: CAPM performance results 83
Table B4: Conditional CAPM performance results 85
Table B5: Multi-index model performance results 87
Table B6: Conditional Multi-index model performance results 89
Table C1: Performance persistence results using Contigency Tables and Sharpe ratio as a performance measure 91
Table C2: Performance persistence results using Contigency Tables and Modified Sharpe ratio as a performance measure 93
Table C3: Performance persistence results using Contigency Tables and CAPM as a performance measure 95
Table C4: Performance persistence results using Contigency Tables and conditional CAPM as a performance measure 97
Table C5: Performance persistence results using Contigency Tables and multi-index model as a performance measure 99
Table C6: Performance persistence results using Contigency Tables and conditional multi-index model as a performance measure 101

GLOSSARY OF TERMS

Abbreviation	Term
ADF	Augmented Dickey-Fuller
ALBI	All Bond Index
ALSI	All Share Index
APT	Arbitrage Pricing Theory
AuM	Assets under Management
CAPM	Capital Asset Pricing Model
CDS	Credit Default Swap
CIS	Collective Investment Schemes
CPI	Consumer Price Index
CPR	Cross-Product Ratio
CRSP	Center for Research in Security Prices
EMH	Efficient Market Hypothesis
ETF	Exchange Traded Funds
FSB	Financial Services Board
FTSE	Financial Times Stock Exchange
II	Industrial Index
IRESS	IRESS Expert database
IRW	Inverse Relative Wealth
JSE	Johannesburg Stock Exchange
LL	Loser-Loser
LW	Loser-Winner
MPT	Modern Portfolio Theory
NAV	Net Asset Value
OMIG	Old Mutual Investment Group
PP	Phillips Perron
RDM	Rand Daily Mail
S&P	Standard & Poors
SARB	South African Reserve Bank
SDF	Stochastic Discount Factors
Stats SA	Statistics South Africa
T-bill	Treasury Bill
UIT	Unit Investment Trust
UK	United Kingdom
US	United States
WL	Winner-Loser
WW	Winner-Winner

ACKNOWLEDGEMENTS

I would like to express all my heart felt gratitude to my family for their love and support throughout this academic journey, for always encouraging me to reach for my dreams and yet keeping me grounded to remember the important things in life, and for their confidence in me.

To my number one cheerleader – my partner – thank you for your patience, understanding, support and love. You have been an ear to moan to at times of hardship and the most proud at times of celebrations.

A special shout-out also goes out to my friends for reminding me to have fun every now and then and enjoy the journey – Thank you guys!

Lastly, I would also like to thank my supervisor for the guidance, patience and debates. Your suggestions did not go unnoticed.

1 INTRODUCTION

1.1 Research Area

The question of whether investors should invest in funds that showcase persistence in past performances, together with the issue of selecting an appropriate method to evaluate the performance of mutual funds, remains an on-going debate in finance literature. Persistence in performance means that a fund with a superior (or poor) performance in the past is more likely to have a superior (or poor) performance in the future. This theory of performance persistence not only violates the efficient markets hypothesis ("EMH"), but it also means that investors can exploit the observed persistence patterns to realise higher returns. This can be done by buying funds with superior past performances and selling those with poor past performances. According to the EMH, however, fund managers should not consistently be outperforming the market and realising higher returns, since no security would be priced incorrectly for a long period of time. Despite whether the EMH holds, all fund managers seek to exploit any temporary mispricing of securities and bonds in the market, which represents a deviation from the continuous stochastic equilibrium, and thereby creates pockets of temporary market inefficiencies.

In a perfectly efficient capital market, however, all truly diversified portfolios would move with the overall securities market, and only gain good returns when the market has archived good returns. If that is the case, then why does mutual fund performance continue to be a topical subject within finance literature? Performance is an ex-post evaluation and remains largely a measure of efficacy for an overall investment strategy (Alexander Forbes, 2016). Each year we see "top performing" funds being awarded with accolades and attracting a significant number of investors. Of course, a fund's best proof of its ability to generate superior returns may be found in its performance track record, and this becomes the key measure on which fund managers are being judged. Much literature has documented that historic performance is the predominant measure in which mutual funds are selected by investors (see Ippolito, 1992; Gruber, 1996; and Busse & Irvine, 2006). Therefore, it may be argued that the benefits of a superior past performance for a mutual fund are one which, if such performance persists, would cause investors to prefer it over another (Treynor, 1965). However, the question of whether past performance is a reliable predictor of future performance remains.

Alexander Forbes (2016), in their December 2016 annual survey titled *"Manager Watch Survey of Retirement Investment Managers"*, argues that past performance is no indicator of the future.

Their argument is based on the review of the 2015 and 2016 surveys, where many of the top quartile performers in 2015 had moved to the bottom for 2016, while some of the poorest performers in 2015 had moved to the top quartile in the 2016 survey (Alexander Forbes, 2016). Academics on the other hand, have long empirically debated the issue and as such, the outcomes of such empirical debates may have implications on other theories of finance. For example, persistence of superior performance may suggest that some fund managers may have superior information and that markets are not efficient. This may also suggest that the modern portfolio theory is the best tool to maximize benefit to the investor.

According to Elton and Gruber (1997), the obsession with fund performance among academics predates even the genesis of the modern portfolio theory ("MPT") by Markowitz in 1952, with Cowles (1933) being one of the early studies on performance evaluation. In his study, Cowles measured the performance of a sampled number of managed portfolios against their comparable passive counterparts and concluded that managed portfolios showed inferior results to their passive benchmarks. However, it should be noted that Cowles' evaluation ignored any consideration of risk, as would have otherwise been suggested by the MPT. Following Markowitz's ground-breaking contribution to literature, several performance evaluation techniques based on risk and return were developed. These included the Treynor index (Treynor, 1965), immediately followed by the Sharp ratio (Sharpe, 1966), and then the Jensen's alpha (Jensen, 1968). The idea behind these methods is to adjust the average returns for some measure of risk, whether the risk is measured in a form of standard deviation or in a form of a beta. Setting the tone for performance evaluation literature, these earlier studies did not come up in support of the view that mutual funds showcase superior performance to the market, nor that funds showcase persistence in performance. Even though Treynor (1965) did not particularly measure the performance of actively managed portfolios against their passive counterparts, he did emphasise that the significance of performance among his sample of funds is heavily influenced by market conditions, suggesting that a fund performance is dependent on market performance.

The wave of literature that followed since the days of Treynor, Sharpe, and Jensen has been somewhat mixed and inconclusive. Some literature has concluded on evidence of performance persistence while others have not. I have observed that some of the reasons for such inconclusive evidence among literature is due to the outcomes being influenced by either the evaluation methodology followed, the duration of evaluation horizon, the market being

observed and the period of the study (1990s vs 2000s, etc), while other studies have only found performance persistence in best performing funds and others in underperforming funds.

Most empirical studies on fund performance evaluation, however, have focused mainly on equity mutual funds and have concentrated on the United States ("US") and the United Kingdom ("UK") markets. This has left literature on performance of bond mutual funds scarce, and even scarcer, literature focusing on smaller and emerging bond markets, such as South Africa. This is concerning given the growing importance that bond funds assume in contributing to the liquidity of emerging bond markets, and their importance to the mutual fund industry in these markets. When we focus on the emerging markets in Africa, South Africa is by far the most matured and advanced financial market in the continent, having the largest value of Assets under Management ("AuM") when we narrow my focus to the mutual fund or unit trust industry. South Africa is also more advanced in terms of its legal and regulatory framework when comparing it to other regions in Africa. The term "mutual fund" is a US term referring to open-ended investment companies that offer redeemable participation rights in all of the fund's securities, similar to unit trusts in South Africa. The difference between the mutual fund and the unit trust lies in their legal structures, but with the same end result to the investor. A unit trust is governed by a trust company while a mutual fund is under the responsibilities of mutual fund directors who ensure that the fund manager fulfils his duties in accordance with the fund objectives (Oldert, 2005).

The inception of the mutual fund industry in South Africa dates back to June 1965, with a single unit trust fund, named the Sage Fund, with an asset value of R600 000 (Meyer-Pretorius & Wolmarans, 2006). Meyer-Pretorius and Wolmarans (2006) further explain that by the end of 1965 South Africa only had two funds in existence, with an estimated combined asset value of R3 million. It was not until 1978 that South Africa launched its first non-equity fund, a fixed income fund named the Standard Bank Extra Income Fund. As at September 2018, there were over 2 130 funds listed under the Collective Investment Schemes ("CIS") in South Africa, with 53 fund managers registered on the CIS list. The total AuM have also significantly increased to just over R5.015 trillion since inception, with the 10 largest fund management companies in South Africa accounting for 67.9% of the total AuM, including multi-managers for the period ending December 2016 (Alexander Forbes, 2016). To date, Old Mutual Investment Group ("OMIG") is the biggest manager with international investment mandates in term of AuM (Alexander Forbes, 2016).

The South African mutual fund industry is governed by the Collective Investment Schemes Control Act of 2002, under the regulation of the Financial Services Board ("FSB"). There are five types of CIS permitted by the regulator: The Local CIS in Securities; the Foreign CIS in Securities; the CIS in Property; the CIS in Participation Bond Schemes; and the CIS in Hedge Funds. The FSB regulatory framework on funds has also gone through its own fair share of evolution. International diversification in South Africa was still very restricted during the periods leading up to the end of 1980s. The deregulation of foreign investments had a significant impact on the South African mutual fund market as a wide range of international products became available. During June 1998, the regulatory framework amended the laws relating to unit trust fees and charges. Prior to the amendments, funds were legally not permitted to charge more than 5% for initial charges and 1% of assets as an annual management fee (Meyer-Pretorius & Wolmarans, 2006). With the deregulation removing the ceiling on fees, this meant that market forces thereby determined the annual management fees.

According to Moneta (2015), similar to equity funds, bond mutual funds also engage in active fund management as evidenced by their high turnover rates. Some studies (see Glode, 2011; and Kosowski, 2011) have shown that equity funds tend to outperform during recession periods than expansion periods, suggesting that fund managers' abilities may be state dependent. Since active bond fund managers use a number of portfolio strategies, such as decreasing (increasing) the duration of the fund if they predict an increase (decrease) on interest rates yields in the market (Ferson, Henry, & Kisgen, 2006), similar to equity fund managers, bond fund managers' abilities may too be state dependent. The predictive ability of bond fund managers has become an even more important factor to consider for bond fund investors in South Africa following the recent sovereign bond credit rating downgrade to just one level above non-investment grade status in December 2015. However, some studies (Gultekin & Rogalski, 1985; Litterman & Scheinkman, 1991; and Knez, Litterman, & Scheinkman, 1994;) argue that the returns on bond funds are almost fully driven by non-diversifiable processes that are very hard to predict, while others provide empirical evidence to support the existence of performance skills among bond fund managers. For example, Blake, Elton, and Gruber (1993) suggest that return differences between active bond funds can be explained either by differences in the maturity range or by differences in the risk premium of the bonds that are held.

As Markowitz (1952) states, there are two stages involved in the process of selecting a portfolio. The first stage starts with the observation and experience, and ends with expectations about future performance, while the second stage starts with the expectation of future performance

and ends with the choice of portfolio (Markowitz, 1952). This paper deals with the first part of the two stages. I evaluate the performance and test for performance persistence of a survivorship bias-free sample of bond funds in South Africa, over the period of July 2008 to December 2016 to provide evidence whether bond fund investors are better off investing in funds with successful active fund managers. I measure performance using the Sharpe ratio, the modified version of the Sharpe ratio, the unconditional performance model as per Jensen's alpha, and the conditional models to test whether persistence is in anyway influenced by the evaluation technique used. To test for performance persistence, I first use contingency tables to rank funds into winners and losers and then I use cross sectional regression to tests for correlation between past and future performance.

1.2 Problem Statement

The development and growth of the mutual fund industry in South Africa over the years is much owed to the investors who view mutual funds as well diversified portfolios, rather than having to decide for themselves on which stocks and bonds to choose and have the responsibility of diversifying their own portfolios. Despite the growing number of actively managed bond funds in South Africa, it is surprising that little is known about whether prior performance of these bond funds contributes to current returns achieved. As more investors look to mutual funds for risk diversification and superior returns, more and more reliance is placed on past performances as investors attempt to determine tomorrow's "top performers". It goes without saying that such reliance on past performances is done without comprehensively understanding the past performances being relied upon, and whether such past performances are an indication that the fund manager is on a "hot streak".

It is also concerning that not much research has been done on performance of South African mutual funds. Those that have attempted to investigate performance of South African mutual funds have mainly focused on equity funds, with empirical evidence on performance of bond funds against their benchmark indices lacking. As noted before, much of the literature research on performance evaluation of bond mutual funds has focused on US and UK markets. To the best of my knowledge, no previous study on performance of South African unit trust/ mutual fund has narrowed down its focus to performance persistence of bond mutual funds in South Africa.

The lack of evidence on any predictability of fund performance may cause investors to believe that none of the variation in returns are attributable to fund management skills (Huij & Derwall,

2008), and as such, may create some scepticism as to whether a fund manager's past performance is likely to repeat in the future. However, an area of general non-dispute around fund performance is that of management fees, as bond funds with relatively high costs tend to underperform compared to those with lower costs.

1.3 Purpose and Significance of the Research

One of the empirical contributions of this study to the body of knowledge is the focus on a smaller market compared to the US and UK. Since evidence on performance evaluation and performance persistence of South African bond funds is scarce, one of the main purposes of this paper is to fill this gap by studying this phenomenon. To the best of my knowledge, this paper is one of the first research papers to focus on South African bond mutual funds.

Following my main contribution above, the objective of this research paper is to, first, present an empirical evaluation of the performance and performance persistence of South African bond funds over the period of July 2008 to December 2016 against their comparable benchmarks, with the aim of testing the hypothesis of whether past performance is an indicator of the future. This will indicate to bond fund investors whether investment strategies based on past performances will necessarily earn significant economic returns. Further, as the performance evaluation is against a passive benchmark, this study will also offer some evidence of whether actively managed bond funds can perform better than their passive indexed counterparts.

Second, I test the duration of performance persistence, considering both short-term and longer-term horizons. Some studies (for example, Grose, Dasilas, & Alexakis, 2014) have suggested that performance persistence of bond funds is evident in the short and medium term horizons, while such evidence of persistence diminishes over a longer-term horizon. Understanding the patterns as well as the duration of bond funds' persistence can offer valuable insights regarding the investment strategies that bond fund investors may follow.

Third, I test whether performance persistence is in any way influenced by the performance evaluation technique employed. I measure performance using the Sharpe ratio, the modified Sharpe ratio, the unconditional performance model as per Jensen's alpha, and the conditional models. A use of conditional performance evaluation approach takes into account information that was available to investors at the time the returns were generated (Silva, Cortez, & Armada, 2003).

1.4 Research Questions and Scope

Due to the lack of empirical research on performance evaluation of South African bond funds, I find myself with the following research question:

- Do actively managed South African bond funds show evidence of performance persistence?

To address my main research question above, this research will narrow on the following sub-questions:

1. Do actively managed South African bond funds show superior performances to their passive bond fund counterparts?
2. Is the performance of South African bond funds attributable to the respective fund managers' abilities?
3. Are the patterns of performance persistence influenced by the performance evaluation technique used?

To better answer these questions, this empirical research provides a detailed evaluation of the performance and performance persistence of a survivorship bias-free sample of bond mutual funds, domiciled in the South African market.

1.5 Outline of the study

The remainder of the paper is organized as follows: **Section 2** provides a detailed literature review of existing studies on performance of mutual funds, particularly for bond funds; **Section 3** describes the data used for the study and its source of collection, the sampling technique used, as well as the research methodology used; **Section 4** presents our research findings on whether there is empirical evidence of performance persistence on South African bond funds; **Section 5** details the research conclusion of the study; while **Section 6** offers recommendations for future studies.

2 LITERATURE REVIEW

The evaluation of mutual fund performance remains one of the widely researched topics within the finance literature (Anderson & Schnusenberg, 2005). The popularity of this topic is not only motivated by the desire to understand fund managers' investment strategies, but also by the implications the results may have on other theories of finance. However, despite the extensive volume of empirical research on this topic, the literature continues to offer opposing results.

Most empirical research on performance of mutual funds has focused on the US markets, followed by studies on the UK markets, with little research that focuses on performance of South African mutual funds. The development of literature has gained momentum over the past couple of decades, with recent studies introducing new performance evaluation techniques to better understand the determinants of mutual fund performance (for example Fama & French, 1993; Silva et al., 2003, 2005; and Agudo & Marzal, 2004). In this chapter we review the literature and related finance theories relevant to my study.

This chapter is organised as follows: **Section 2.1** provides the review of relevant finance theories, such as the efficient market hypothesis, behavioural finance, the arithmetic of active management and equilibrium accounting; and **Section 2.2** reviews the empirical literature, looking at the evolution of pioneering studies, literature focusing on performance of bond mutual funds, conditioning market information, and literature on performance of South African mutual funds.

2.1 Theoretical review

2.1.1 Efficient Market Hypothesis

The efficient market hypothesis ("EMH") in its simplest form means that security prices already include all available information in the market, implying that the risk-adjusted returns from active and passive portfolios are equal before deducting any research and trading expenses, and therefore deems active management to be wasteful (Ippolito, 1993). Following the birth of the EMH it became a common belief, in literature, that performance results of mutual funds are consistent with this original version of the so-called hypothesis, thereby confirming that any expenditure incurred on research of incorrectly priced securities is wasteful in a market where security prices already reflect all information that is available in the market. This impression, is much owed to the two most popular studies on this subject, which are Sharpe (1966) and Jensen (1968) who concluded that active mutual funds underperform their market indices. It

was Sharpe (1966) who further argued that the only justification for persistence in inferior performance is the continued large amount of expenditure on fruitless research for incorrectly priced securities.

The notion of EMH is closely accompanied by the theory of random walks. This theory asserts that a historic price behaviour of a security has no bearing on predicting the future price movement of such security (Sharpe, 1966). As such, the theory of random walks suggests that it may be very difficult, and thereby costly, to try to distinguish securities that are priced incorrectly. The concept behind the random walk theory is that if security prices quickly reflect all of the information that is available today, therefore tomorrow's prices will change to reflect only information reflected in tomorrow's news which is independent from today's information. News, by definition, is unpredictable and thereby the resulting change in security prices must also be unpredictable and represent a random departure from the previous day's prices. Therefore, according to the EMH, active fund managers should not be able to outperform their market benchmarks after deducting research and trading fees as the hypothesis predicts that active managers will persistently gain alphas that are equal to a negative of the expenses incurred in search of "superior" information (Ippolito, 1993).

Not long after the EMH was theorized in the 1970s that it became the commonly accepted paradigm in literature. More and more studies seemed not to find any evidence of past security prices being a helpful predictor of the future, and thereby showed evidence of active mutual fund samples underperforming their market benchmarks. However, several cracks in the literature seemed to appear in the 1980s and 1990s. The results of these studies (for example, Grossman & Stiglitz, 1980; Ippolito, 1989, 1993), taken as a whole, indicate inconsistencies with the hypothesis that funds' expenses are fruitless. Grossman and Stiglitz (1980) in particular, offer a sound alternative. The authors do not completely disregard the EMH, but rather add to it the notion that the gathering of market information is costly. They argue that informed investors will thus earn higher gross returns, adjusted for risk, although they will also incur more expenses than passive investors. This, therefore implies that investors that do not continuously improve their knowledge of the market can expect to be making losses from the trades that they make. This argument fits in well with the modified version of the EMH which considers the proposition that the information in the market is not free, compared to the original version which asserts that information is free and is fully considered into securities prices.

However, despite these developments in literature, the EMH still prevails. The main reason for the durability of the EMH in literature is the lack of sufficiently competing theories (Ippolito,

1993). Even the alternative theories offered above did not become as popular as Sharpe's and Jensen's studies. Because the rejection of the EMH will imply that markets are not "informationally efficient", many academics are reluctant the reject the hypothesis (Ippolito, 1993). The lack of competing theories therefore biases in support of the EMH as the null hypothesis, that active fund managers should not be able to outperform the market. However, one recent theory that seems to be gaining momentum as an alternative to EMH, is behavioural finance.

2.1.2 Behavioural Finance

The concept of behavioural finance is one which is an exact contrast to the EMH and the theory of random walks. Ricciardi and Simon (2000) define behavioural finance as an attempt to explain and gain an understanding of the reasoning process of investors, including their emotions involved and the extent to which these emotions influence the decision-making process. Although the concept only started gaining momentum in the 1990s, its foundation dates back to the early 1900s. Selden's (1912) book titled *"Psychology of the stock market"* was one of the first literature to apply the principles of psychology to the behaviour of the stock market. The book is based upon the belief that the movements of security prices are dependent, to a large extent, on the mental and emotional attitudes of the investors (Selden, 1912). Fast forward to the beginning of the twenty-first century, and the academic dominance of the EMH had become somewhat less of an accepted norm. A number of academics started to emphasize psychological and emotional behaviour to stock price determination, and they believed that future security prices are, to some extent, somewhat predictable based on the trends of historic prices and certain fundamental valuation metrics (Malkiel, 2003). This then implies that predictable price patterns can allow investors to earn superior risk adjusted returns to the market.

The underlying assumption governing the EMH and the theory of random walk is that investors are rational when it comes to their financial decision-making processes. Further, under the EMH, the rationality of investors is necessary to bring the market into equilibrium. It is this rationality that is being challenged by the behavioural finance scholars, under the prospect theory. Prospect theory, a model introduced by Kahneman and Tversky (1979), asserts that market participants do not always act rationally due to their own biases and preferences driven by psychological factors that influence the choices being made under conditions of uncertainty. In particular, people tend to under weigh outcomes that are only probable compared to outcomes that are certain, and usually ignore components that are shared by all prospects under

consideration (Kahneman & Tversky, 1979). According to Schwartz (1998), investors tend to weigh prospects and possible outcomes according to gains and losses based on some point of reference rather than the optimum state of wealth.

Statman (1995) also argued that both investors and fund managers are far from being rational, and that their behaviour and psychology are great influences in their financial decision-making processes. In his study, Statman (1995) observes the choices that investors make, rather than security prices, and offers some insight into the process by which investors form expectations about security returns. In a survey conducted by Fortune magazine, titled *"America's most admired corporations"* (Fortune Magazine, 1993), respondents who were regarded as sophisticated investors – members of boards of directors, executives and financial analysts - were asked to rank companies on the quality of management and on the value of long-term investment (as represented by the stock price) among other categories. If these respondents believed in market efficiency, they would conclude that the quality of management is fully reflected in the stock price, and as such, Statman's research would find zero correlation between what respondents believed to be good management and the value of the long-term investment. However, the results showed a strong positive correlation between rankings of the two categories, with an adjusted R^2 of 0.86. In other words, these "sophisticated" respondents thought that good investments are stocks of well managed companies, despite the evidence indicating otherwise.

To echo Statman's point, De Bondt (1998) also makes the argument that many people cannot differentiate between "good companies" and "good stocks". He further argues that few investors have adequate understanding of valuation techniques recommended by finance textbooks and that the perception of value in the eyes of an average investor depends in large on mental frames that are usually shared through stories in the media, conversations among friends and tips from advisors. This speaks to the growing literature on herding mentality and social pressures that drives stock prices through demand, and cause prices to deviate substantially from their intrinsic values. Following one of the well-known warnings in the US markets during the late 1990s by Alan Greenspan, then a chairman of the US Federal Reserve, that the US stock markets were overvalued and expensive, Shiller (2000) could not find any good reasons for such high stock valuations and attributed this to investor irrationality. In particular, Shiller attributed such irrationality to what he calls a "psychological feedback loop". News of rising stock quickly spreads among the investors, their emotions are elevated and buying is stirred; stock prices rise again, leading to more news, and so on (Shiller, 2000). These

behavioural traits of market participants tend to lead to investment bubbles such as the dot-com bubble in 2001 and the 2007-2008 financial crisis. As such, given the loss in stock values during these market bubble periods, behaviourists would therefore argue that the decrease in stock prices can only be explained through psychological considerations, since the basic elements of market valuation techniques did not change during these periods.

2.1.3 The Arithmetic of Active Management

In taking a different approach in support of the EMH and backing his initial argument that active managers cannot, on average, generate more superior returns than their passive counterparts, Sharpe (1991) introduced a theory which he termed "The Arithmetic of Active Management" that is ruled only by the laws of division, multiplication, addition and subtraction. In his paper, Sharpe (1991) makes two assertions that he claims will always hold for any time period. First, before considering any management costs associated, the average return on an actively managed investment will equal an average return on a passively managed investment. Second, after costs, the average return on an actively managed investment will be less that of the average return on a passively managed investment.

The first assertion is based on the notion that, over any specified period of time, the market return consists of the weighted average of returns on all securities in the market, using the opening market value as weights. Market events that take place during the course of the year, such as mergers and acquisitions, stock dividends, and new listings may require a more complex calculation but they do not affect the basic principles of this theory (Sharpe, 1991). Because it is expected that the passive manager will earn exactly the market return, before costs, it therefore follows that the active manager will earn, at best, a return equal to the market return. Arithmetically, if two returns on the equation are same, the third return should also be the same. For example, if the market return, made up of the weighted average of passive and active stocks, is 5% and it is expected that the passive stocks will, by definition, then earn a 5% return, it is therefore mathematically logical that the active stocks also earn a return of 5%.

The second assertion, while it follows on from the first, is based on the notion that costs relating to active management will, on average, exceed those of passive management. The reason for such high costs is because active managers must pay for research in search of incorrectly priced stocks and for frequent trading compared to passive managers (Sharpe, 1991). Because both passive and active managers earn the same return before costs, and given that active managers

incur more costs, it therefore follows that after costs active returns must be lower than passive returns.

To dispute any empirical evidence of active managers outperforming the market, Sharpe provides three reasons. First, the so-called "passive" managers may not be truly passive in the definitive sense of the phrase. These passive managers turn to "sample" the market, rather than holding all stocks in market proportions, suggesting that "passive" managers may, to some degree, be some form of active managers. In fact, some even charge the same or even higher amount of fees as active managers (Sharpe, 1991). For example, the Halifax UK FTSE 100 Index Tracking Fund and the Virgin UK Index Tracking Trust both charge management fees of 1% per annum for blindly tracking the ups and downs of the FTSE 100 and FTSE All Share, respectively. This level of fees is on average similar to the fees charged by some active funds. Second, the set of active managers that are subjects of empirical studies may not fully represent the entire market component of active investors. For example, the set of the active market may be only focusing on professional and institutional investors, excluding individual investors from the set. For some active managers to outperform the market, some active investors, in this case the non-institutional individual investors, need to underperform in order to balance the arithmetic scales. Also linked with the exclusionary criterion within the active component of the market, another example arises when the empirical set of active managers excludes those that have gone out of business or absorbed by other active funds. The "survivorship bias" of excluding bad results from the average active returns may, of course, produce superior results (Sharpe, 1991).

Third, what Sharpe ranks as possibly the most important reason, is the extent to which the empirical summary statistics for the active market may not accurately reflect the performance of an actively managed investment. Sharpe (1991) asserts that the computation of such statistics should be weighted by the opening balance of AuM for each active manager as the different type of measures used in empirical studies may lead to some element of biasness in the computed statistics. For example, an average active manager that favours small-capitalisation stocks will be measured poorly when those stocks, in general, underperform large-capitalisation stocks. As such, when correctly measured, the average active investor must not outperform an average passive investor, after costs. Any empirical study that concludes otherwise is thereby guilty of incorrect statistical measurements (Sharpe, 1991).

Sharpe's arithmetic of active management suggests that, since active managers will earn returns equal to passive managers before cots, one active manager's profit is another active manager's

loss, which aggregates to a zero-sum game for all active managers. Pedersen (2016), however, challenges Sharpe's arithmetic law, arguing that the equality of actively managed returns to passively managed returns is simply based on the implicit assumption that the composition of the stock market does not change. Of course, in a world of fixed set of securities, passive investors will never trade as there are no new shares being issued to or taken away from the stock market, and as such their portfolios remain market-capitalisation weighted irrespective of how the stock prices move. In such a world, as suggested by Sharpe, only the active investors will trade and thereby incur the related trading costs which eat away into their returns. This assumption will, of course, not hold in the real world because of new share issues, share buy-backs, and indices that are continually being rebuilt so that even a "passive" investor will regularly trade.

Although seemingly insignificant, the stock market changes over time, and whenever passive investors would trade to maintain their market-weighted portfolios, they may trade in less favourable prices than active managers, which then breaks Sharpe's arithmetic (Pedersen, 2016). It is important to realise that passive investors must trade to maintain their market-capitalisation weighted portfolios and Sharpe's claim that his arithmetic equality will hold for "any time period" may in fact suggest that passive investors magically arrive at market weighted portfolios without any trades. Pedersen (2016) therefore asserts that Sharpe's arithmetic equality "breaks down" when trading activity of passive investors is considered. Similar with active investors, passive investors also incur trading costs when they trade, and since active returns should equal passive returns (before costs), the level of costs then determines which investor will earn superior returns. Further, in an attempt to maintain the market weighting, passive investors may find themselves having to buy or sell stocks at unfavourable prices.

To aid the above argument, even Sharpe's (1991) discussion on trading in his footnote 4 states "we assume here that passive managers purchase their securities before the beginning of the period in question and do not sell them until after the period ends. When passive managers do buy or sell, they may have to trade with active managers; at such times, the active managers may gain from the passive managers, because of the active managers' willingness to provide desired liquidity (at a price)". Two points to take away from that footnote: first, active investing is not a "zero-sum game among active managers" during "any time period" as some supporting researchers claim; second, before costs, active managers may earn superior returns as providers of liquidity. Therefore the underlying notion is that, since passive managers must trade to

maintain the market weightings, nothing ensures that they would trade at the same price as active managers, and thereby nothing ensures that both active and passive managers would earn the same return (Pedersen, 2016).

2.1.4 Equilibrium Accounting

The concept of equilibrium accounting is a theory that is similar to Sharpe's arithmetic of asset management. Equilibrium accounting states that equity investors in aggregate will get value-weighted equity market return less their investment cost (Fama & French, 2008). The equilibrium is based on the notion that, before costs, passive investors should earn passive returns, that is, they earn returns equal to the market return and have alphas equal to zero. According to Fama and French (2008), it then follows that if some active investors have positive alphas before cost, it must be, dollar for dollar, at the expense of other active investors, and thereby active management is in aggregate a zero sum game with zero aggregated alphas before costs. As such, when returns are measured after costs, active management will result in negative alphas. An important suggestion that this theory makes is that not all investors in aggregate will earn returns that are above average performance. Further, funds that showcase positive alphas will be offset by the funds with negative alpha within the active management segment of the market as passive investors will always earn the market average.

To evaluate mutual fund performance under the assumptions of equilibrium accounting, Fama and French (2008) examined all mutual funds that primarily invested in US equities, from the Center for Research in Security Prices ("CRSP") database for the period January 1962 to September 2006, looking at 12 to 60 months of past performance. The benchmarks used for the evaluation of fund performance were Fama and French's (1993) three-factor model as well as Carhart's (1997) four-factor model. The results were that, before estimated fees and expenses, the value-weighted portfolios of mutual funds are close to the market portfolio, with alphas close to zero. As such, an alpha estimated on net returns will therefore be negative by about the amount of fees and expenses. These results, however, are contrary to the results by Berk and Green (2004) who developed a model in which active managers in aggregate produce an alpha equal to zero after fees and expenses are considered. According to Fama and French (2008) the equilibrium accounting asserts that such an equilibrium (of an alpha greater than zero on gross basis) is impossible, unless passive managers lose immensely to active managers.

In a much earlier study by Grossman and Stiglitz (1980), the authors had raised a question, where [competitive] equilibrium consists of a market in which arbitrage profits do not exist

because prices already take into account all available information, whether it is possible for a competitive economy to be always in equilibrium. The duo goes on to argue that this is not the case and as such, the notion that all markets are always in equilibrium and perfectly arbitraged does not hold when arbitrage is expensive. Grossman and Stiglitz (1980) propose a model that reflects "an equilibrium degree of disequilibrium". This means that security prices reflect only the information of informed investors (arbitrageurs) so that those who incur market research costs get compensated. As such, the market price system will make available only the information obtained by informed investors over the uninformed investors rather than already considering all information that is available, irrespective of whether uninformed investors had knowledge of such information.

2.2 Empirical review

2.2.1 The evolution of pioneering studies

Given the theoretical arguments offered above regarding whether the markets are efficient and thereby governed by rational investors, one would consider that the most substantial test of market efficiency would be the ability of active fund managers to persistently outperform the market in its entirety. Surely, in a market where stock prices are determined by irrational investors and tend to deviate from rational valuation estimates, and investors can predict stock price patterns, then active fund managers should be able to persistently outperform the market. In general, most empirical studies on performance of mutual funds have typically directed their attention to the following areas of concern: whether active mutual funds can outperform their market benchmarks; if so, whether the outperformance is due to the fund manager having "hot hands"; and whether mutual fund performance shows evidence of persistence.

Although not as popular as the studies in the 1960s, Cowles (1933) is one of the classic studies on this subject matter. In his study, Cowles analysed the forecasting abilities of sixteen financial services firms, twenty fire insurance companies, the Wall Street Journal[1] and twenty-four financial publications[2]. In making 7 500 recommendations on individual stocks during the period January 1928 to July 1932, the financial services firms' picks underperformed the average market by 1.43% annually. The insurance companies making similar stock selections during 1928 to 1931 achieved average returns that were 1.2% worse than the average common stock, annually. The Wall Street Journal on the other hand published forecasts of the stock

[1] William Peter Hamilton was then the editor of the Wall Street Journal responsible for making recommendations on which stocks to pick during Cowles' study.
[2] The study is silent on the names of the twenty-four financial publications that were included in the study sample.

market based on the Dow Jones Industrial Average during 1904 to 1929. On 90 predictions that Hamilton announced on market outlook, 50% of these predictions were unsuccessful while the other 50% were successful. Lastly, the financial publications that forecast the stock market from January 1928 to June 1932 failed in aggregate by 4% per annum to meet the average market return. This classic study was the first to set the tone for the null hypothesis that active investments cannot outperform the average stock market. However, it should be noted that Cowles' evaluation ignored any consideration of risk, as would have otherwise been suggested by the MPT.

The first extensive and methodical study on mutual funds following the emergence of the MPT in 1952 was by Friend et al. (1962). The study examined the annual performance of 152 US mutual funds during 1953 to 1958 against the created index of Standard & Poor's ("S&P") indices consisting of five securities, with data weighted by its representation in the mutual fund sample. The results of the study were that the sampled mutual funds earned an average annual return of 12.4% while their S&P benchmark earned an average annual return of 12.6%, thereby having a negative alpha equal to negative 20 basis points. The study recognises, however, that the management expenses for the sampled funds were well in above the 100 basis points. Had they been any lesser, the funds may have matched or slightly exceeded their market benchmark, after subtracting costs. Even though that might have been the case, the authors concluded that these alternative results would not suggest an overall inefficiency in the market as a whole.

Despite Friend et al. (1962) being the first extensive study to evaluate mutual fund performance, the paradigm that costs incurred in active investment are wasteful was only set by the three subsequent papers that went on to dominate literature on this topic. The first of these papers was Treynor and Mazuy (1966) in their analysis in evaluating whether mutual funds can outguess the market. In their study, the authors did not measure the alphas of their sample funds, rather, they tested the market-timing[3] abilities of US fund managers of 57 open-ended mutual funds over a 10-year period from 1953 to 1962. The concept of market-timing led to an introduction of a non-linear version of the capital asset pricing model ("CAPM"), whereby if fund managers could anticipate the direction of the market they could decrease their portfolio risk should they think the market is going to fall and increase it should they think that the market is going to rise, and thereby changing the linear security line in CAPM to a non-linear function. Using an F-test, the study concluded that there was no statistical evidence to suggest that the

[3] Market-timing means that the fund managers can anticipate the rise or fall of the general stock market and thereby adjust the composition of their portfolios accordingly (Treynor & Mazuy, 1966).

funds possessed any market-timing abilities, and therefore mutual fund returns are completely dependent on the movements in the general market.

In an attempt to extend on Treynor's (1965) work, Sharpe (1966) subjected the proposed measure to an empirical test in order to evaluate its predictive ability. In applying Treynor's (1965) measure, Sharpe (1966) measured the annual reward-to-volatility ratio (which later became famously known as the Sharpe ratio) of 34 US open-ended mutual funds during 1954 to 1963 against the ratio calculated for the Dow Jones Industrial index as a benchmark over the same period. It was Treynor (1965) that advocated for the importance of using a performance measure that considers risk-adjusted returns to rate performance, even though the study itself did not measure performance of active mutual funds against their market benchmarks. The results of Sharpe's study found that the average Sharpe ratio of the sampled funds was 0.633 while that of the Dow Jones Industrial portfolio was 0.667, with only 11 of the 35 mutual funds outperforming the Dow Jones portfolio. Sharpe also evaluated his ratios relative to the level of fees for all funds in his sample and found that the funds with better performance tend to be those with low levels of fees. This evidence is consistent with the concept of EMH, that large amounts of expenditure in search for incorrectly priced securities are relatively fruitless (Sharpe, 1966). In testing persistence, Sharpe performed performance rankings and found that funds that rank low (or high) in historic periods (1944 to 1953) tend to continue ranking low (high) in future periods (1954 to 1963), with a Spearman's rank correlation coefficient of +0.360. Although the coefficient is positive, the relationship between the two periods is far from being perfect.

To complement Sharpe's results, Jensen (1968) evaluated the performance of 115 US open-ended mutual funds during 1955 to 1964 using the CAPM to calculate the performance alphas of the funds in his sample. Out of this sample, only 56 funds had sufficient data for the preceding 10-year period between 1945 to 1954. Net of expenses, the average performance alpha calculated for the sample was -0.011 for the entire sample period, suggesting that on average the funds earned 1.1% less than what they should have earned annually given their level of risk. Jensen (1968) therefore concluded that the funds did not possess predictive abilities to forecast market prices well enough to recoup their expenses, or to even out-perform the market on gross returns basis.

In summary, all three pioneering studies (Treynor & Mazuy, 1966; Sharpe, 1966; and Jensen, 1968) found statistically significant and strong results to suggest that active mutual funds underperform risk-adjusted index portfolios. These conclusions went on to form the basis for a

hypothesis against which all subsequent literature will be compared. These results have also become the foundation to advocate for the EMH.

2.2.2 Performance of bond mutual funds

The years following the development of the above early studies saw an explosion of literature on mutual fund performance debating whether fund managers can outperform the average market. However, the majority of this empirical work has focused on equity security funds and on the US markets. Although the debate is still at its early stages for bond funds, the evidence to date does not appear to reject the null hypothesis even for bond funds. One of the earliest and most cited studies on performance of bond mutual funds is a US paper by Blake et al. (1993). The study employs two different samples: a sample of 46 nonmunicipal bond funds, free of survivorship bias, during a 10-year period from 1979 to 1988; and a much larger sample consisting of all bonds listed in the Investment Company Institute[4] database at the end of 1991, with survivorship bias. Although some studies (see Brown et al., 1992; and Elton et al., 1996) have found that survivorship bias overstates the correlation between past and future performance, Blake et al. (1993) have argued that survivorship bias is somewhat less of an important issue for bond funds than it is for equity funds since the performance of bond funds is less volatile and fewer funds dissolve or merge. Using both single-index and multi-index models in calculating alpha, the study found that bond funds underperformed their benchmark indices post expenses. Further, the study found no evidence to suggest forecasting abilities to predict the future using past performance.

Kahn and Rudd (1995) also reported evidence of underperformance of bond mutual funds, with an average alpha of -0.015. The study examined all US active taxable bond funds that were included in both the Micropal and Morningstar databases during the period October 1986 to September 1990. The sample excluded preferred stock funds, index funds, international bond funds, money market funds and junk bond funds. In using contingency tables, the study found evidence for persistence in performance of its sample bond funds, even after controlling for management fees. However, the benefits of the observed persistence do not cancel out the average fund underperformance. Similarly, a study by Elton et al., (1995) also found evidence of underperformance as the bond funds in their sample reported inferior returns than those predicted by the relative pricing models, by on average an amount equal to expenses. This

[4] The Investment Company Institute is a leading global association of regulated funds, including mutual funds, exchange-traded funds (ETFs), closed-end funds, and unit investment trusts (UITs) in the United States and similar funds offered to investors in jurisdictions worldwide.

suggests that before costs, bond fund performance is neutral. Elton et al., (1995) had developed their own fundamental relative pricing models to examine the performance of bond mutual funds. Their sample consisted of 123 US active bond funds over 115 monthly observations from February 1980 to December 1992. The results of these studies seem to set the tone to suggest that bond fund investors would be better compensated investing in low-cost passive funds.

This paradigm in bond fund literature persisted throughout the rest of the 1990s well into the 2000s. For example, Philpot et al. (1998) reported no evidence of performance persistence from a sample of 27 US bond mutual funds over 1982 to 1993. Persistence inferences were based on regression equations and the study argues that these results are not surprising given that bond mutual funds have very similar characteristics and, as such, bond fund managers have little opportunity to consistently outperform one another and thus differentiate themselves (Philpot et al., 1998). Considering relative heterogeneity, Philpot et al. (2000) reached a similar conclusion, that even nonconventional bond funds reported no evidence of performance persistence nor management skill. Ferson et al. (2006) use stochastic discount factors ("SDFs")[5] to evaluate a sample of US government bonds over the period 1986 to 2000 and find that their results are consistent with the view that before costs, bond fund performance is neutral, and funds underperform by an amount equal to their expenses. In later studies, Chen et al. (2010) and Ayadi and Kryzanowski (2011) reach a similar conclusion and argue that the underperformance by bond funds appears to be significant only after expenses have been taken into account, with superior performance on a before-expenses basis. This view is further supported by Moneta (2015) who found evidence that active bond funds exhibited superior performance of 1% per annum over their benchmarks before costs, after evaluating a sample of 1 000 US bond mutual funds during the period from 1997 to 2006. This suggests that, to some extent, active managers may be able to recover their fees and costs (Moneta, 2015).

Droms and Walker (2006) on the other hand have found evidence of short-term performance persistence after using contingency tables and the significance of a z-statistic to analyse performance of annual performance data from a sample of 797 US corporate and government bond funds during a 10-year period from 1990 to 1999. The authors concluded that the nature of the observed persistence was influenced by the fluctuations in interest rates. Using several alternative performance evaluation models, Huij and Derwall (2008) investigated performance of 3 549 US bond mutual funds during 1990 to 20003 and showed that bond funds that

[5] SDFs are exponential functions of term structure factors that contain time averages of models' state variables (Ferson et al., 2006). The authors found that these factors are more statistically and economically significant for explaining returns.

displayed strong (weak) performance over a past period continued to do so in future periods. The authors further demonstrated that a strategy based on past fund returns earns economically and statistically significant abnormal returns, suggesting that investors of bond mutual funds can exploit such observed persistence. Likewise, Du et al. (2009) also found empirical evidence of performance persistence over shorter time horizons, after examining 1 081 US corporate bond funds during 1992 to 2003. Du et al., (2009) also concluded that their empirical evidence suggests that the short-term persistence may be due to superior managerial skills, although Elton et al. (1996) and Brown et al. (1992) have argued that such persistence results may be due to survivorship bias.

Looking at funds that are based or invest outside the US, the empirical evidence continues to show mixed results. Gallo et al. (1997) examined the monthly performance returns of 22 international bond funds during November 1988 to March 1994. The performances were evaluated using the Sharpe ratio and Jensen's alpha. The major findings were that the bond fund managers were unable to outperform their passive index benchmarks, and that past performance was not a useful predictor of future performance. Detzler (1999) also studied the performance of a sample of global bond mutual funds and similarly concluded that, net of expenses, active funds did not show superior performance against their benchmarks and that performance is negatively related to expenses.

Silva et al. (2003) turned their focus to European bond funds, particularly bond funds in France (266), Germany (90), Italy (58), Portugal (22), Spain (157) and the UK (45) for the period of February 1994 to December 2000. The results, in general, showed evidence of underperformance, particularly for funds in Italy, Spain and Portugal. Funds from the UK, Germany and France showed neutral performance. To test the persistence phenomenon, the authors, however, only later examined the same sample of European bond funds in 2005. Silva et al. (2005) used cross-sectional regressions and contingency tables, and found evidence of performance persistence, particularly in French, German and Spanish bond funds.

Grose et al. (2014) examined persistence in performance of bond mutual funds domiciled in Italy (314), Spain (202), Portugal (24) and Greece (39) during January 2000 to December 2010. Fund performance was measured using the Sharpe ratio and its modified version, Jensen's alpha, and a conditional model with time varying betas, while persistence was tested using contingency tables. The results showed existence of persistence for both short- and long-term horizons, but only for Spanish and Italian funds. These findings are constant with the finding by Silva et al. (2005) as discussed above. Leite et al. (2016) also found strong evidence of

performance persistence in short- and long-term horizons. Leite et al. (2016) evaluated monthly returns of 47 Portuguese bond funds from January 2001 to December 2012, which included both surviving and non-surviving funds.

The review of the above literature suggests no general consensus as to whether active bond mutual funds can truly outperform a passive strategy and whether past performance is an adequate predictive measure for future performance. Some literature has made an argument that the standard performance measures do not consider market information related to economic conditions, and thereby do not reflect economically specific returns for such performance evaluation.

2.2.3 Conditioning information

The use of the conditioning information variable for performance measurement is one of the latest developments in mutual fund performance literature. The traditional methodologies followed by the vast majority of studies to measure mutual fund performance are unconditional in nature, meaning that no information about the condition of the economy is used to predict performance. As such, the expected risks and returns are assumed to be constant over time. Since active bond fund managers use a number of strategies, such as duration adjustment in response to changes in interest rate yields (Ferson et al., 2006), an argument can be made that these unconditional measures may report significantly incorrect results. For instance, managers who correctly predict the market may show poor performance while those who incorrectly predict the market may show superior performance (Silva et al., 2003).

Farnsworth (2015) defined a conditional performance measure as an approach that incorporates information that was publicly available to fund managers at the time the performance returns were generated. This measure therefore assumes that risks and returns will vary over time as information in the market changes. A lot of empirical evidence has suggeted that the inclusion of predetermined conditioning information variables (related to economic conditions) sharpens inferences on performance and that conditional performance measures may have better capacity to distinguish persistence. Ferson and Schadt (1996) evaluated monthly data for 67 US mutual funds during 1968 to 1990 and found evidence that their risk exposure changes in response to the availability of public information in the economy. The study concludes that conditioning on information controls for biases in the traditional models and suggests that performance persistence may be better detected by conditional models. Christopherson et al. (1998) examined the performance of pension funds and reported evidence that conditional measures

are superior in detecting peformance persistence. Silva et al. (2003) examined the performance of a set of European bond funds using both conditional and unconditional models during 1994 to 2000 and concluded that when their study included public information variables the results tend to show slightly better performance. When the authors extended this study in 2005 (Silva et al., 2005) to test for persistence, they found evidence that persistence decreases when conditional alphas are considered, suggesting that time-varying betas are determinants of performance persistence.

Ferson et al. (2006) also employed conditional models to evaluate performance of bond funds and reported comparable results to unconditional models. The study found that economic information tends to predict higher conditional expected returns. Recent studies, also found evidence of similar results. Grose et al. (2014) found that although the average bond fund's alphas are close to zero, conditional alphas tend to show beta results when public information variables are considered, while Leite et al. (2016) further reported strong evidence that the use of conditional models is more informative and robust in detecting performance persistence than unconditional models.

These studies advocate for the inclusion of conditioning public information in performance measurements to better predict mutual fund returns and performance persistence. The underlying argument is that previous studies based on unconnditional models may be significantly incorrect due to the covariance between conditional risks and market returns, and report persistence of this confounding co-movement rather than "true" performance persistence (Silva et al., 2005). Conditional models therefore control for this bias.

2.2.4 Performance of South African mutual funds

Some of the literature has examined the performance of South African unit trusts, offering different views and conclusions regarding the persistence thereof. However, my research could not find literature with a sole focus on South African bond funds. This may suggest that this paper is one of the first studies to examine the performance of bond mutual funds domiciled in South Africa, providing me with an opportunity to make a contribution to the body of literature.

One of the reasons for the lack of literature on South African unit trust performance could be the lack of data and the limited number of unit tusts in existence over the years, as the South African unit trust industry only began showing extensive growth after 1997. In their study, Oldham and Kroeger (2005) noted that their sample was relatively small due to the number of unit trusts that met their selection criteria. As such, even though their study showed some

evidence of performance persistence, the authors warned that the results could not, therefore, be extrapolated to the unit trust industry as a whole.

Gilbertson and Vermaak (1982) are among the earlier studies to examine the performance of South African unit trusts. The study analysed monthly returns of 11 mutual funds over a sample period of 1974 to 1981 against three indices, namely the Johannesburg Stock Exchange ("JSE") All Share Index ("ALSI"), the JSE Industrial Index ("II") and the Rand Daily Mail ("RDM") 100 Index. The results found that one, two, and four funds outperformed the JSE ALSI, JSE II, and RDM 100, respectively. When risk-adjusted performance metrics are appplied, the majority of the funds then outperformed all three indices. The authors concluded that these results support the notion that the JSE is somewhat inefficient. Knight and Firer (1989) updated Gilbertson and Vermaak's (1982) study and evaluted performance of 10 of the 11 unit trusts during January 1977 to 1986, with the one unit trust excluded due to changes in the trust's objective and altermately its risk profile. On non-risk adjusted basis, only 2 trusts outperformed the market, but in aggregate the sample earned an average return of about 2% less than that of the market. On risk-adjusted basis, however, 5 trusts significantly outperformed the market at 5% confidence level.

Meyer (1998) studied the performance of 84 unit trusts (24 general funds, 38 specialist equity funds, 16 income funds and 6 gilt funds) for the period starting from July 1985 to June 1995, using Jensen's alpha to measure performance and non-parametic contingency tables to test for persistence. On testing persistence over 1-, 2-, and 4-year periods, Meyer (1998) found a strong repeat "loser" performance, particularly in the shorter horizon. On the other hand, although the best results for persistence were obtained over the 4-year period where there was evidence of repeat "winner" performancce, the results found that persistence was relatively weak in the shorter horizon. The results are different from the majority of studies that advocate for persistence as these studies rather find a strong winner phenomenon over shorter periods of evaluation and suggest that persistence fades over a longer period. Similar evidence is found by von Wielligh and Smit (2000) when they examined the performance perisistence of general equity unit trusts and all unit trusts that traded in South Africa during January 1988 to December 1997 and January 1993 to December 1997, respectively. Performance was measured using the CAPM and the multi-factor arbitrage pricing theory ("APT"). The study found that although there was evidence of performance persistence in the short-term, there was even stronger evidence of persistence in the long-term. In particular, it appeared that loser funds tend to be worst performers in the long-term while winner funds continue to outperform. As such, von

Wielligh and Smit (2000) advise that long-term investors should invest in unit trusts that have above-average historic monthly returns.

Firer et al. (2001) evaluated the performace persistence in South African general equity (43) and fixed income (35) unit trusts during January 1989 to December 1999. The results found significant persistence for risk-adjusted returns of equity unit trusts while persistence for fixed income unit trusts was far less significant, with underperforming persistence prevailing. As the overall persistence for equity unit trusts was relatively stronger for a 2-year formation and holding period, the authors recommended that choosing equity unit trusts that were winners in the past 2 years and holding them for the following 2 years may be a better strategy to follow for long-term investors. In contrast, Collinet and Firer (2003) recommended a much shorter formation and hold horizon. The study analysed the relative performance of 447 general equity unit trusts during 1980 to 1999 and found a positive but weak correlation betweeen past and future performances, with persistence displaying high sensitivity to the length of the holding period. The authors suggested a strategy of selecting winner funds over the past 6 months and holding them for the next 6 months in order to earn abnormal returns.

Oldham and Kroeger (2005) evaluated the performance of 20 unit trusts from various sectors against the JSE ALSI from January 1998 to Decmber 2002. The results found that only 4 unit trusts were able to outperform the market and the overall persistence was only evident in the shor-term. Meyer-Pretorius and Wolmarans (2006) on the other hand compared the average performance of 567 unit trusts to the JSE ALSI over the period of 1988 to 2005 and found that general equity fund managers successfully outperformed the market before costs. The study found that through market timing, fund managers earned an average return of 19.46% while the market earned an average return of 17.97%. However, when costs are taken into account the active average return decreased to 12.37%[6]. These results support the argument that active funds only underperform their index benchmarks due to management expenses. It should be noted that the peformance measures used by Meyer-Pretorius and Wolmarans (2006) do not consider risk-adjusted metrics in their approach.

In fairly recent studies, Bertolis and Hayes (2014) analysed the performance of all South African unit trusts relative to the JSE ALSI during January 1994 to December 2012. The evidence showed that unit trusts underperformed the JSE ALSI during the periods of economic

[6] We note that the management fees as suggested by the study are abnormally high. However, the study is silent on the composition of such management fees.

downturn and outperformed during periods of economic growth. Overall, the unit trusts showed slight outperformance, but this was not found to persist. Similarly, Malefo et al. (2016) found that South African unit trusts showed superior performance during non-crisis times, with subsequent inferior performance in turbulent times. The study also found that regardless of the performance measure, the unit trusts on average do not outperform the market on a consistent basis, showing no evidence of perisstence. Using a combination of perfomance measures, including Baysian alpha, Sharpe ratio, and Sortino ratios, Thobejane et al. (2017) analysed a sample of 191 equity unit trusts for the period February 2006 to January 2016. The results found strong evidence of market timing ability, with weak evidence of persistence in performance.

2.3 Literature review summary

In summary, the debate surrounding the performance of mutual funds continues to remain topical among researchers in finance literature, with the null hypothesis that active mutual funds do not produce superior returns to those of their passive counterparts. From an academic theoretical perspective, the EMH, together with the supporting theories, asserts that active management is wasteful and should not outperform the market due to investors being rational. Further, active managers will underperform the market by an amount negative of research costs incurred. However, behavioral finance scholars argue that investors are not rational at times and that their choices are influenced by their own biases and preferences driven by psychological factors, causing the markets to deviate from the efficient equilibrium.

Despite the extensive amount of reseearch on this subject, the evolution of empirical evidence over the years is inconclusive. According to Kahn and Rudd (1995), the inconclusive empirical results could be attributed to the difference in sample periods being evaluated, the different performance methodologies used, the integrity of the sample data used, the effects of survivorship bias, and whether management fees have been taken into accounnt when evaluating performance. However, the majority of empirical literature still focuses on US and UK markets, leaving a gap in literature for studies focusing on emerging markets' mutual fund performance. My literature review still shows a considerable amount of studies that advocate for the null hypothesis despite the introduction of new theories of finance, such as prospect theory. On balance, of those studies that show outperformance, performance persistence appears to be short lived and diminishes over a longer period of review. Further, the persistence phenomenon is observed more in underperforming funds rather than in overperforming funds.

In the South African context, most of the literature focuses on equity unit trusts as my research could not find literature with a sole focus on bond funds/ unit trusts. This indicates a big gap in the South African literature, suggesting that this paper may be one of the first studies to examine the performance of bond mutual funds domiciled in South Africa, providing me with an opportunity to make a contribution to the body of literature. In review of the available literature, similar to international studies, the literature on performance of South African unit trusts tends to advocate for the notion that active managemet yields negative alphas after managemet costs, with past performance likely to be a poor predictor of future performance. This may somehow validate that the South African equity unit trust industry is somewhat efficient. This paper wishes to examine whether this efficiency in equity unit trusts further extends to the South African bond market. Although the literature debate on such efficiency is still at its early stages for bond funds, the evidence to date does not appear to reject the null hypothesis even for bond funds. As such, this has created an expectation that my findings are most likely to indicate that the bond funds in my sample are, too, unable to outperform the market and showcase evidence of performance persistence.

3 RESEARCH METHODOLOGY

Prior to the introduction of the modern portfolio theory ("MPT") by Markowitz in 1952, all of the empirical literature on mutual fund performance applied models that only took into account the returns of portfolios, ignoring any consideration of the risk-return relationship. Following the introduction of the MPT, academic researchers quickly realised the importance of developing evaluation techniques that adjust for risk when measuring portfolio returns. These techniques include the Treynor index (Treynor, 1965), the Sharpe ratio (Sharpe, 1966) and the Jensen's alpha (Jensen, 1968). The idea behind these methods is to adjust the average returns for some measure of risk, whether the risk is measured in a form of standard deviation or in a form of a beta., with the aim of using a single parameter to determine portfolio performance.

Similar to the recent studies, this paper follows a risk adjusted approach in determining portfolio returns. In this chapter I detail the following: my research approach and methodology; sample data, sampling approach and evaluation period; reseach reliability and validity; and any limitations to my research.

3.1 Research Approach and Strategy

Building on previous literature on mutual fund performance, this research paper also follows a deductive (quantitative) approach in examining the null hypothesis that active management cannot produce superior returns to those of a passive management strategy. Past research has shown that a quantitative approach is more approapriate when undertaking an empirial time series analysis. However, following the developments of different performance evaluation techniques in literature, the debate on mutual fund performance has now extended on whether the performane evaluation methodology followed has any influence on the empirical results of the study. Jensen (1968) advises that when choosing an appropriate methodology, the evaluation model chosen shoud incorporate and reflect the manager's ability to forecast the market behaviour and his ability for asset allocation. To contribute to this debate, this paper measures mutual fund performance using the Sharpe ratio and its modification, the unconditional performance model as per Jensen's alpha, as well as the conditional model with time varying variables. A use of conditional performance evaluation approach takes into account information that was available to investors at the time the returns were generated (Silva et al., 2003).

Below, I elaborate on each of the chosen methodologies as follows: **Section 3.1.1** discusses the contrast between the original Sharpe ratio and its modified version; **Section 3.1.2** details the

reasons behind the introduction of the CAPM; **Section 3.1.3** expands on the development of multi-index models; while **Section 3.1.4** introduces the use of conditioning information variables in my models.

3.1.1 The Sharpe ratio and its modified version

Almost all literature on mutual fund performance agrees that simply evaluating a fund's rate of return against that of its market benchmark may neglect risk differentials between the fund and the market index. More sophisticated performance measures were then developed by earlier studies to measure risk-adjusted returns and consider returns from riskless investments. The Sharpe (1966) ratio, formally known as the reward-to-variability ratio, was among the first performance measures that explicitly adjust for risk in assessing mutual fund performance. The ratio is expressed as the excess rate of return earned per each unit of total risk, as follows:

$$S_p = \frac{R_p - R_f}{\sigma_p} \quad (1)$$

where S_p is the risk-adjusted return of portfolio *p* over the specified time period;

R_p represents the average rate of return of the portfolio over the observed time period;

R_f is the average risk free rate over the same period, and

σ_p is the total risk of the portfolio as measured by the standard deviation of the overall returns of the portfolio over the same period.

Even though the Sharpe ratio uses the total variability and neglects the relative systematic risk, in using the ratio as a performance measure, it is widely accepted that the parameters of risks and returns are well balanced and the model requires no further validation (Grose et al., 2014). However, some studies (see Agudo & Marzal, 2004; Krimm, Scholz, & Wilkens, 2012; and Ledoit & Wolf, 2008) have debated the appropriateness of the Sharpe ratio as a measure to evaluate mutual fund performance. This debate stems from the apparent inability of the Sharpe ratio to provide reliable results during the periods of market difficulties when either the fund or the market earns negative average returns. During a period of negative portfolio returns, R_p is less than R_f ($R_p < R_f$) and, as such, the Sharpe ratio will provide a positive return per unit of risk, leading to inaccurate conclusions. The academic consensus, however, asserts that the Sharpe ratio will always hold when the average returns are non-negative.

Even Sharpe (2007) acknowledges the inability of the Sharpe ratio to consistently rank funds that experience nonnormal distribution of returns. One approach proposed by Agudo and Marzal (2004) to avoid the incosistant results from the Sharpe ratio is to treat the excess return

in the numerator as a relative premium rather than an absolute, as follows:

$$S_p = \frac{(R_p / R_f)}{\sigma_p} \quad (2)$$

Agudo and Marzal (2004) assert that their modification to the original Sharpe ratio is not a mere algebraic solution. One reason being that the risk-free rate, initially considered as a constant, becomes a significant and volatile variable when considering studies that take the evolution of portfolio performance over time into account, and thereby require treating the risk-free rate the same way as the total risk.

Eling (2008) addressed the frequent debate of whether funds with non-normal return distributions can be adequately examined by the original Sharpe ratio by evaluating 38 954 funds duing a period from 1996 to 2005 and using a number of performance measures proposed as modifications to the Sharpe ratio. The study found that these proposed measures produced almost identical performance rankings as the original Sharpe ratio. In short, the study concluded that choosing a performance measure is not an important aspect to fund performance evaluation. Eling and Faust (2010) also found similar results. However, Zakamouline (2010), concluded that the choice of performance measure does influence the outcome of hedge fund evaluation. Similarly, Ornelas et al. (2012) reached the same conclusion when ranking US mutual funds.

Given the inconclusive literature on the Sharpe ratio, this paper contributes to the debate by employing both the original Sharpe ratio and the modified version as suggested by Agudo and Marzal (2004) for performance ranking, thus testing the appropriateness of the original Sharpe ratio in a sample of bond mutual funds.

3.1.2 Unconditional CAPM (Jensen's alpha)

Extending on work by Treynor (1962), Sharpe (1964) and Lintner (1965) on asset pricing, Jensen (1968) developed his own version of the CAPM which can be used in mutli-period horizons where investors have heterogeneous periods and can trade continously through time. The pricing model suggested by all three prior studies was based on the assumption that all investors have the same single period horizon and expectations regarding investment opportunities. Jensen's (1968) model, in its simplest form, asserts that the expected return for any portfolio (or security) should represent a premium on the risk-free rate equal to an amount proportionate to the systematic risk of that portfolio (as represented by its beta) relative to the

market return over the risk-free rate. The model, which later became famously know as Jensen's alpha, is expressed as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p(R_{m,t} - R_{f,t}) + \varepsilon_{p,t} \quad (3)$$

where $R_{p,t}$ is the rate of return of portfolio *p* at time *t*;

$R_{f,t}$ is the risk-free rate over the same observed period;

β_p represents the undiversifiable risk of the portfolio;

$R_{m,t}$ is the return on the market portfolio index;

α_p denotes an alpha (Jensen's alpha) which measures the excess return on the portfolio after adjusting for the average market return; and

$\varepsilon_{p,t}$ represents an error term of the regression.

The sign of the alpha displays whether the portfolio manager has an ability to forecast security prices. As such, a positive alpha represents superior risk-adjusted returns to the market while a negative and a zero alpha would represent inferior and neutral performances, respectively.

Blake et al., (1993) were among the first to extend the Jensen's alpha measure to bond funds. Although common criticism of Jensen's alpha as an appropriate performance measure has always centered around its estimation error and the choice of an appropriate benchmark, to obtain my unconditional risk-adjusted measure we also use the Jensen's alpha as my single index model to regress the portfolio excess returns against the market excess returns. The selection of a benchmark, however, is not as straight forward, as the benchmark index must reflect the objectives of a fund's strategy as well as its risk appetite. For my market benchmark, I use the JSE All Bond Index ("ALBI"). The JSE ALBI is a market weighted index consisting of the top 20 vanilla bonds from across the full range of maturities and ranked dually by liquidity and market capitalisation. The index serves as an indicative measure of daily movements in the bond market and is the most used by bond funds for comparative purposes. My single-factor model is therefore revised as follows:

$$r_{p,t} = \alpha_p + \beta_p r_{ALBI,t} + \varepsilon_{p,t} \quad (3a)$$

where $r_{p,t}$ represents the excess return on risk-free rate for portfolio *p* at time *t*, and

$r_{ALBI,t}$ is the excess return of the JSE ALBI over the same period.

3.1.3 Multi-index model

It is sometimes argued that the use of only one factor in a single-index model to evaluate mutual fund performance may be unsuccessful in considering different investments, and as such, a single market index may not be appropriate to measure the performance of all funds in a sample (see Blake et al., 1993; and Silva et al., 2003). Blake et al., (1993) were among the first to introduce the use of multi-index models for bond funds and examine whether these models can better explain the investment strategies used by bond fund managers. Earlier studies on equity and/or balanced mutual funds had gradually found evidence indicating that the use of multi-index models may result in different performance rankings to those by single-index models (see Elton et al., 1993; and Lehmann & Modest, 1987). In contrast, when applied to bond funds, Blake et al. (1993) found that the use of multi-index models had very similar results to those by a single-factor model. However, the results of multi-index models were said to be more robust and very useful in providing explanations for the behaviour of bond funds returns.

Following Blake et al.'s (1993) findings, several studies (for example, Silva et al., 2003, 2005; Huij & Derwall, 2008; and Leite et al., 2016) advocate for the use of multi-index models to measure performance of bond funds. Consistent with these studies, I measure the performance of bond funds in my sample by using a multi-index model expressed as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \sum_{i=1}^{k} \beta_{p,i}(R_{i,t} - R_{f,t}) + \varepsilon_{p,t} \qquad (4)$$

where the variables $R_{p,t}$; $R_{f,t}$; α_p; and $\varepsilon_{p,t}$ are as defined in the single-index model above;

$\beta_{p,i}$ represents the sensitivity of the excess return on portfolio *p* to the excess return on the *i*'th index;

$R_{i,t}$ is the return on the *i*'th index;

k represents the number of indices that I use as my benchmarks.

In selecting the appropriate benchmarks to use, Elton et al. (1988) offer some guidence, and document that returns on bond performance can be measured by possibly two and no more than three factors, while five to seven are necessary for equity stocks. For my multiple benchmarks, in addition to the JSE ALBI market index used in the single-index model above, I use the excess return on the stock market index as represented by the JSE ALSI and a default spread, similar

to Silva et al. (2003, 2005). The JSE ALSI[7] is a market capitalisation-weighted index consisting of all companies making up the top 99% of the total pre free-float market capitalisation of all companies listed on the JSE. I use the stock market index as proxy for the general economic conditions as it can be viewed and used as a measure of economic factors that drive security returns (see Cornell & Green, 1991; and Elton et al., 1995). Some studies (for example, Grose et al., 2014) have used the dividend yeild as a measure of economic condition. I believe the use of the JSE ALSI as proxy for economic conditions is more approapriate as the market performance is fully reflected in the listed companies' NAVs. The default spread is a measure of default risk that may impact the bond returns in the market. As such, my multi-factor model can be revised as follows:

$$r_{p,t} = \alpha_p + \beta_1 r_{ALBI,t} + \beta_2 r_{ALSI,t} + \beta_3 \text{Default}_{,t} + \varepsilon_{p,t} \quad (4a)$$

where $r_{p,t}$ represents the excess return on risk-free rate for portfolio *p* at time *t* using a multi-factor model;

α_p measures the risk-adjusted return of portfolio *p*;

β_1, β_2, and β_3 represent the beta coefficients for each factor in my model;

$r_{ALBI,t}$ is the excess return of the overall bond index;

$r_{ALSI,t}$ is the excess return of the stock market index;

Default_t is the default spread; and

$\varepsilon_{p,t}$ representing the regression error term.

Refer to my data section below to see how the default spread is determined.

3.1.4 Conditional models

Although a number of recent studies have continued to use single- and multi-factor models to measure mutual fund peformance, these models have often been critised for their assumption of constant alphas and betas. For bond funds, this criticism may even be more crucial as bond fund managers are more prone to market timing than equity fund managers, especially for funds investing in government bonds since predictions on future interest rates and duration matching are essential for active investment strategies. Grinblatt and Titman (1989) were among the early studies to document that unconditional models may overestate the level of performance, more so when managers are market timers and follow strategies that may lead to time-varying risks. This notion is further supported by Silva et al. (2003) who argue that conditional models allow for better assessment and understanding of bond fund performances. In updating their 2003

[7] There are also certain rules regarding local holding in the shares in order for a company to be added to the index.

study, Silva et al. (2005) further concluded that evidence of performance persistence tend to reduce when conditional betas are considered, particularly for multi-index models, which suggests to some extent that persistence may be driven by time-varying betas. As such, I also use conditional models in which I allow for both alphas and betas to vary over time as in Ferson and Schadt (1996) and Christopherson et al. (1998).

In order to allow for time-varying risks and returns I assume that both alpha and beta are linear functions of a vector of a predetermined information variable, Z_{t-1}, which represents public economic information at time *t-1*, as follows:

$$\beta_p(Z_{t-1}) = \beta_p + \beta'_p z_{t-1} \text{ and } \alpha_p(Z_{t-1}) = \alpha_p + A'_p z_{t-1} \quad (5)$$

where z_{t-1} is a vector of perdetermined information;

β'_p is the vector that measures the responsiveness of the conditional beta to the information variables avialable at time t-1; and

A'_p measures the responsiveness of the conditional alpha to the information variables.

As such, my single- and multi-factor models are revised as:

Conditional single-factor model:

$$r_{p,t} = \alpha_p + A'_p z_{t-1} + \beta_p r_{ALBI,t} + \beta'_p(z_{t-1} r_{ALBI,t}) + \varepsilon_{p,t} \quad (5a)$$

Conditional multi-factor model:

$$r_{p,t} = \alpha_p + A'_p z_{t-1} + \beta_1 r_{ALBI,t} + \beta'_1(z_{t-1} r_{ALBI,t}) + \beta_2 r_{ALSI,t} + \beta'_2(z_{t-1} r_{ALSI,t}) + \beta_3 Default_{,t} + \beta'_p(z_{t-1} Default) + \varepsilon_{p,t} \quad (5b)$$

In considering the use of predetermined conditioning information variables, I make use of the term spread, an inverse relative wealth, and a dummy variable for the month of January as these variables have been shown to have predictive abilities when investigating both equities and bond markets, as explaned in section 3.2.2 below.

3.1.5 Performance persistence

At the centre of mutual fund performance persistence is the relationship between past and future returns. In other words, a question arises as to wether past performance can be a reliable predictor of future performance for bond funds. There are three methodologies usually followed to test persistence, these are: the cross-sectional regression models, where all of the funds' alphas are estimated over an evaluation period as well as post the evaluation period to test for

a statistically signifiicant relationship between the two periods; the performance ranked portfolios, where each bond fund's past performance is used to create rankings which are used for allocation into several quartiles; and contigency tables which classify funds into winners and losers based on their deviation from the mean performance. However, there is no consesus in literature as to which methodology is best for testing performance persistence.

Following the examiniation of specifications and outcome of numerous persistence methodologies, Carpenter and Lynch (1999) found that without overlapping periods, both the chi-squared test on classification of winners and losers and the t-test on performance rankings are well superior in measuring persistence compared to other alternatives, including the cross-sectional regressions. Further, the authors have also found that the t-tests are more superior than the chi-squared tests. Huij and Derwall (2008) also find similar results after comparing four different methodologies to investigate persistence. The duo proposed that, even though all the other methods are well suited to measure persistence in relative performance of bond funds, other than the performance rankings approach, all the other three methods do little for the funds' returns relative to a set of passive indexes. Due to the lack of consensus in literature as to which methodology is superior in testing for persistence, in this paper I elect to chose two of the methodologies, namely, the contingency tables and the cross-sectional regressions to test for persistence and to determine whether the phenomenon is in any way influenced by the persistence methodology used. I choose the contigency tables for their robustness of the chi-squared test as advocated by Carpenter and Lynch (1999) and I choose the cross regression analysis for its ability to test for a statistically signifiicant relationship between alphas of two periods

Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Under the cross-sectional regression approach, fund performance in one period is regressed against the peformance achieved during the following period and the measure of statistical measure of significance is observed, as follows:

$$A_{\alpha,t} = \alpha_p + \beta_p A_{\alpha,t-1} + \varepsilon_{p,t} \quad (6)$$

where $A_{a,t}$ is the current period's performance alpha for the portfolio at time *t*;

β_p represent the beta coefficients for the previous period's performance alpha; and

$A_{\alpha,t-1}$ is the previous period's performance alpha for the portfolio at time *t-1*.

3.2 Data Collection, Frequency and Choice of Data

3.2.1 Data

My sample dataset consists of bond mutual funds domiciled in and primarily investing in South Africa, sourced from the IRESS Expert database ("IRESS"). In compilling the dataset I selected unit trusts that are trading on the JSE and have been classified as either bond, fixed income, fixed interest, or yield enhanced funds or portfolios. Similar to Blake et al., (1993) and Huij and Derwall (2008), I omitted money market, debenture bonds and preference shares unit trusts in my sample of bond funds given my focus on funds investing in government, corporate and municipal bonds and fixed income instruments. In addition, I also omitted all funds of funds to avoid any double counting, bond/fixed income funds that feed into other funds, and as such classifed as feeder funds, as well as omitting global bond funds. In order for a unit trust to be selected as part of the final bond fund sample, it must have monthly data available for the entire sample period, and therefore my sample has been selected based on the avaiability of historic information from the IRESS. The final sample consists of 52 funds. In table 1 of Appendix A below I summarise the profile and summary statistics of the sample.

To examine performance of the sample, I evaluate the monthly returns of these bond funds over the period from July 2008 to December 2016. The monthly returns are calculated on net asset value ("NAV") to NAV basis, based on the monthly prices quoted on IRESS, with fund income distributions assumed to be reinvested at NAV per unit on the ex-dividend date. The monthly prices are quoted net of fund management expenses. The returns are calculated as:

$$R_{p,t} = \ln (P_t / P_{t-1}) \quad (7)$$

where $R_{p,t}$ represents the average rate of log return of fund *p* at month *t*;

P_t is the fund's price at the end of month *t* for which the return is being calculated; and

P_{t-1} is the price at the beginning of month *t*.

In order to calculate excess returns, from the fund monthly returns I subtract the risk-free rate of return. Because the sample is determined at individual fund level rather than at aggregate

portfolio level and is guided by the availability of data for each composite fund over the duration of the samle period, it is therefore unlikely to be affected by survivorship bias. To test for performance persistance the sample period is subdivided into: 8 one-year periods; and 2 four-year periods.

As a proxy for the risk-free rate I use the yield on a 3-months Treasury bill ("T-bill") rate, converted into monthly return equivalents, similar to other South African fund performance studies (for example, Meyer, 1998; von Wielligh & Smit, 2000; and Thobejane et al., 2017). Data for the 3-month T-bill is obtained from the South African Reserve Bank ("SARB") website. For my single- and multi-factor models discussed above, I obtain data for the JSE ALSI and JSE ALBI from IRESS. For the default spread variable I use the South African credit default swap ("CDS") spread as a proxy, as it measures the sovereign riskiness as an issuer. The data for South African CDS spreads is obtained from the DataGrapple[8] website.

3.2.2 Conditioning information variables

When considering the use of conditional models as discussed above, a vital issue that arises is the choice of information variables to be used as conditioning factors. The majority of literature that uses conditional performance evaluation models assumes a set of predetermined conditioning information variables as predicting factors of performance returns. This set of information variables consists of a term spread, an inverse relative wealth, and a dummy variable for the month of January. According to Silva et al. (2003), this popular set has been shown to have predictive abilities when investigating stock returns mainly in the US. Silva et al. (2003, 2005) is among the very few studies that have investigated returns predictability of the bond markets outside the US, and found that the predetermined information variables also hold for predicting bond market returns. These findings are similar to Keim and Stambaugh (1986), and Fama and French (1989) who found common factors of predictability in both stock and bond markets in the US, implying that variables that are useful in predicting stock market returns should also be able to predict bond market returns. As such, for my conditional information variable I also consider this popular set of information variables, consisting of a term spread, an inverse relative wealth, and a dummy variable for the month of January.

For the term spread I consider the difference between a long- and short-term bond yields. As a long-term bond yield I use the yield on a 10-year R186 government bond obtained from the

[8] DataGrapple analyses and visualizes large time series using clustering methods. The website offers an access to a large CDS database. DataGrapple obtains its data from Hellebore Capital, which has opened to DataGrapple its credit derivatives database containing price information on traded CDS.

SARB website, and as a short-term bond yield I use the yield on the 3-months T-bill rate discussed above. The inverse relative wealth ("IRW") is defined as the exponential ratio of weighted average of past to current real wealth (Silva et al., 2003) and is used as a proxy for time-varying risk aversion. As a proxy for real wealth I use the wighted average levels of the JSE ALSI deflated by the consumer price index ("CPI"). The CPI data is obtained from Statistics South Africa ("Stats SA") and is one-month lagged in order to take into account the publication lags, to therefore consider only publicly available information. Similar to Leite et al. (2016), the IRW is derived using the following equation:

$$IRW_t = \text{ewa } W_{t-1}/W_t = [W_{t-1} + (coef * W_{t-2}) + (coef^2 * W_{t-3}) + \ldots.] * (1 - coef)/W_t \quad (8)$$

where ewa W_{t-1} is the exponentially weighted average of real wealth levels at time *t-1*;

W_t the real wealth levels at time t; and

coef representing the smoothing coefficient.

As in previous studies using time-varying information variables (see Ilmanen, 1995; Silva et al., 2003; Ayadi & Kryzanowski, 2011; and Leite et al., 2016), I use a smoothing parameter of 0.90 and a 36-months window. According to Ilmanen (1995), a smoothing coefficient of 0.9 best captures the effects of business cycles. Further, Ilmanen (1995) demonstrates that the cumulative last 36 month's weight is over 90 percent. The dummy variable for the January month takes a value of 1 if the following month is January and otherwise a value of 0 for all the other months.

3.3 Sampling

As mentioned above, my final sample was guided by the availability of bond unit trusts' historical data from IRESS database. As such, in order for a unit trust to be selected as part of the final bond fund sample, it must have monthly data available for the entire sample period.

3.4 Data Analysis Methods

All data analysis in this study has been done in both Microsoft Excel 2016 and using EViews statistical software. This includes all summary statistics, statistical regression computations, as well as tests for statistical significance. Further, all of the statistical output is manually analysed and collated using arrays and pivot tables.

3.5 Research Reliability and Validity

Regarding the stationarity of my data relating to the performance returns of the bond fund sample and the independent variables for my single- and multi-factor models, I have tested for stationarity of these variables using the Augmented Dickey-Fuller ("ADF") test and concluded to reject the null hypothesis that the data contains a unit root. When testing for stationarity of the selected conditioning variables, I concluded that I cannot reject the null hypothesis for the term spread. In order to reduce the problem of spurious regression due to non-stationtity, the term spread data was then stationarised at fist difference level.

To reach a robust conclusion about the stationarity of my data sample and the independent variables used in my performance models, I further conducted the Phillips Perron ("PP") test for the null hypothesis. The results are similar to those of the ADF test above. As such, I reject the null hypothesis that my data sample contains a unit root, and similarly, the PP test further concludes that I cannot reject the null hypothesis for the term spread.

To test for validity and robustness of my regression models discussed above, I created an overall portfolio containing all the funds' excess returns in my sample, on equally-weighted basis, over the entire sample period. Table 2 below presents the summary statistics and the "goodness fit" of the models. For all my models the statistical measures of fit, the R^2 values, are greater than 0.9, statistically implying that the models can explain more than 90.0% of the variations in performance returns of the bond mutual funds sample. Further, the F-statistics for each of the models are well below 0.05, implying that all the models are statistically significant. Therefore, I conclude that the models use in this paper are highly robust and suitable to measure and evaluate the performance returns of the bond funds in my sample.

Table 2:
Model summary statistics

Performance model	Multiple R	R-Squared	Adj R^2	Sig F-value
Single-index model	0.9499	0.9024	0.9014	0.0000
Multi-index model	0.9518	0.9060	0.9031	0.0000
Conditional single-index	0.9553	0.9125	0.9089	0.0000
Conditional multi-index	0.9669	0.9348	0.9277	0.0000

To further assess the validity of my models, table 2a below presents the reliability measures relating to the independent variables used in the models, showing the coefficient values and the corresponding p-values at 5% significance level, and thereby testing the null hypothesis that

the betas for each of the independent variables is equal to zero. From the beta coefficients presented across all four models, it can be observed that the excess returns on the ALBI are statistically significant in explaining the variations in the funds' returns in all the models, thereby rejecting the null hypothesis (H_0: $\beta = 0$) as the p-values are well below 0.05. However, when I observe the two additional variables (ALSI and default spread) used in the multi-index model, it can be concluded that the beta coeffitiants for these variables are not statistically different from zero at 5% significance level. This suggests that the bond funds in my sample are not significantly exposed to the variations in the JSE ALSI and default spreads, and is in contrast to the findings of Silva et al. (2003, 2005) and Leite et al. (2016).

Table 2a:
Model variable coefficients and p-values

	Performance Model							
	Single-index		Multi-index		Cond single-index		Cond multi-index	
X-variable	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
ALBI	0.8796	0.0000	0.8556	0.0000	0.8518	0.0000	1.3091	0.0000
ALSI	-	-	0.0292	0.2435	-	-	-0.0390	0.5533
Default	-	-	-0.0910	0.1212	-	-	-0.6917	0.0065
ALBI * Spread	-	-	-	-	15.5182	0.0012	22.7423	0.0003
ALBI * IRW	-	-	-	-	0.0301	0.8200	-0.4932	0.0031
ALSI * Spread	-	-	-	-	-	-	-16.3390	0.0000
ALSI * IRW	-	-	-	-	-	-	0.0874	0.3186
Default * Spread	-	-	-	-	-	-	24.3874	0.0116
Default * IRW	-	-	-	-	-	-	0.6145	0.0204
January dummy	-	-	-	-	0.0014	0.7230	0.0017	0.6394

Given that the JSE ALBI alone can significantly explain the variations in performance returns of the bond funds, this might indicate that the funds in my sample are "closet index funds" with their respective fund managers being benchmark huggers. As such, the funds tend to perform much like their performance benchmark index. Whilst there might be some theoretical evidence to support this claim, a more formal empirical research may be required.

When considering the conditional single-index model, only the term spread conditioning variable appears to be statistically significant. In contrast with the findings by Silva et al., (2003, 2005) and Leite et al., (2016), the IRW and the January dummy variables are not statistically significant in predicting the returns in my bond funds sample as the p-values for these two information variables are well above 0.05. For the conditional multi-index model the JSE ALSI, the conditioning IRW and the January dummy variables are not able to explain significant portions of variations in performance returns of the bond funds in my sample.

Table 3 reports a correlation matrix among the independent variables. According to Kennedy (2008), a correlation coefficient of 0.70 or more is the level at which multicollinearity exists. Based on the analysis presented, with an exception of the correlation between ALBI and ALBI conditioned by IRW, ALSI and ALSI conditionned by IRW, and default spread and default spread conditioned by IRW, all correlation coefficients among the independent variables are below 0.70. The higher correlation coefficients may indicate a posibility of multicollinearity and, as such, may question the results produced by my models. However, some litrature (for example, Farrar & Glauber, 1967; and O'Brien, 2007) argue that multicollinearity does not

Table 3:
Correlation matrix among independent variable

	ALBI	ALSI	Def	$ALBI_{TS}$	$ALBI_{IRW}$	$ALSI_{TS}$	$ALSI_{IRW}$	Def_{TS}	Def_{IRW}	Jan
ALBI	1.00									
ALSI	0.56	1.00								
Default	-0.03	0.00	1.00							
ALBI * TS	0.05	0.24	0.07	1.00						
ALBI * IRW	0.97	0.58	-0.04	0.05	1.00					
ALSI * TS	0.21	0.26	0.02	0.59	0.13	1.00				
ALSI * IRW	0.63	0.95	0.01	0.15	0.64	0.22	1.00			
Def * TS	0.13	0.11	0.04	0.57	0.16	0.38	0.07	1.00		
Def * IRW	-0.13	0.00	0.96	0.09	-0.10	-0.03	-0.03	0.04	1.00	
Jan dum	-0.17	-0.08	0.00	-0.06	-0.20	0.01	-0.11	-0.06	-0.01	1.00

necessarily bias the regression results but rather results in larger standard errors from the related independent variables.

3.6 Limitations

It is important to note that this research paper is subject to some limitations. The sample used in this study is limited to bond and fixed income unit trusts domiciled in South Africa. In compiling my data set I ommited money market, debenture bonds, preference shares, fund of funds, feeder funds and global bond unit trusts. Therefore, the results of this paper should should not be extrapolated to other type of unit trusts without extreme caution. Further, my evaluation period was guided by the availability of monthly returns data for my sample criteria and, as such, the evaluation period from 01 July 2008 to 31 December 2016 may be considered very short by any statistical standards. To accommodate for the lack of data for a longer period, while it is not typical among literature, evaluating fund performance using weekly returns could be an area for future research.

Although the number of South African bond mutual funds has significantly increased in the last decade, the sample size only consists of 52 funds. The lack of data available for the entire sample period has been the main factor behind the final sample size. For a unit trust to be selected as part of the final bond fund sample, it must have monthly data available for the entire sample period, and therefore the sample has been selected based on the avaiability of historic information from the IRESS[9]. Compared to the previous studies on bond mutual funds, which focus mainly on the US and UK markets, my reletively small sample size may question the industry wide validity of my findings. Further, the sample period (01 July 2008 to 31 December 2016) covers a period when South African capital markets were highly volatile, with the global financial crisis during 2007/ 2008 and the sovereign debt downgrade during 2015. As such, the results for persistence in performance may be exclusive to this particular time duration. However, if a manager continues to outperform the market despite the high market volatility, then it may be argued that such fund manager may truly have "hot hands".

When testing for outperformance and for performance persistence, this study measures the equally-weighted mean return of the sample against that of its benchmark. Therefore the overall performance of the sample as a whole is inferred on the basis of mean returns, mean Sharpe ratios and mean alpha values. Although there is no overall consensus in finance literature on how the sample returns should be weighted, this too could be an area for future research to study the impact on the results. Further, because the statistical significance of returns is tested at the individual fund level, the statisical significance of the mean returns at the overall portfolio level is assumed and therefore not tested by this study. It is also important to note that, when using the JSE ALSI as proxy for the general economic conditions in the multi-index models, one should be mindful that the JSE ALSI is market-cap weighted and as such, subject to concentration of high market-cap shares such as Naspers.

However, irrespective of the limitations to this study as mentioned above, it should be noted that I do not believe that these limitations will undermine the credibility and the validity of the results, but rather present caution to be brought to the attention of the reader. As such, valid and informed inferrences may continue be drawn from the results of this study.

[9] Further to relying on the data from IRESS, we have also inspected other data providers, including Morningstar, Bloomberg and S&P Capital IQ and found no further additional data points.

4 RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

In this chapter, I apply the peformance measures and persistence methodologies discussed in chapter 3 above to assess whether the funds in my sample are, too, subject to the null hypothesis that active management is wasteful and will not yield superior results and that past peformance is not a good indicator of future performance. On observing prior empirical studies on performance of bond mutual funds, regardless of the recent mixed results, the conclusion that one is most likely to draw is that bond funds are not able to outperform the market, presenting on average negative or neutral performancce returns. This type of conclusion, with very few exceptions, is similar to that usually reached by studies on performance evaluation of equity funds.

In assessing whether my study will yield similar results, I present the empirical findings below. I have evaluated the performance of the bond funds in my sample both at aggregate level, by creating an equally-weighted portfolio containing all the sampled funds, and at an individual level for each fund. Fund performance is evaluated over a short-, medium- and longer-term periods represented by eight and a half 1-year intervals, two 4-year intervals and one 8.5-year interval, respectively. Performance persistencce is examined as discussed in chapter 3 above. This chapter is organised as follows: **Section 4.1** presents the fund performance results using the evaluation methodologies discussed in chapter 3 above; and **Section 4.2** discusses the performance persistance results.

4.1 Fund performance evaluation

4.1.1 The Sharpe ratio and its modified version

In table 4, I present the performance results of my sample using the Sharpe ratio methodology in comparison to its modified version. I also present the mean Sharp and alternative ratios for the market index performance as represented by the JSE ALBI. The results show that the portfolio of funds has, in general, outperformed the market during the entire evaluation period (31 July 2008 to 31 December 2016), when using both the orignal Sharpe ratio and its modified version. However, fewer individual funds (36) showed signs of outperformance when using the original Sharpe ratio when compared to 49 funds that appear to have outperformed the market when using the modified version of the Sharpe ratio. What is interesting to note is that, even though the results show an overall portfolio outperformance, under the original Sharp ratio model this outperformance is barely significantly evident as the portfolio reward-to-variability ratio is 0.1169 when compared to the market ratio of 0.1136. This might actuallly be the first

Table 4:
Summary performance results using the Sharpe ratio vs modified version

Below I present the performance results for both the original Sharpe ratio and its modified version. The reward-to-variability ratio is calculated for each bond fund in my sample as well as for the market, using the JSE ALBI as a proxy for market benchmark index. The Funds column represents the equally-weighted performance average of the created portofolio containing all the bond funds in my sample. I also present the number of individual funds that have managed to outperform the market for each of the evaluation periods ("F>M"). A fund that has a highger Sharpe or modified ratio than the market is considered to have outperformed its market index.

	Original Sharpe Ratio			Modified Sharpe Ratio		
Duration	**Funds**	**Market**	**F>M**	**Funds**	**Market**	**F>M**
8.5-year period:						
31 Jul 2008 to 31 Dec 2016	0.1169	0.1136	36	-0.0594	-0.1263	49
4-year periods:						
31 Jul 2008 to 31 Dec 2012	0.4807	0.5161	17	-0.1110	-0.1847	42
01 Jan 2013 to 31 Dec 2016	-0.3016	-0.2891	25	-0.0059	-0.0522	38
1-year periods:						
31 Jul 2008 to 31 Dec 2009	0.5796	0.6671	3	-0.3156	-0.3184	18
01 Jan 2010 to 31 Dec 2010	0.8534	0.9091	6	-0.0764	-0.1829	41
01 Jan 2011 to 31 Dec 2011	0.1845	0.1217	41	0.1802	0.0484	37
01 Jan 2012 to 31 Dec 2012	0.3342	0.3083	38	0.0212	0.0842	14
01 Jan 2013 to 31 Dec 2013	-0.3117	-0.3405	40	0.2276	0.2809	25
01 Jan 2014 to 31 Dec 2014	-0.3051	-0.2766	32	-0.2131	-0.2406	11
01 Jan 2015 to 31 Dec 2015	-0.3733	-0.3674	20	0.0904	-0.1721	35
01 Jan 2016 to 31 Dec 2016	-0.2122	-0.1410	22	-0.0639	-0.1449	41

evidence to support the argument that the fund managers in the sample portfolio might be "benchmark index huggers", or that they cannot significantly outperform the market.

When observing performance over the medium-term horizons, during the periods from 31 July 2008 to 31 December 2012 and from 01 January 2013 to 31 December 2016, the sample portfolio showed evidence of underperformance for both periods under the original Sharpe ratio model, with only 17, out of the 52 funds, outperforming the market during the former period and only 25 funds outpeforming the market during the latter. These results offer some interesting insight as the two periods being evaluated can be tested as proxy for a financal crisis period (31 July 2008 to31 December 2012) and a non-crisis period (01 January 2013 to 31 December 2016). Even though some recovery from the 2007/2008 global financial crisis was expected in 2010 due to South Africa hosting the soccer world cup, much of the period still continued to suffer from the impact of the crisis as some of the country's vital industries (for example, mining and manufacturing) struggled to recover. It therefore follows, the results suggest that the global financial crisis did not have much impact on the performance of the sample portfolio as it underperformed during and after the crisis periods, with a slight

improvement on the number of the individual funds that showed signs of outperformance during the non-crisis period. These findings are similar to those by Leite et al. (2016) who evaluated the performance of Portuguese bond funds during and after Eurozone financial crisis, even though the authors used a conditional multi-factor model to reach their conclusion.

When I compare the Sharpe ratio results to those offered by the modified version, I note that when using the modified Sharpe ratio model the results are reversed, with the sample portfolio outperforming the market in both periods under evaluation. 42 funds showed signs of outperformance during the crisis period while 38 funds showed signs of outperformance during the non-crisis period.

For the short-term (1-year) periods, a similar contrast in results between the original Sharpe ratio and its modified version can also be observed. Out of the 8.5 short-term periods being evaluated, in 5 periods I have observed the original Sharpe ratio showing resuts of portfolio underpeformance while the modified version has showed result of porfolio outperformance, and in 2 periods I have observed the exact opposite. It is only during 01 January 2011 to 31 December 2011 where the two models yieled the same results, with the sample portfolio outperforming the market.

In summary, the findings present consistantly conflicting results between using the original Sharpe ratio method and its modified version, with the exception of when I evaluate performance for the entire sample period. While the original Sharpe ratio mainly advocates for portfolio underperformance, when evaluating performance using the modified Sharpe ratio model, I observed a tendency towards an improved fund performance across all periods under review. The differing performance results between the two measures are similar to the findings by Agudo and Marzal (2004), who also compared the results from using the original Sharpe ratio and from using the same modified version. For the majority of the studies that have concluded that the use of a number of proposed modified versions of the Sharpe ratio produce almost identical result to the original Sharpe ratio (for example, Eling, 2008; and Eling & Faust, 2010), it should be noted that the treatment of the premium on returns (numerator) on those proposed modified versions of the Sharpe ratio still remained absolute rather than being treated as relative, with the focus being a modification on the risk measure (denominator). The absolute treatment is the same as the treatment in the original Sharpe ratio. This offers an interesting area of further research to assess the most appropriate modification to the Sharpe ratio, and the impact on performance results of modifying either the premium on returns and/or the risk measure.

From the results above, I can safely infer that an evaluation measure used matters when assessing the performance of bond mutual funds.

4.1.2 The CAPM model (Jensen's alpha) and its conditional version

In table 5, I summarise the performance results from using the CAPM, as presented by the Jensen's model, in comparison to the conditional CAPM methodology. As discussed in chapter 3 above, both models measure performance using the regression intercept, the alpha ("α_p"), and conclude on inferior, superior or neutral performance based on the sign of the intercept. The results show that the sample portfolio of funds displays, in general, positive alphas of +0.0003 and +0.0015 during the entire evaluation period (31 July 2008 to 31 December 2016), for both the unconditional and conditional CAPMs, respectively. However, although the positive alphas may indicate signs of outperformance, these alphas do not appear to be statistically significant, even at a 10% significant level, and therefore I cannot reject the null hypothesis that these are not significantly different from zero. These results are in line with most literature on performance of bond funds that advocates that bond funds are not able to outperform the market, representing on average negative or neutral performances (for example, Blake et al., 1993; Detzler, 1999; Silva et al., 2003; Grose et al., 2014; and Leite et al., 2016). Interestingly, these results can also be intepreted as being similar to the findings of the original Sharpe ratio above, that showed no significant outperformance to the market. At the individual fund level, out of the 51 funds that reported positive alphas under the unconditional CAPM, only 1 fund displayed a statistically significant postive alpha, at 5% significance level. Under the conditional CAPM on the other hand, none of the 42 funds that reported positive alphas displayed statistical significance.

In observing the results for the medium-term horizons (31 July 2008 to 31 December 2012; 01 January 2013 to December 2016), both models continue not to offer any statistically significant positive alphas for the two periods under review, even though some level of positive alphas is observed. For the period 31 July 2008 to 31 December 2012, out of the 47 funds with positive alphas under the unconditional CAPM, only 1 fund had a statistically significant positive alpha, at 5% level, while none of the 41 "positive alpha" funds under the conditional CAPM were actually statistically significant. For the second medium-term period, the unconditional CAPM reported 8 individual funds with statistically significant negative alphas, at 10% level, which represent underperformance, while the conditional CAPM had no statistically significant alphas, whether negative or positive. Interestingly, even though these

Table 5:
Summary performance results using the CAPM vs conditional CAPM

Below I present the performance results of the sample portfolio for both the CAPM model, per Jensen's alpha, and the conditional CAPM. For the conditional model, the predetermined information variables are the term spread, the IRW and a dummy variable for the month of January. The results consist of the regressed estimates for alphas ("α_p"), the beta coefficients ("β_p") and the statistical measure of regression fit, the adjusted R^2 values for each evaluation period. The CAPM is inherently a single factor model, and I have thereby used the JSE ALBI as proxy for market benchmark index. The number of individual funds that show signs of outperformances are presented in the positve alphas column ("$+\alpha_p$"). The sign of the alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive alpha would indicate outperformance.

	Unconditional Single-Index				Conditional Single-Index			
Duration	α_p	β_p	Adj. R^2	$+\alpha_p$	α_p	β_p	Adj. R^2	$+\alpha_p$
8.5-year period:								
31 Jul 2008 to 31 Dec 2016	0.0003	0.880*	0.901	51	0.0015	16.400*	0.909	42
4-year periods:								
31 Jul 2008 to 31 Dec 2012	0.0004	0.908*	0.843	47	0.0008	18.665*	0.864	41
01 Jan 2013 to 31 Dec 2016	-0.0009	0.838*	0.941	15	0.0019	-2.911	0.939	38
1-year periods:								
31 Jul 2008 to 31 Dec 2009	-0.0027	0.965*	0.801	21	-0.0056	13.741	0.8267	39
01 Jan 2010 to 31 Dec 2010	0.0016	0.923*	0.835	51	0.0015	-54.473	0.811	38
01 Jan 2011 to 31 Dec 2011	0.0014	0.650*	0.561	49	0.0123	-96.391	0.570	52
01 Jan 2012 to 31 Dec 2012	0.0013	0.841*	0.961	41	0.0002	2.355	0.945	30
01 Jan 2013 to 31 Dec 2013	-0.0003	0.071*	0.905	21	0.0037	29.271**	0.915	42
01 Jan 2014 to 31 Dec 2014	-0.0011	0.947*	0.961	16	0.0074	-23.677	0.971	38
01 Jan 2015 to 31 Dec 2015	-0.0009	0.819*	0.977	10	0.0089	16.474	0.972	25
01 Jan 2016 to 31 Dec 2016	-0.0015	0.760*	0.796	15	0.0027	18.436	0.719	40

* Statistically significant at 1% confidence level
** Statistically significant at 10% confidence level
Note: all other unmarked beta and alpha coefficients are not statistically significant

results may lack much of the statistical significance, the second medium-term may offer some level of support to Silva et al. (2003) who observed a slight tendency towards improved performance under the conditional CAPM, as the alpha moves from -0.0009 under the unconditional CAPM to +0.0019 under the conditional CAPM.

For the short-term (1-year) periods, a similar theme continues as I cannot reject the null hypothesis that all of the presented alphas are not significantly different from zero, for both the conditional and unconditional CAPMs. On the individual fund level, no statistically significant alphas were produced under the conditional CAPM for the short-term periods under review, while under the unconditional CAPM only 2 funds produced statistically significant positve alphas during 01 January 2011 to 31 December 2011, 1 fund with a statistically significant positive alpha during 01 January 2012 to 31 December 2012 and 5 with statistically significant negative alphas during 01 January 2016 to 31 December 2016, at 5% level. However, looking

at the results presented without the emphasis of statistial significance, similar to the observation made on the medium-term reults, the conditional CAPM appears to offer some slight tendency towards improved performance for the majority of the observed short-term periods. This notion is consistant with some of the studies on equty funds, such as Ferson and Schadt (1996), who also found that the distribution of alphas tends to move to the right region of outperformance when conditional models are used.

In summary, my overall findings present neutral or negative performance for both unconditional and conditional models. This neutral or negative performance is observed during the short-, medium- and long-term periods, which may actually be the first indication of persistence. Even though the results table may present some level of positive alphas, it is important to note that none of these are statistically significant at 5% significance level and I therefore could not reject the null hypothesis that these are not significantly different from zero.

What was interesting to note was that the results are statistically similar under both the unconditional and conditional CAPMs. Similar to the findings by Silva et al. (2003) and Grose et al. (2014), it therefore follows that incorporating conditional information variables in the performance models does not seem to change the performance results much, as the sample portfolio continued, on average, to present neutral or negative results. One observation that could be a reason for this is that, other than the term spread, all other conditional variables employed are for the most part statistically insignificant. However, it has also been observed that the distribution of conditional alphas marginally shifts to the right region of outperformance when compared to the unconditional model.

4.1.3 The multi-index model and its conditional version

Building on the findings of the CAPMs above, table 6 presents the results of using the unconditional and conditional multi-index models as performance measures, by adding two additional factors to the CAPMs, being the excess stock index as represented by the JSE ALSI and the default spread, in an attempt to add some explanatory power to the original CAPM. In observing the unconditional results, irrespective of the signs of their coefficients, both the JSE ALSI and the default spread do not seem to offer much explanatory power over the single-factor model as the p-values of these two variables are observed to not reject the null hypothesis that these variables are not significantly different from zero for all the periods under review. In contrast, this observation is different from the conclusions reached by Blake et al. (1993) and Silva et al. (2003, 2005) that the explanatory powers of multi-index models are more robust, very useful and superior to those of the single-index models.

Table 6:
Summary performance results using the unconditional vs conditional Multi-Index Models

Below I present the performance results of the sample portfolio for both the uncondtitional and conditional multi-index models. For both models, I consider the ALBI, the ALSI and the default spread as my benchmark performance indices, with the term spread, the IRW and a dummy variable for the month of January being considered as predetermined information variables applied to the conditional multi-index model. The results consist of the regressed estimates for alphas ("α_p"), the beta coefficients for each of the indices ("ALBI", "ALSI" and "Default") and the statistical measure of regression fit, the adjusted R^2 values for each evaluation period. The number of individual funds that show signs of outperformances are presented in the positve alphas column ("+α_p"). The sign of the alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive alpha would indicate outperformance.

	Unconditional Multi-Index						Conditional Multi-Index					
Duration	**α_p**	**ALBI**	**ALSI**	**Default**	**Adj. R^2**	**+α_p**	**α_p**	**ALBI**	**ALSI**	**Default**	**Adj. R^2**	**+α_p**
8.5-year period:												
31 Jul 2008 to 31 Dec 2016	0.003	0.856*	0.029	-0.091	0.903	51	0.004	23.558*	-16.291*	24.310**	0.928	43
4-year periods:												
31 Jul 2008 to 31 Dec 2012	0.003	0.894*	0.017	-0.091	0.843	47	0.006	26.277*	-18.744*	32.206**	0.906	43
01 Jan 2013 to 31 Dec 2016	0.001	0.809*	0.047	-0.065	0.941	29	0.014	4.158	-17.237***	5.768	0.941	47
1-year periods:												
31 Jul 2008 to 31 Dec 2009	0.014	1.007*	0.008	-0.696	0.791	36	0.041***	19.391	-13.943	44.764	0.908	45
01 Jan 2010 to 31 Dec 2010	-0.055	0.844*	0.093	3.413	0.820	10	-0.173	-193.606	104.335	153.036	0.463	11
01 Jan 2011 to 31 Dec 2011	-0.013	0.767*	-0.073	0.763	0.527	10	-0.200	-215.664	121.261	179.763	-0.626	3
01 Jan 2012 to 31 Dec 2012	0.005**	0.901*	-0.069	-0.067**	0.978	48	0.007	387.866***	-443.43***	175.564	0.999	46
01 Jan 2013 to 31 Dec 2013	0.004	0.717*	0.021	-0.204	0.884	22	-0.081	-46.055	-46.172	-36.382	0.919	13
01 Jan 2014 to 31 Dec 2014	-0.009	0.890*	0.090	0.307	0.954	26	-0.231	1021.863	-1327.829	388.306	0.920	3
01 Jan 2015 to 31 Dec 2015	0.013	0.807*	-0.018	-0.516	0.973	44	0.006***	80.073	-42.877	112.881	0.970	28
01 Jan 2016 to 31 Dec 2016	0.010	0.762*	0.142	-0.300	0.781	39	-0.056	275.192	140.572	47.107	0.977	5

* Statistically significant at 1% confidence level
** Statistically significant at 5% confidence level
*** Statistically significant at 10% confidence level
Note: all other unmarked beta and alpha coefficients are not statistically significant

It is only during the period 01 January 2012 to 31 December 2012 where I observe only the Default spread to be statisticlly significant, at 5% level. When applying the predetermined conditioning variables to the ALSI and term spread, I start to observe some level of statistical significance during the long-, medium-term periods, and during the period 01 January 2012 to 31 December 2012.

In intepreting the performance results, table 6 show that the portfolio of funds displays, in general, positive alphas of +0.003 and +0.004 during the entire evaluation period (31 July 2008 to 31 December 2016), for both the unconditional and conditional multi-index models, respectively. However, similar to the CAPMs above, although the positive alphas may indicate signs of outperformance, these alphas do not appear to be statistically significant, even at a 10% significant level, and therefore I cannot reject the null hypothesis that these are not significantly different from zero. Interestingly, the similarity of these results to the results of the single-index models is in line with the findings by Blake et al. (1993) who found that the use of multi-index models had very similar results to those of a single-factor model, although the results of the multi-factor model were said to be more robust and very useful in providing explanations for the behaviour of bond funds returns. At the individual fund level, out of the 51 funds that reported positive alphas under the unconditional mutli-index model, 11 funds displayed statistically significant alphas, 7 at 10% level and 4 at 5% level. Under the conditional multi-index model on the other hand, out of the 43 funds that reported positive alphas, 10 funds displayed statistically significant alphas, 6 at 10% level, 3 at 5% level and 1 at 1% level. When I compare these findings to the results of both the unconditional and conditional single-index models above, it is observed that more funds seem to exibit signs of outperformance under the multi-index models. This might indicate that multi-index models may tend to overestimate fund performance. This is in contrast to the findings by Elton et al. (1993), extending on the work of Ippolito (1989), and Silva et al. (2003) who reinforced the notion that single-index models might overestimate fund performance.

In observing the results for the medium-term horizons (31 July 2008 to 31 December 2012; 01 January 2013 to 31 December 2016), both models continue not to offer statistically significant positive alphas for the two periods for the sample portfolio, even though some level of positive alphas is observed. For the period 31 July 2008 to 31 December 2012, out of the 47 funds with positive alphas under the unconditional multi-index model, 10 funds had statistically significant positive alphas, 6 at 10% level and 4 at 5% level. For the second medium-term

period, none of the 29 individual funds under the unconditional multi-index model presented statistically significant alphas. Observing the results of the conditional multi-index model on the other hand, out of the 43 funds that displayed positive alphas during 31 July 2008 to 31 December 2012, only 4 funds had statistically significant alphas, at 10% level, 1 negative alpha and 3 positive alphas, while none of the 47 "positive alpha" funds during 01 anuary 2013 to 31 December 2016 were actually statistically significant.

For the short-term (1-year) periods, the unconditional multi-index model only exhibits a statistically significant positve alpha, at 5% level, during 01 January 2012 to 31 December 2012. For the rest of the periods, I cannot reject the null hypothesis that the presented alphas are not significantly different from zero. The conditional multi-index model on the other hand only exhibits positive alphas, at 10% level, during 31 July 2008 to 31 December 2009 and during 01 January 2015 to 31 December 2015. For the rest of the periods the alphas are not considered to be significant. Similar to the long- and medium-term horizons, the short-term period results offer similar results to those of the single-index model, that the sample portfolio presents, on average, neutral or negative performance.

In summary, the overall findings present statistically neutral fund performance for the sample portfolio under both unconditional and conditional models, with an exception of statistically significant postive alphas during 01 January 2012 to 31 December 2012 under the conditional model and during 31 July 2008 to 31 December 2009 and 01 January 2015 to 31 December 2015 under the conditional model. This overall neutral performance is observed during short-, medium- and long-term periods. Even though the results table may present some level of positive alphas for the periods under review, it is important to note that the vast majority of these are not statistically significant and I therefore could not reject the null hypothesis that these are not significantly different from zero.

What was interesting to note was that the results are statistically similar to those of the single-index models above, which may give some indication that the two additional variables in my multi-index models do not offer much explonatory power over the single-index model for the sample portifolio. However, at the individual fund level, it is noted that the multi-index models tend to exhibit improved fund performance when compared to the resutls of the single-index models, which is in contract to the majority of the studies that compare single- to multi-index models.

It is also noted that, similar to the single-factor models, on overall, the inclusion of conditional information variables in my models does not seem to significantly change the performance results. One observation that could be a reason for this is that, other than the term spread, all other conditional variables employed are for the most part statistically insignificant.

4.2 Fund performance persistence

As mentioned in chapter 3, I employ the contigency tables and the cross-sectional regressions to assess performance persistence and to determine whether the phenomenon is in any way influenced by the persistence methodology used. The contigency tables are applied at the individual fund level when fund performance is measured using the Sharpe ratio and its modified version, the single-index model and its conditional version, and the multi-index model and its conditional version. The cross-sectional regression of alphas approach is applied to the overall equally-weighted sample portfolio. Performance persistence is assessed over a short-term made up of 8 one-year periods and over a longer-term made up of 2 four-year periods.

4.2.1 Performance persistence over short-term periods

Contigency tables

The contigency tables of peformance persistence results over the short-term horizons are presented in table 7. The contigency tables presented are estimated when using the Sharpe ratio, the modified Sharpe ratio, the CAPM, the conditional CAPM, the multi-index model and the conditional multi-index model as peformance evaluation models. Where I find statistical evidence that winners (or losers) in one period remain winners (losers) in the subsequent period, the null hypothesis that funds do not exhibit performance persistence will be rejected. To test for statistial significance I calculate the Chi-square statistic and its p-value, at 5% significance level, as used by Kahn and Rudd (1995).

There are generally three statistical approaches that are used to test for the level of significant performance independence when using the contigency table to test for performance persistence. These are the repeat winner test by Malkiel (1995), the Cross-Product Ratio (“CPR”) first introduced by Fienberg (1977) and the Chi-square statistic. The repeat winner approach shows the proportion of WW to WL, where a percentage of WW to WW+WL is above 0.5 with a Z-statistic greater than 0 is considered to indicate persistence. The CPR on the other hand is a ratio of WW and LL over the product of WL and LW, where a ratio of 1 would not reject the hypothesis that a performance in one period is independent to that in another and a ratio greater

than 1 would indicate persistence. Finally, the Chi-sqaured tests whether an association exists between winner and loser funds and uses the p-value to assess persistence.

According to Carpenter and Lynch (1999), because the Chi-squared test considers the persistence of the contigency table as a whole, the test is found to be well specified and more robust that the other two tests. As such, I elected to use the Chi-squred test statistic which is estimated as follows:

$$\chi^2 = \frac{(WW - D_1)^2}{D_1} + \frac{(WL - D_2)^2}{D_2} + \frac{(LW - D_3)^2}{D_3} + \frac{(LL - D_4)^2}{D_4} \quad (9)$$

where D_1 = [(WW+WL) * (WW+LW)]/ N;

D_2 = [(WW+WL) * (WL+LL)]/ N;

D_3 = [(LL+LW) * (WW+LW)]/ N;

D_4 = [(LL+LW) * (WL+LL)]/ N; and

N represents the number of funds in my sample.

The Chi-squared value, however, can only be valid uder a asymptotical assumption and thereby needs to be adjusted for possible small sample bias. I therefore use the Yate's continuity correction to modify the Chi-squared value, a recommended correction particularly for when the sample size is small. This correction is particularly necessary for my study as my sample size only consists of 52 bond funds.

Considering the results under the original Sharpe ratio, the lack of statisitcal significance of the Chi-square test statistics for the vast majority of the short-term subperiods suggests little evidence of overall performance persistence. More specifically, I find, on average, that 31 of the 52 funds in my sample represent the WL/LW pool, with only 14 WW and 8 LL funds during the short-term horizons. It is only during the subperiods 01 January 2014 to 31 December 2015 and 01 January 2015 to 31 December 2016 where the Chi-square statistics are significant, at 1% level. The results under the modified Sharpe ratio do not offer any more encouraging results. Similarly, the statistical insignificance of the Chi-square statistic does not indicate the existence of persistence. However, when considering the individual subperiods, the modified Sharpe ratio offers more statistical significance of the Chi-squares when compared to the original Sharpe ratio, with the reported Chi-squared statistics being significant, at 1% level, for the subperiods 01 January 2010 to 31 December 2011, 01 January 2011 to 31 December 2012 and 01 January 2012 to 31 December 2013.

Table 7:

Short-term performance persistence results using Contigency Tables across all six fund performance evaluation models

Below I present the performance persistence results of the sample portfolio using the contigency tables across all six fund performance evaluation models. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW"). The table presents the number of funds, out of the sample of 52 funds, under each of the four (WW, LL, WL and LL) categories. The Chi-square statistics ("χ^2") and their corresponding p-values are also presented. The last two columns under performance evaluation model header present the Chi-sqaure statistics ("χ^2_{Yates}") and the corresponding p-values considering the Yates correction for continuity.

	Original Sharpe Ratio								Modified Sharpe Ratio							
Duration	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**
1-year periods:																
31 Jul 2008 to 31 Dec 2010	23	11	10	8	3.81***	0.0509	2.75***	0.0971	6	13	11	22	3.50***	0.0614	2.48	0.1155
01 Jan 2010 to 31 Dec 2011	8	13	23	8	0.89	0.3461	0.40	0.5248	23	17	5	7	14.86*	0.0001	12.77*	0.0004
01 Jan 2011 to 31 Dec 2012	6	13	10	23	3.13***	0.0770	2.15	0.1427	4	9	26	13	12.08*	0.0005	10.09*	0.0015
01 Jan 2012 to 31 Dec 2013	16	11	13	12	0.05	0.8294	0.00	0.9485	17	24	0	11	21.65*	0.0000	18.98*	0.0000
01 Jan 2013 to 31 Dec 2014	20	4	8	20	1.03	0.3097	0.47	0.4929	5	18	23	6	0.40	0.5295	0.08	0.7732
01 Jan 2014 to 31 Dec 2015	10	1	30	11	17.04*	0.0000	14.38*	0.0001	7	14	4	27	0.02	0.8908	0.05	0.8262
01 Jan 2015 to 31 Dec 2016	12	0	9	31	16.07*	0.0001	13.21*	0.0003	15	14	19	4	2.43	0.1188	1.58	0.2087
Average	**14**	**8**	**15**	**16**					**11**	**16**	**13**	**13**				

	Single-index Model								Cond. Single-index Model							
Duration	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**
1-year periods:																
31 Jul 2008 to 31 Dec 2010	18	0	31	3	4.70**	0.0302	2.44	0.1183	36	13	3	0	39.00*	0.0000	34.79*	0.0000
01 Jan 2010 to 31 Dec 2011	17	27	4	4	24.08*	0.0000	21.34*	0.0000	20	9	16	7	0.62	0.4316	0.24	0.6272
01 Jan 2011 to 31 Dec 2012	8	10	13	21	4.46**	0.0347	3.34***	0.0676	19	15	8	10	4.85**	0.0276	3.70***	0.0544
01 Jan 2012 to 31 Dec 2013	18	17	11	6	6.68*	0.0097	5.31**	0.0212	28	14	1	9	20.61*	0.0000	17.90*	0.0000
01 Jan 2013 to 31 Dec 2014	23	13	1	15	11.73*	0.0006	9.68*	0.0019	31	13	6	2	22.85*	0.0000	19.91*	0.0000
01 Jan 2014 to 31 Dec 2015	17	6	21	8	0.63	0.4271	0.23	0.6303	8	10	25	9	2.93***	0.0869	1.97	0.1600
01 Jan 2015 to 31 Dec 2016	19	5	6	22	0.23	0.6287	0.02	0.8857	6	10	11	25	6.21**	0.0127	4.80**	0.0285
Average	**17**	**11**	**12**	**11**					**21**	**12**	**10**	**9**				

Table 7 (Continued)

Short-term performance persistence results using Contigency Tables across all six fund performance evaluation models

Below I present the performance persistence results of the sample portfolio using the contigency tables across all six fund performance evaluation models. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW"). The table presents the number of funds, out of the sample of 52 funds, under each of the four (WW, LL, WL and LL) categories. The Chi-square statistics ("χ^2") and their corresponding p-values are also presented. The last two columns under performance evaluation model header present the Chi-sqaure statistics ("χ^2_{Yates}") and the corresponding p-values considering the Yates correction for continuity.

	Multi-index Model								Cond. Multi-index Model							
Duration	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**	**WW**	**LL**	**WL**	**LW**	χ^2	**p-value**	χ^2_{Yates}	**p-value**
1-year periods:																
31 Jul 2008 to 31 Dec 2010	2	35	0	15	4.28**	0.0385	1.69	0.1933	6	19	5	22	0.00	0.9582	0.08	0.7732
01 Jan 2010 to 31 Dec 2011	7	17	10	18	0.48	0.4876	0.16	0.6904	17	21	11	3	12.69*	0.0004	10.74*	0.0011
01 Jan 2011 to 31 Dec 2012	4	7	21	20	17.62*	0.0000	15.36*	0.0001	13	18	7	14	2.23	0.1357	1.46	0.2275
01 Jan 2012 to 31 Dec 2013	10	19	14	9	0.51	0.4771	0.18	0.6729	17	7	10	18	0.48	0.4876	0.16	0.6904
01 Jan 2013 to 31 Dec 2014	9	9	10	24	3.34***	0.0675	2.34	0.1261	12	10	23	7	0.23	0.6283	0.03	0.8594
01 Jan 2014 to 31 Dec 2015	21	10	12	9	1.31	0.2529	0.73	0.3942	8	16	11	17	0.43	0.5131	0.13	0.7145
01 Jan 2015 to 31 Dec 2016	14	16	16	6	2.02	0.1555	1.28	0.2578	15	21	10	6	7.69*	0.0055	0.00**	0.0127
Average	**10**	**16**	**12**	**14**					**13**	**16**	**11**	**12**				

* Statistically significant at 1% confidence level
** Statistically significant at 5% confidence level
*** Statistically significant at 10% confidence level

Interestingly, when I compare the number of persistence winner funds to persistence loser funds under both the Sharpe ratio and the modified Sharpe ratio, I observe that WW funds outnumber the LL fund under the Sharpe ratio (14 WW vs 8 LL), whereas when using the modified Sharpe ratio, the LL funds outnumber the WW funds (16 LL vs 11 WW). These results are similar to Grose et al.'s (2014) findings, who documented that the modified Sharpe ratio results are contradictory to those by the Sharpe ratio. This might indicate that 3 of the WW funds under the Sharpe ratio exhibit qualities of the sign reversal phenomenon.

When considering the results under the single-index model, I find evidence of performance persistence as, on average, 28 of the funds fall under the WW/LL pool. The statistical significance of the presented Chi-square statistics confirms the high probability of persistence. It is only during 01 January 2014 to 31 December 2015 and 01 January 2015 to 31 December 2016 where statistical significance is not observed. This evidence of performance persistence becomes slightly stronger when considering the results under the conditional single-index model as only the period from 01 January 2010 to 31 December 2012 does not present a statistical significant Chi-sqare statistic. This is particularly demostrated by the increase of the average number of WW funds from 17 under the single-index model to 21 under the conditional single-index model and the slight increase of the average number of LL funds from 11 to 12 under the single-index model and its conditional version, respectively. These results are in line with Silva et al. (2005), who found that, in context of a single-factor model, when conditional alphas are in use when compared unconditional alphas, the evidence of performance persisitence tends to slightly improve. What is also important to note is that under both the single-index and the conditional single-index models the average number of WW funds outnumbers the LL funds, which may indicate an overall outperformance persistence.

Interestigly, when comparing the findings from the context of the single-index model to those observed under the multi-index model, any evidence of persistence diminishes significantly when multi-index alphas are considered instead of the single-index alphas. As such, an indication of persistence under the multi-index model could not be observed. In contrast, Silva et al. (2005) found the exact opposite, evidence of stronger persistence when multi-index alphas are considered. It is only during 31 July 2008 to 31 December 2010 and 01 January 2011 to 31 December 2012 where a statistical significance of Chi-squares, at 5% level, can be observed. The conditional multi-index model does not offer any encouring results, as no evidence of persistence is observed under this model, as well. None of the Chi-sqare statistics

presented under the conditional multi-index model are statistically significant, other than for the periods 01 January 2010 to 31 December 2011 and 01 January 2015 to 31 December 2016 which exhibit significant Chi-squares at 1% level. What is further interesting to note is that the average number of LL fund under both the multi-index model and its conditional version remains constant at 16.

Cross-sectional regressions

In table 8 I present the cross-sectional regression statistics from regressing the performance alphas of the second subperiod of the evaluation period to the alphas of the first subperiod. By their very nature of regressing one set of alphas to the next, the cross-sectional regression estimates cannot be estimated for when using the Sharpe ratio and its modified version. As such, I estimate the cross-sectional regressions for the single-index model, the conditional signle-index model, the multi-index model and the conditional multi-index model. A statistically significant positive t-statistic for the slope coefficient, at 5% level, indicates evidence of performance persistence and, as such, rejects the null hypothesis that past performace is not an indicator of future performance.

Considering the single-index model results, only four evaluation periods exhibit positive cross-sectional coeffients. However, it is only for the periods from 01 January 2012 to 31 December 2013 and 01 January 2013 to 31 December 2014 where the corresponding t-statistics are statistically significant at 1% level. The rest of the t-statitics are either negative and/or are not statistically significant. However, on observing the adjusted R^2 for each of the evaluation period, none of the cross-regression estimates appear to suggest that the alphas in a first subperiod significantly explain the variations in alphas in the second subperiod. In contrast to the contigency tables results under the single-index model, the findings do not favour evidence of overall performance persistence during the short-term horizon. The conditional alphas results on the other hand are slightly more encouraging. I observe statistically significant positive t-statistics, at 5% level, for the periods 01 January 2011 to 31 December 2012, 01 January 2012 to 31 December 2013 and 01 January 2013 to 31 December 2014. Further, even though outside the significance level range, some level of persistence is also observed during the period 31 July 2008 to 31 December 2010, at 10% level. These findings are similar to those of the contigency tables above under the conditional single-index model.

When considering the results under the multi-index model, the observed persistence patterns decrease drastically. Only the period during 01 January 2012 to 31 December 2013 presented

Table 8:

Short-term performance persistence results using Cross-sectional Regression across unconditional and conditional alphas

Below I present the performance persistence results of the sample portfolio using the cross-sectional regressions for the unconditional and conditional alphas under both the single- and multi-index models. Under the cross-sectional regression approach, fund performance in one period is regressed against the peformance achieved during the previous period and the measure of statistical measure of significance is observed. The constant ("α"), cross-sectional slope coefficient ("β") and the corresponsing t-statistic are presented. Statistically significant positive t-statistics are considered to indicate signs of performance persistene.

	Single-Index Model				Cond. Single-Index Model			
Duration	**α**	**β**	**t-stat**	**Adj. R^2**	**α**	**β**	**t-stat**	**Adj. R^2**
1-year periods:								
31 Jul 2008 to 31 Dec 2010	0.002	-0.007	-0.922	-0.003	0.002	0.033	1.992***	0.055
01 Jan 2010 to 31 Dec 2011	0.001	0.178	1.115	0.005	0.012	0.044	0.501	-0.015
01 Jan 2011 to 31 Dec 2012	0.001	0.058	0.266	-0.019	-0.010	0.851	2.010**	0.056
01 Jan 2012 to 31 Dec 2013	-0.001	0.308	6.678*	0.461	0.004	0.663	11.889*	0.733
01 Jan 2013 to 31 Dec 2014	0.000	2.537	7.688*	0.533	0.002	1.457	6.809*	0.471
01 Jan 2014 to 31 Dec 2015	-0.001	-0.121	-2.480**	0.092	0.016	-0.963	-3.270*	0.160
01 Jan 2015 to 31 Dec 2016	-0.002	-0.194	-0.551	-0.014	0.003	-0.076	-5.454*	0.361

	Multi-Index Model				Cond. Multi-Index Model			
Duration	**α**	**β**	**t-stat**	**Adj. R^2**	**α**	**β**	**t-stat**	**Adj. R^2**
1-year periods:								
31 Jul 2008 to 31 Dec 2010	-0.056	0.041	0.796	-0.007	-0.170	0.227	0.872	-0.005
01 Jan 2010 to 31 Dec 2011	-0.019	-0.113	-4.924*	0.313	-0.149	0.317	4.776*	0.300
01 Jan 2011 to 31 Dec 2012	0.001	-0.266	-14.596*	0.806	0.010	0.015	1.863***	0.046
01 Jan 2012 to 31 Dec 2013	-0.009	2.759	4.215*	0.247	0.007	-12.810	-3.644*	0.194
01 Jan 2013 to 31 Dec 2014	-0.009	0.176	0.516	-0.015	-0.242	-0.133	-1.350	0.016
01 Jan 2014 to 31 Dec 2015	0.014	0.013	0.374	-0.017	-0.013	-0.081	-1.078	0.003
01 Jan 2015 to 31 Dec 2016	0.009	0.033	0.184	-0.019	-0.059	0.591	7.811*	0.541

* Statistically significant at 1% confidence level
** Statistically significant at 5% confidence level
*** Statistically significant at 10% confidence level

a statistically significant positive t-statistic, at 1% level, and none of the adjusted R^2 indicate any level of model fit. Similarly, the conditional multi-index alphas do not offer much more different results. Statistically significant positve t-statistics, at 1% level, are only observed during 01 January 2010 to 31 December 2011 and 01 January 2015 to 31 December 2016. The findings are similar to those of Silva et al. (2005) who also found that although persistence increases under the conditional single-index model, it tends to decrease when conditional multi-index alphas are considered.

In summary, the results concerning whether past performance can predict future performance in the short-term suggest that persistence is greatly sensitive to the performance model used, although a slight impact on the results may also be caused by the methodology used to test for such persistence. Notwithstanding whatever performance model used, with the exception of the single-index model, the findings are consistent for both contigency tables and cross-sectional regressions methodologies.

In comparing the results across all 6 performance models, I conclude that the single-index and conditional single-index models will lead to stronger evidence of bond fund performance persistence in the short-term horizon. On the other hand, in the context of contrasting the original Sharpe ratio to its modified version, the single-index model to its conditional version and the multi-index model to its conditional version, I conclude that the modified Sharpe ratio, as well as the conditional alphas for both single- and multi-index models, will tend to slightly improve the persistence phenominon. This type of conclusion is consistent with that obtained for most studies that contrast performance methodologies (for example Silva et al., 2005; Grose et al., 2014; and Leite et al., 2016), which indicates that incorporating conditioning information variables into performance models improves the inferences made on performance persistence of bond mutual funds.

I further conclude that, when I contrast the results of the single-index models (both unconditional and conditional alphas) to those of the multi-index models, persistence significantly reduced when using the multi-index models. This suggests that the additional indices considered in the multi-index models are actually unrelated to the funds' performances and drive some of the reduction in persistence.

4.2.2 Performance persistence over longer-term periods

Contigency tables

Table 9 presents the performance persistence results over the longer-term horizon using contigency tables to test for the phenomenon. Similar to the short-term results, the contigency tables presented are also estimated across all six of the performance evaluation models. The results suggest strong eivdence of persistence over the longer-term under both the original Sharpe ratio and the modified Sharpe ratio. More specifically, I find that 40 of the 52 funds in my sample represent the WW/LL pool under the original Sharpe ratio and 41 funds presenting the same under the modified Sharpe ratio. The statistically significant Chi-sqaure statistics, at 1% level, confirm the existence of this persistence. However, under the original Sharpe ratio I observe that the persistence is skewed towards WW funds, with 32 of the funds falling under this category while under the modified Sharpe ratio we observe the skeweness to be toward LL funds, with 31 funds being categorised as such. I therefore conclude that the results also suggest a strong evidence of sign reversal phenomenon. When I contrast these findings to those over the short-term period, I conclude that persistence improves over longer-periods when using the Sharpe ratio and the modified version.

When considering the results under the single-index model, even though I observe that 27 of the funds are WW funds, I note that the Chi-square statistic is not statistically signifcant and as such, I cannot reject the null hypothesis that the funds do not exhibit signs of performance persistence in the longer-term. When I compare against the short-term results, these results are in line with Grose et al. (2014), who also found a gradual decline in persistence over longer-term horizons when single-index alphas are considered. However, when considering conditional single-index alphas on the other hand, I observe that the evidence of persistence becomes gradually stronger in the longer-term. The results present 34 WW funds that also exhibit statistically significant Chi-squares, at 1% level. Unlike the contrast between the original Sharpe ratio and the modified version, we further observe that the sign reversal significantly diminishes when I move from unconditional single-index alphas to conditional single-index alphas.

The multi-index results on the other hand are very similar to those over the short-term horizon, in that any evidence of persistence that might have been observed in other performance models disappears when multi-index alphas are considered. The conditional multi-index alphas do not offer any better results, either. None of the presented Chi-square estimates under both the multi-

Table 9:

Longer-term performance persistence results using Contigency Tables across all six fund performance evaluation models

Below I present the performance persistence results of the sample portfolio using the contigency tables across all six fund performance evaluation models. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW"). The table presents the number of funds, out of the sample of 52 funds, under each of the four (WW, LL, WL and LL) categories. The Chi-square statistics ("χ^2") and their corresponding p-values are also presented. The last two columns under performance evaluation model header present the Chi-sqaure statistics ("χ^2_{Yates}") and the corresponding p-values considering the Yates correction for continuity.

	Original Sharpe Ratio								Modified Sharpe Ratio							
Duration	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**
31 Jul 2008 to 31 Dec 2016	32	8	6	6	8.89*	0.0029	6.91*	0.0085	10	31	9	2	14.73*	0.0001	12.23*	0.0005
	Single-index Model								**Cond. Single-index Model**							
Duration	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**
31 Jul 2008 to 31 Dec 2016	27	4	11	10	0.00	0.9788	0.10	0.7501	34	11	4	3	23.08*	0.0000	19.88*	0.0000
	Multi-index Model								**Cond. Multi-index Model**							
Duration	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**	**WW**	**LL**	**WL**	**LW**	**χ^2**	**p-value**	**χ^2_{Yates}**	**p-value**
31 Jul 2008 to 31 Dec 2016	11	15	9	17	0.02	0.8950	0.02	0.8777	18	11	15	8	0.75	0.3876	0.33	0.5646

* Statistically significant at 1% confidence level
** Statistically significant at 5% confidence level
*** Statistically significant at 10% confidence level

index and conditional multi-index models are statistically significant. In fact, the funds appear to be fairly spread out in all four categories (WW, WL, LL and LW)

Cross-sectional regressions

Table 10 presents the performance persistence results over the longer-term horizon using the cross-sectional regression statistics to test for the phenomenon. Similar to the short-term results, the cross-sectional regression statistics are estimated for the single-index model, the conditional single-index model, the multi-index model and the conditional multi-index model. Similar to the short-term results, the findings suggest no evidence of performance persistence over the longer term when single index alphas are considered, as evidenced by a statistically non-significant t-statistic presented under the single-index model. These results are similar to those presented by the contigency tables. However, these results become slightly more encouraging when conditioning information variables are considered. Under the conditional single-index model I observe a statistically significant positive t-statistic, at 5% level, suggesting that conditional single-index alphas lead to stronger evidence of performance persistence.

When considering the results under the multi-index model, I continue to observe evidence of performance persistence. The results present a statistically significant postive t-statistic, at 1% level, over the longer-term. In comparison to the short-term results, the findings suggest that persistence significatly increases over the long term. It is interesting to note that these results are contradictory to the results under the contigency tables. When I consider the conditional multi-index model, I continue to further observe evidence of performance persistence, at 5% significance level. Again, these results continue to favour increased persistence over the longer-term when compared to contigency tables and contract the results by the contigency tables.

In summary, the findings concening whether fund performance persists over the longer-term horizon suggest that persistence is greatly sensitive to both the performance model used and the methodology used to test for such persistence. As such, I find the results to be inconclusive and difficult to interpret on the overall context. However, notwithstanding the differences between the two persistence methodologies, the results lead one to conclude that both the Sharpe ratio and the modified version strongly increase the persistence in performance over the longer-term horizon. I note that this conclusion is in contrast with some of the popular literature on bond funds (for example, Huij & Derwall, 2008; and Grose et al., 2014) that concluded that persistence over longer-term horizons gradually decreases when the Sharpe ratio is considered.

Table 10:
Longer-term performance persistence results using Cross-sectional Regression across unconditional and conditional alphas

Below I present the performance persistence results of the sample portfolio using the cross-sectional regressions for the unconditional and conditional alphas under both the single- and multi-index models. Under the cross-sectional regression approach, fund performance in one period is regressed against the peformance achieved during the following period and the measure of statistical measure of significance is observed. The constant ("α"), cross-sectional slope coefficient ("β") and the corresponsing t-statistic are presented. Statistically significant positive t-statistics are considered to indicate signs of performance persistene.

	Single-Index Model				Cond. Single-Index Model			
Duration	**α**	**β**	**t-stat**	**Adj. R^2**	**α**	**β**	**t-stat**	**Adj. R^2**
31 Jul 2008 to 31 Dec 2016	-0.001	-0.010	-0.292	-0.018	0.002	0.076	2.586**	0.100
	Multi-Index Model				**Cond. Multi-Index Model**			
Duration	**α**	**β**	**t-stat**	**Adj. R^2**	**α**	**β**	**t-stat**	**Adj. R^2**
31 Jul 2008 to 31 Dec 2016	-0.001	0.732	5.231*	0.341	0.013	0.419	2.507**	0.094

* Statistically significant at 1% confidence level
** Statistically significant at 5% confidence level
*** Statistically significant at 10% confidence level

The single-index model results on the other hand seem to be inconclusive. The contigency tables conclude that any evidence of short-term persistence diminishes over the longer-term when single-index alphas are considered while cross-sectional regressions conclude that single-index alphas do not lead to any evidence of persistence over the short- and longer-term horizons. When I add conditioning information variables to the single-index alphas, the contigency tables do not offer any different results and I therefore also conclude that persistence continues to diminish over the longer-term horizon when conditional single-index models are used. In contrast, under the cross-sectional regressions, I conclude that persistence prevails even over the longer-term when conditional single-index models are used.

The conflict between contigency tables and cross-sectional regressions continues to be evident even when multi-index models are considered. The contigency tables conclude that the nonpersistence observed in the short-term continues to prevail even in the longer-term horizon when both unconditional and conditional multi-index models are used as performance measures. The cross-sectional regressions on the other hand conclude that both unconditional and conditional multi-index models will lead to strong evidence of performance persistence in the longer-term. In light of such conflicting views, I therefore conclude that the methodology used to test persistence becomes specifically important when assessing such persistence in the longer-term horizon.

5 RESEARCH CONCLUSIONS

In this paper I examine the performance and performance persistence of 52 South African bond funds over the period from 01 July 2008 to 31 December 2016. To my knowledge, this paper is among the first research papers to focus on South African bond mutual funds. To measure fund performance, I utilize the Sharpe Ratio, the modified Sharpe ratio, the CAPM as presented by Jensen's alpha (single-index model) and the multi-index models to examine whether the performance measure followed will influence the performance results. In addition, I examine the impact of conditioning information variables on bond fund performance by further measuring performance using the conditional single-index and conditional multi-index models. For the conditioning variables I consider a term spread, an inverse relative wealth, and a dummy variable for the month of January as per Silva et al. (2003). To test for persistence, I use two-way contingency tables and the cross-sectional regression analysis over some short-term and longer-term horizons.

Based on my analysis, I find empirical evidence to suggest that bonds funds, in general, are not able to outperform their market benchmarks over the short-term horizons. This evidence is also observed over the medium- and longer-term horizons as I could not reject the null hypothesis that bond funds are not able to outperform the market, representing on average negative or neutral performances (for example, Blake et al., 1993; Detzler, 1999; Silva et al., 2003; Grose et al., 2014; and Leite et al., 2016). These findings are consistent across the Sharpe ratio, the unconditional single-index alphas and the unconditional multi-index alphas. As such, I also conclude that, where conditioning and modifying variables are not considered, performance measures used do not matter when evaluating bond fund performance as a similar conclusion is reached irrespective of a performance model used. It can also be concluded that these results are in support of the established theories of finance such as the EMH, the arithmetic of active management and the equilibrium accounting which assert that risk-adjusted returns from active and passive portfolios are equal before deducting any research and trading expenses, and hence active trading is deemed wasteful (Ippolito, 1993). According to Fama and French (2008), it then follows that if some active investors have positive alphas after cost, it must be, dollar for dollar, at the expense of other active investors, and thereby active management is in aggregate a zero sum game with zero aggregated alphas before costs.

What is interesting to note from the results is that, on observing the performance under the single- and the multi-index models, I conclude that the JSE ALSI and the default spread

considered in the multi-index model, in addition to the JSE ALBI used in the single-index model, do not offer much explanatory power over the single-index model, as these do not appear to be statistically significant, at 5% level. In contrast, this conclusion is different from the conclusions reached by Blake et al. (1993) and Silva et al. (2003, 2005) that the explanatory powers of multi-index models are more robust, very useful and superior to those of the single-index models. However, the similarity of the multi-index results to those of the single-index models is in line with the findings by Blake et al. (1993) who found that the use of multi-index models had very similar results to those of a single-factor model, although the authors still found the multi-index results to be more robust and very useful in providing explanations for the behaviour of bond funds returns.

In comparing these models to their modified and conditional version, similar to Agudo and Marzal (2004), I conclude that the modified Sharpe ratio has a tendency to improve fund performance when compared to the original Sharpe ratio. It should be noted that the modified Sharpe ratio version used in this paper treats the risk premium (numerator) as a relative measure while the studies (for example, Eling, 2008; and Eling & Faust, 2010) that concluded that the modified Sharpe ratio will yield similar results to the original version rather modify the risk measure (denominator) of the ratio. The results of the conditional models (both single- and multi-index) on the other hand suggest that incorporating conditional information variables does not offer much significant improvements on the results as, on average, the sample continued to exhibit neutral or negative performance. One observation that could be a reason for this is that, other than the term spread, all other conditional variables employed are, for the most part, statistically insignificant. However, despite the observed underperformance, I note the improvement on alphas when these conditioning variables are considered, which suggests that the distribution of alphas shifts slightly towards the region of outperformance when conditional models are used. This is in favour of Silva et al.'s (2003) argument that incorporating conditional measures in models allows for better performance evaluation.

At the centre of fund performance evaluation is whether funds that exhibited outperformance in the past are able to continue to do so in the future. The outcome of the performance persistence testing is divided into short-term and longer-term periods. In the short-term period, I find evidence to suggest that persistence is not sensitive to the persistence methodology used to test the phenomenon. As such, the results were consistent for both the contingency tables and the cross-sectional regression methodologies, irrespective of the performance measure used. However, I observe that persistence is rather sensitive to the performance model used.

In observing the persistence results under each performance measure, I conclude that only the single-index and the conditional single-index models will lead to strong evidence of persistence in bond fund performance in the short-term horizon. This, by itself, may create skepticism that single-index alphas (conditional and unconditional) may tend to overestimate persistence, especially when the performance measurement results were constistent across all performance models used. However, even though no evidence of actual persistence was observed when using all the other performance models, I find evidence to suggest that the modified Sharpe ratio and the conditional alphas under both the single- and multi-index models will tend to slightly improve the persistence phenominon. This finding is in line with the recent studies on conditional models (for example Silva et al., 2005; Grose et al., 2014; and Leite et al., 2016) which indicates that incorporating conditioning information variables into performance models improves the inferences made on performance persistence of bond mutual funds.

When I contrast the results of the single-index models to those of the multi-index models, the results conclude that persistence significantly reduced when using the multi-index models in the short-term horizon. This suggests that the additional indices considered in the multi-index models are actually unrelated to the funds' performances and drive some of the reduction in persistence.

In considering the results over the longer-term horizon, I find evidence to conclude that persistence is greatly sensitive to both the performance model used as well as the methodology used to test such persistence. However, notwithstanding the methodology used to test persistence, the results lead us to conclude that both the Sharpe ratio and the modified version strongly increase the persistence in performance over the longer-term horizon. I note that this conclusion is in contrast with some of the popular literature on bond funds (for example, Huij & Derwall, 2008; and Grose et al., 2014) that concluded that persistence over longer-term horizons gradually decreases when the Sharpe ratio is considered.

The single-index model results on the other hand seem to be inconclusive. The contingency tables conclude that any evidence of the observed short-term persistence diminishes over the longer-term when single-index alphas are considered while cross-sectional regressions conclude that single-index alphas do not lead to any evidence of persistence over both the short- and longer-term horizons. The conflict between contingency tables and cross-sectional regressions continues to be evident even when multi-index models are considered. The contingency tables conclude that the non-persistence observed in the short-term continues to

prevail even in the longer-term horizon while the cross-sectional regressions on the other hand conclude that the multi-index model will lead to strong evidence of performance persistence in the longer-term. In light of such conflicting views, I therefore conclude that the methodology used to test persistence becomes specifically important when assessing such persistence in the longer-term horizon.

When I add conditioning information variables to the single-index alphas, both the contigency tables and the cross-sectional regressions do not offer any different results from the unconditional alphas as discussed above, with no evidence of persistence in the longer-term when contigency tables are used while persistence is evident when cross-sectional regressions are used. Similarly, the conditional multi-index alphas also offer similar results to the unconditional multi-index alphas. The contigency tables conclude no evidence of persistence in the longer-term when conditional multi-index models are considered, while the cross-sectional regressions conclude conditional multi-index models will lead to strong evidence of performance persistence in the longer-term.

Overall, the results are consistent with the notion that bond markets are efficient and thereby in support of a passive management investment strategy. The results of this paper may not have concluded on strong evidence of fund outperformance or persistence, nonetheless they urge for a need for bond mutual funds to pay special attention to the costs associated with their trading activities, in order to maximise the fund performance returns for their investors for the level of risk they take. As such, this issue would be a natural extension to this paper and might actually provide some interesting insight to a lot of investment questions that remain unanswered.

6 RECOMMENDATIONS FOR FUTURE RESEARCH

The results and conclusions reached in this paper are subject to a number of assumptions and limitations. As such, these lead to avenues for future research. One of these limitations include the composition of the evaluation period which was guided by the availability of monthly returns data for my sample criteria, which limited the number of statistical observations. To accommodate for the lack of data for a longer period, while it is not typical in literature, evauluating fund performance using weekly returns could be an area for future research to thereby increase the number of observations and enhance the credibility and robustness of the regression analysis.

When testing for outperformance and for performance persistence, this study measures the equally-weighted mean return of my sample against that of its benchmark. Therefore the overall performance of my sample as a whole is inferred on the basis of mean returns, mean Sharpe ratios and mean alpha values. Although there is no overall consensus in finance literature on how the sample returns should be weighted, this too could be an area for future research. Further, because the statistical significance of returns is tested at the individual fund level, the statisical significance of the mean returns at the overall portfolio level is assumed and therefore not tested by this study.

The composition of the performance models used has also been another area open to criticism, especially around the choice of an appropriate benchmark index used in the performance models. As noted before, the selection of a benchmark is not as straight forward, as the benchmark index must reflect the objectives of a fund's strategy as well as its risk appetite. As such, an updated study on benchmark appropriateness and alternative becnhmarks in a South African context may be required. Further, when incorporating conditioning variables in the models, a set of information variables was assumed as having predictive ability without any previous analysis of their impact on bond fund performance. As such, the appropriateness of the selected conditioning information variables should be tested to validate the robustness of my conditional models.

Lastly, I have noted a number of modifications to the original Sharpe ratio (for example, Eling, 2008; and Eling & Faust, 2010) as alternative performance measurement methods. As such, further research to assess the most appropriate modification to the Sharpe ratio, and the impact on performance results of modifying either the premium on returns and/or the risk measure may prove to be useful.

REFERENCES

Agudo, L. F., & Marzal, J. L. S. (2004). An analysis of Spanish investment fund performance: Some considerations concerning Sharpe's ratio. *Omega*, *32*(4), 273–284. https://doi.org/10.1016/j.omega.2003.11.006

Alexander Forbes. (2016). *Manager Watch Survey of retirement fund investment managers*.

Anderson, S. C., & Schnusenberg, O. (2005). A review of studies in mutual fund performance, timing, and persistence. *Working Paper, SSRN*.

Ayadi, M. A., & Kryzanowski, L. (2011). Fixed-income fund performance: Role of luck and ability in tail membership. *Journal of Empirical Finance*, *18*(3), 379–392. https://doi.org/10.1016/j.jempfin.2011.02.002

Berk, J. B., & Green, R. C. (2004). Mutual fund flows and performance in rational markets. *Journal of Political Economy*, *112*(6), 1269–1295. https://doi.org/10.1086/424739

Bertolis, D. E., & Hayes, M. (2014). An investigation into South African general equity unit trust perfomance during different economic periods. *South African Actuarial Journal*, *14*(0), 73–100.

Blake, C. R., Elton, E. J., & Gruber, M. J. (1993). The performance of bond mutual funds. *The Journal of Business*, *66*(3), 371–403.

Brown, S. J., Goetzmann, W., Ibbotson, R. G., & Ross, S. A. (1992). Survivorship bias in performance studies. *The Review of Financial Studies*, *5*(4), 553–580.

Busse, J. A., & Irvine, P. J. (2006). Bayesian alpha and mutual fund persistence. *The Journal of Finance*, *61*(5), 2251–2288.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, *52*(1), 57–82. https://doi.org/10.2307/2329556

Carpenter, J. N., & Lynch, A. W. (1999). Survivorship bias and attrition effects in measures of performance persistence. *Journal of Financial Economics*, *54*(3), 337–374. https://doi.org/10.1016/S0304-405X(99)00040-9

Chen, Y., Ferson, W., & Peters, H. (2010). Measuring the timing ability and performance of bond mutual funds. *Journal of Financial Economics*, *98*(1), 72–89. https://doi.org/10.1016/j.jfineco.2010.05.009

Christopherson, J. A., Ferson, W. E., & Glassman, D. A. (1998). Conditioning manager

alphas on economic information: Another look at the persistence of performance. *The Review of Financial Studies*, *11*(1), 111–142.

Collinet, L., & Firer, C. (2003). Characterising persistence of performance amongst South African general equity unit trusts. *Omega*, *31*(6), 523–538. https://doi.org/10.1016/j.omega.2003.08.008

Cornell, B., & Green, K. (1991). The investment performance of low-grade bond funds. *The Journal of Finance*, *46*(1), 29–48.

Cowles, A. (1933). Can stock market forecasters forecast ? *Econometrica*, *1*(3), 309–324.

De Bondt, W. F. M. (1998). A portrait of the individual investor. *European Economic Review*, *42*(3–5), 831–844. https://doi.org/10.1016/S0014-2921(98)00009-9

Detzler, M. L. (1999). The performance of global bond mutual funds. *Journal of Banking & Finance*, *23*(8), 1195–1217. https://doi.org/10.1016/S0378-4266(99)00005-9

Droms, W. G., & Walker, D. A. (2006). Performance persistence of fixed income mutual funds. *Journal of Economics and Finance*, *30*(3), 347–355. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-77951884607&partnerID=40&md5=e16c59e3384effb8176464f4243302ef

Du, D., Huang, Z., & Blanchfield, P. J. (2009). Do fixed income mutual fund managers have managerial skills? *The Quarterly Review of Economics and Finance*, *49*(2), 378–397. https://doi.org/10.1016/j.qref.2008.02.005

Eling, M. (2008). Does the measure matter in the mutual fund industry? *Financial Analyst Journal*, *64*(3), 54–66. https://doi.org/10.2469/faj.v64.n3.6

Eling, M., & Faust, R. (2010). The performance of hedge funds and mutual funds in emerging markets. *Journal of Banking and Finance*, *34*(8), 1993–2009. https://doi.org/10.1016/j.jbankfin.2010.01.008

Elton, E. J., & Gruber, M. J. (1997). Modern portfolio theory, 1950 to date. *Journal of Banking & Finance*, *21*(11–12), 1743–1759. https://doi.org/10.1016/S0378-4266(97)00048-4

Elton, E. J., Gruber, M. J., & Blake, C. R. (1995). Fundamental economic variables, expected returns, and bond fund performance. *The Journal of Finance*, *50*(4), 1229–1256.

Elton, E. J., Gruber, M. J., & Blake, C. R. (1996). Survivorship bias and mutual fund performance. *The Review of Financial Studies*, *9*(4), 1097–1120.

https://doi.org/10.1093/rfs/9.4.1097

Elton, E. J., Gruber, M. J., Das, S., & Hlavka, M. (1993). Efficiency with costly information : A reinterpretation of evidence from managed portfolios. *The Review of Financial Studies*, *6*(1), 1–22.

Elton, E. J., Gruber, M. J., & Nabar, P. G. (1988). *Bond returns, immunization, and the return-generating process*. *Studies in Banking and Finance, Essays in Memory of Irvin Friend*. New York: North Holland.

Fama, E. F., & French, K. R. (1989). Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics*, *25*(1), 23–49. https://doi.org/10.1016/0304-405X(89)90095-0

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (2008). Mutual fund performance. *The Journal of Finance*, (August), 1–36.

Farnsworth, H. (2015). Conditional Performance Evaluation. In *Wiley Encyclopedia of Management* (pp. 1–2). Chichester, UK: John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118785317.weom040021

Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis : The problem revisited. *The Review of Economics and Statisticscs*, *49*(1), 92–107.

Ferson, W. E., Henry, T. R., & Kisgen, D. J. (2006). Evaluating government bond fund performance with stochastic discount factors. *The Review of Financial Studies*, *19*(2), 423–455. https://doi.org/10.1093/rfs/hhj015

Ferson, W. E., & Schadt, R. W. (1996). Measuring fund strategy and performance in changing economic conditions. *The Journal of Finance*, *51*(2), 425–461.

Fienberg, S. E. (1977). *The analysis of cross-classified categorical data* (First Edit). Cambridge, Massachusetts: MIT Press.

Firer, C., Beale, J. P., Edwards, M. D., Hendrie, J. N., & Schepppening, D. C. (2001). The persistence of performance of South African unit trusts. *South African Journal of Business Management*, *32*(2), 1–8.

Fortune Magazine. (1993). *America's most admired corporations*. *FORTUNE Magazine*.

Friend, I., Brown, F. E., Herman, E. S., & Vickers, D. (1962). *A study of mutual funds* (US Securit). Pennsylvania, United States: Wharton School of Finance and Commerce, University of Pennsylvania.

Gallo, J. G., Lockwood, L. J., & Swanson, P. E. (1997). The performance of international bond funds. *International Review of Economics and Finance*, *6*(1), 17–35. https://doi.org/10.1016/S1059-0560(97)90011-3

Gilbertson, B. P., & Vermaak, M. N. (1982). The performance of South African mutual funds: 1974–1981. *Investment Analysts Journal*, *11*(20), 35–45. https://doi.org/10.1080/10293523.1982.11082204

Glode, V. (2011). Why mutual funds "underperform." *Journal of Financial Economics*, *99*(3), 546–559. https://doi.org/10.1016/j.jfineco.2010.10.008

Grinblatt, M., & Titman, S. (1989). Portfolio performance evaluation: Old issues and new insights. *The Review of Financial Studies*, *2*(3), 393–421.

Grose, C., Dasilas, A., & Alexakis, C. (2014). Performance persistence in fixed interest funds: With an eye on the post-debt crisis period. *Journal of International Financial Markets, Institutions & Money*, *33*, 155–182. https://doi.org/10.1016/j.intfin.2014.07.010

Grossman, S. J., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. *The American Economic Review*, *70*(3), 393–408.

Gruber, M. J. (1996). Another Puzzle: The Growth in Actively Managed Mutual Funds. *The Journal of Finance*, *51*(3), 783–810. https://doi.org/10.1111/j.1540-6261.1996.tb02707.x

Gultekin, N. B., & Rogalski, R. J. (1985). Government bond returns, measurement of interest rate risk, and the arbitrage pricing theory. *The Journal of Finance*, *40*(1), 43–61.

Huij, J., & Derwall, J. (2008). "Hot Hands" in bond funds. *Journal of Banking & Finance*, *32*(4), 559–572. https://doi.org/10.1016/j.jbankfin.2007.04.023

Ilmanen, A. (1995). Time-varying expected returns in international bond markets. *The Journal of Finance*, *50*(2), 481–506.

Ippolito, R. A. (1989). Efficiency with costly information: A study of mutual fund performance, 1965-1984. *The Quarterly Journal of Economics*, *104*(1), 1–23.

Ippolito, R. A. (1992). Consumer Reaction to Measures of Poor Quality: Evidence from the Mutual Fund Industry. *The Journal of Law and Economics*, *35*(1), 45–70. https://doi.org/10.1086/467244

Ippolito, R. A. (1993). On studies of mutual fund performance, 1962–1991. *Financial Analysts Journal*, *49*(1), 42–50. https://doi.org/10.2469/faj.v49.n1.42

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

Kahn, R. N., & Rudd, A. (1995). Does Historical Performance Predict Future Performance? *Financial Analysts Journal*, *51*(6), 43–52. https://doi.org/10.2469/faj.v51.n6.1948

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, *47*(3), 263–291. https://doi.org/10.1111/j.1536-7150.2011.00774.x

Keim, D. B., & Stambaugh, R. F. (1986). Predicting returns in the stock and bond markets. *Journal of Financial Economics*, *17*(2), 357–390. https://doi.org/10.1016/0304-405X(86)90070-X

Kennedy, P. (2008). *A guide to econometrics* (6th ed.). Oxford, UK: Blackwell Publishing.

Knez, P. J., Litterman, R., & Scheinkman, J. (1994). Explorations into factors explaining money market returns. *The Journal of Finance*, *49*(5), 1861–1882.

Knight, E. T., & Firer, C. (1989). The Performance of South African Unit Trusts 1977-1986. *South African Journal of Economics*, *57*(1), 37–47. https://doi.org/10.1111/j.1813-6982.1989.tb00177.x

Kosowski, R. (2011). Do mutual funds perform when it matters most to investors? US mutual fund performance and risk in recessions and expansions. *Quarterly Journal of Finance*, *01*(03), 607–664. https://doi.org/10.1142/S2010139211000146

Krimm, S., Scholz, H., & Wilkens, M. (2012). The Sharpe ratio's market climate bias: Theoretical and empirical evidence from US equity mutual funds. *Journal of Asset Management*, *13*(4), 227–242. https://doi.org/10.1057/jam.2012.11

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

Lehmann, B. N., & Modest, D. M. (1987). Mutual fund performance evaluation: A comparison of benchmarks and benchmark comparisons. *The Journal of Finance*, *42*(2), 233–265.

Leite, P., Faria, O., & Armada, M. R. (2016). The impact of the Eurozone sovereign debt crisis on bond fund performance persistence: Evidence from small market. *Investment*

Analysts Journal, *0*(0), 1–14.

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *The Journal of Finance*, *XX*(4), 587–615.

Litterman, R., & Scheinkman, J. (1991). Common factors affecting bond returns. *The Journal of Fixed Income*, *1*(1), 54–61.

Malefo, B. K., Hsieh, H. H., & Hodnett, K. (2016). Performance evaluation of actively managed mutual funds. *Investment Management and Financial Innovations*, *13*(4), 188–195. https://doi.org/10.21511/imfi.13(4-1).2016.04

Malkiel, B. G. (1995). Ruturns from investing in equity mutual funds 1971 to 1991. *Journal of Finance*, *50*(2), 549–572.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *The Journal of Economic Perspectives*, *17*(1), 59–82.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, *7*(1), 77–91.

Meyer-Pretorius, M. C., & Wolmarans, H. P. (2006). The unit trust industry in South Africa from 1965 to June 2005: are investors better off? *Meditari Accountancy Research*, *14*(1), 49–67. https://doi.org/10.1108/10222529200600004

Meyer, M. C. (1998). The persistence of unit trust performance for the period July 1985-June 1995. *South African Journal of Business Management*, *29*(3), 100–108.

Moneta, F. (2015). Measuring bond mutual fund performance with portfolio characteristics. *Journal of Empirical Finance*, *33*, 223–242. https://doi.org/10.1016/j.jempfin.2015.03.012

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity*, *41*(5), 673–690. https://doi.org/10.1007/s11135-006-9018-6

Oldert, N. (2005). *Profile's unit trusts and collective investments*. Johannesburg: Profile Media.

Oldham, G., & Kroeger, J.-A. (2005). Performance, persistence and benchmarks of selected South African unit trusts for the period 1998-2002. *South African Journal of Business Management*, *36*(4), 81–90.

Ornelas, J. R. H., Júnior, A. F. S., & Fernandes, J. L. B. (2012). Yes, the choice of performance measure does matter for ranking of us mutual funds. *International Journal*

of Finance & Economics, *17*(1), 61–72. https://doi.org/10.1002/ijfe.437

Pedersen, L. H. (2016). Sharpening the arithmetic of active management. *Financial Analysts Journal*, (November), 1–23. https://doi.org/10.2139/ssrn.2849071

Philpot, J., Hearth, D., & Rimbey, J. N. (2000). Performance persistence and management skill in nonconventional bond mutual funds. *Financial Services Review*, *9*(3), 247–258. https://doi.org/10.1016/S1057-0810(00)00066-4

Philpot, J., Hearth, D., Rimbey, J. N., & Schulman, C. T. (1998). Active management, fund size, and bond mutual fund returns. *The Financial Review*, *33*(2), 115–125. https://doi.org/10.1111/j.1540-6288.1998.tb01372.x

Ricciardi, V., & Simon, H. K. (2000). What is Behavioral Finance ? *Business, Education and Technology Journal*, *II*(1), 1–9. https://doi.org/10.2139/ssrn.256754

Schwartz, H. H. (1998). *Rationality gone Awry? Decision making inconsistent with economic and financial theory*. Westport, Connecticut: Greenwoood Publishing Group, Inc.

Selden, G. C. (1912). *Psychology of the stock market* (First Prin). New York City, New York: Ticker Publishing Company.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *XIX*(3), 425–442.

Sharpe, W. F. (1966). Mutual fund performance. *The Journal of Business*, *39*(1), 119–138. https://doi.org/stable/2351741

Sharpe, W. F. (1991). The arithmetic of active management. *Financial Analysts Journal*, *47*(1), 7–9.

Sharpe, W. F. (2007). Expected utility asset allocation. *Financial Analysts Journal*, *63*(5), 18–30. https://doi.org/10.2469/faj.v63.n5.4837

Shiller, R. J. (2000). *Irrational exuberance*. Princeton, United States: Princeton University Press. https://doi.org/10.2469/cp.v23.n3.4255

Silva, F., Cortez, M. C., & Armada, M. R. (2003). Conditioning information and European bond fund performance. *European Financial Management*, *9*(2), 201–230. https://doi.org/10.1111/1468-036X.00216

Silva, F., Cortez, M. C., & Armada, M. R. (2005). The Persistence of European bond fund performance : Does conditioning information matter ? *International Journal of Business*,

10(4), 341–362.

Statman, M. (1995, December). Behavioral finance versus standard finance. *AIMR Conference Proceedings*. https://doi.org/10.2469/cp.v1995.n7.4

Thobejane, B. M., Simo-Kengne, B. D., & Mwamba, J. W. M. (2017). Performance evaluation of equity unit trusts in South Africa. *Managerial Finance*, *43*(3), 379–402. https://doi.org/10.1108/MF-01-2016-0015

Treynor, J. L. (1962). *Toward a theory of market value of risky assets* (Unpublished manuscripts) (Vol. 1). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=628187

Treynor, J. L. (1965). How to rate management of investment funds. *Harvard Business Review*, *43*(1), 63–75. https://doi.org/10.1002/9781119196679.ch10

Treynor, J. L., & Mazuy, K. K. (1966). Can mutual funds outguess the market? *Harvard Business Review*, *44*(4), 131–136. https://doi.org/10.2469/faj.v56.n3.2356

von Wielligh, J. F. C., & Smit, E. vd M. (2000). Persistence in the performance of South African unit trusts. *South African Journal of Business Management*, *31*(3), 120–129.

Zakamouline, V. (2010). *The choice of performance measure does influence the evaluation of hedge funds. Working Paper, SSRN*. https://doi.org/http://dx.doi.org/10.2139/ssrn.1403246

APPENDICES

Appendix A – Mutual fund data summary

Table 1:
Summary statistics and mutual fund sample profile

Below we present the sample of bond mutual funds evaluated in my study. The summary statistics are calculated on monthly returns over the period from 01 July 2008 to 31 December 2016. The sample is determined at composite fund level rather than at aggregate portfolio level. The fund size represents the net asset value of average assets under management as at 31 December 2016. The samples cosists of bond mutual funds that invest in local government and corporate bonds, fixed income instruments, and excludes funds which invest in money markets.

Fund name	Fund size (R'000)	Mean return	Median return	STD Dev.
Absa Bond Class A	1,248,698	0.078%	0.035%	2.066%
Absa Bond Class B	1,248,698	0.078%	0.037%	2.038%
Af Investments Pure Fixed Interest Unit Trust	2,352,114	-0.127%	0.108%	2.426%
Allan Gray Bond Fund	545,278	0.105%	0.087%	1.673%
Citadel Sa Bond H4 Fund B1	1,359,501	0.033%	0.292%	1.963%
Coronation Bond Fund B	1,270,195	0.139%	0.013%	2.218%
Coronation Bond Fund R	1,270,195	0.211%	0.122%	2.424%
Counterpoint Met Enhanced Income Fund (A)	327,148	0.010%	0.063%	0.648%
Investec Corporate Bond Fund Class Z	10,937,406	0.054%	0.085%	2.129%
Investec Gilt Fund Class A	3,576,250	0.113%	0.034%	2.172%
Investec Gilt Fund Class B	3,576,250	0.112%	0.034%	2.173%
Investec Gilt Fund Class C	3,576,250	0.047%	-0.033%	2.065%
Investec Gilt Fund Class R	3,576,250	0.113%	0.030%	2.178%
Investec High Income Fund Class A	6,921,116	-0.011%	0.047%	0.747%
Investec High Income Fund Class B	6,921,116	-0.006%	0.052%	0.755%
Investec High Income Fund Class C	6,921,116	-0.006%	0.050%	0.684%
Momentum Bond Fund (A)	1,277,105	0.092%	-0.050%	2.236%
Momentum Bond Fund (B1)	1,277,105	0.035%	-0.086%	2.148%
Momentum Bond Fund (B2)	1,277,105	0.036%	-0.039%	2.178%
Momentum Bond Fund (B3)	1,277,105	0.036%	-0.065%	2.171%
Momentum Bond Fund (B4)	1,277,105	0.039%	-0.008%	2.204%
Momentum Bond Fund (B7)	1,277,105	0.093%	-0.050%	2.235%
Momentum Bond Fund Class C1	1,277,105	0.038%	-0.056%	2.187%
Momentum CPI Linked Bond Portfolio (A)	442,582	0.217%	0.486%	1.541%
Momentum Mom Active Bond Fund	627,828	0.182%	0.151%	2.233%
Momentum Mom Managed Bond Fund	189,014	0.103%	0.105%	2.050%
Nedgroup Investments Core Bond Fund A	730,147	0.082%	0.073%	1.880%
Nedgroup Investments Core Bond Fund B	730,147	0.038%	-0.013%	1.792%
Nedgroup Investments Core Bond Fund R	730,147	0.082%	0.073%	1.880%
Oasis Bond Fund	409,709	0.084%	0.257%	1.614%
Old Mutual Bond Fund B	589,045	0.084%	0.187%	2.429%
Old Mutual Bond Fund C	589,045	0.077%	0.067%	2.299%
Old Mutual Bond Fund R	589,045	0.121%	0.189%	2.426%
Prescient Bond Quantplus Fund - A1	177,845	0.021%	0.135%	2.233%
Prudential High Yield Bond Fund	504,219	0.096%	0.000%	2.239%
Sanlam Select Bond Plus Fund B2	854,660	0.028%	-0.028%	2.109%
Sanlam Select Bond Plus Fund B6	854,660	0.028%	-0.007%	2.122%
Sanlam Select Bond Plus Fund B8	854,660	0.025%	-0.011%	2.097%
Sim Bond Plus Fund	1,815,758	0.132%	0.199%	2.502%
Sim Bond Plus Fund B2	1,815,758	0.102%	0.190%	2.554%
Sim Bond Plus Fund B3	1,815,758	0.104%	0.216%	9.663%

Table 1 (Continued):
Summary statistics and mutual fund sample profile

Fund name	Fund size (R'000)	Mean return	Median return	STD Dev.
Smm Bond Fund B2	3,143,861	-2.917%	0.220%	30.918%
Stanlib Bond Fund - Class B4	3,580,452	0.108%	0.066%	2.223%
Stanlib Bond Fund A Class	3,580,452	0.163%	0.133%	2.294%
Stanlib Bond Fund Class B3	3,580,452	0.111%	0.069%	2.266%
Stanlib Bond Fund R Class	3,580,452	0.163%	0.133%	2.294%
Stanlib Income Fund - B1	21,648,373	0.029%	0.557%	1.068%
Stanlib Income Fund - B4	21,648,373	0.026%	0.409%	0.878%
Stanlib Income Fund - Class B2	21,648,373	0.028%	0.512%	1.008%
Stanlib Income Fund Class B5	21,648,373	0.029%	0.548%	1.056%
Stanlib Prudential Bond Fund - Class A	2,298,736	0.071%	0.470%	2.143%
Stanlib Prudential Bond Fund - Class B1	2,298,736	0.065%	0.533%	2.236%

Appendix B – Fund performance results

Table B1:
Sharpe ratio performance results

Below I present the performance results as measured by the Sharpe ratio of each the evaluation periods. The reward-to-variability ratio is calculated for each bond fund in my sample as well as for the market, using the JSE ALBI as a proxy for market benchmark index. The Sharpe ratio for the JSE ALBI is presented in black. A value presented in red indicates a ratio below the market ratio (underpoerformance) while that presented in green indicates a ratio above the market ratio (outperformance).

Evaluation periods	Jul '08 to Dec '16	Jul '08 to Dec '12	Jan '13 to Dec '16	Jul '08 to Dec '09	Jan '10 to Dec '10	Jan '11 to Dec '11	Jan '12 to Dec '12	Jan '13 to Dec '13	Jan '14 to Dec '14	Jan '15 to Dec '15	Jan '16 to Dec '16
JSE All Bond Index	0.1136	0.5161	-0.2891	0.6671	0.9091	0.1217	0.3083	-0.3405	-0.2766	-0.3674	-0.1410
Portfolio mean ratio	0.1169	0.4807	-0.3016	0.5796	0.8534	0.1845	0.3342	-0.3117	-0.3051	-0.3733	-0.2122
Fund name											
Absa Bond Class A	0.1227	0.4929	-0.2855	0.5984	0.8379	0.1562	0.3245	-0.3405	-0.2676	-0.3719	-0.1097
Absa Bond Class B	0.1230	0.4970	-0.2848	0.6048	0.8539	0.1640	0.3220	-0.3673	-0.2696	-0.3670	-0.1112
Af Investments Pure Fixed Interest A	0.1262	0.4801	-0.2836	0.5687	0.8995	0.2388	0.2769	-0.3491	-0.3063	-0.3600	-0.1145
Allan Gray Bond Fund	0.1321	0.5051	-0.2987	0.5912	0.9211	0.2326	0.3258	-0.3305	-0.2842	-0.3872	-0.1766
Citadel Sa Bond H4 Fund B1	0.1112	0.4784	-0.2947	0.6031	0.7351	0.0938	0.3646	-0.3106	-0.3801	-0.3617	-0.0880
Coronation Bond Fund B	0.1337	0.4782	-0.2572	0.5659	0.8569	0.2002	0.3072	-0.2924	-0.2829	-0.3416	-0.0707
Coronation Bond Fund R	0.1477	0.4888	-0.2550	0.6086	0.8272	0.1868	0.3001	-0.2909	-0.2838	-0.3401	-0.0674
Counterpoint Met Enhanced Income	0.1222	0.4268	-0.3865	0.5283	0.7844	0.1535	0.2297	-0.2998	-0.4831	-0.3163	-0.6498
Investec Corporate Bond Fund Z	0.1134	0.5086	-0.3109	0.6013	0.9033	0.1644	0.3448	-0.3619	-0.3418	-0.3846	-0.1324
Investec Gilt Fund Class A	0.1284	0.5217	-0.2941	0.6498	0.8885	0.1191	0.3489	-0.3548	-0.2749	-0.3862	-0.1458
Investec Gilt Fund Class B	0.1281	0.5212	-0.2942	0.6485	0.8885	0.1191	0.3490	-0.3549	-0.2749	-0.3864	-0.1462
Investec Gilt Fund Class C	0.1130	0.5019	-0.2936	0.5992	0.8994	0.1218	0.3463	-0.3525	-0.2770	-0.3822	-0.1468
Investec Gilt Fund Class R	0.1283	0.5208	-0.2943	0.6483	0.8841	0.1185	0.3497	-0.3556	-0.2744	-0.3874	-0.1456
Investec High Income Fund Class A	0.1176	0.4283	-0.4098	0.5149	0.8098	0.2675	0.2023	-0.2648	-0.5324	-0.3079	-0.7810
Investec High Income Fund Class B	0.1189	0.4343	-0.4097	0.5372	0.8084	0.2673	0.2013	-0.2641	-0.5322	-0.3077	-0.7813
Investec High Income Fund Class C	0.1194	0.4374	-0.4098	0.5391	0.8250	0.3077	0.2036	-0.2659	-0.5325	-0.3074	-0.7820
Momentum Bond Fund (A)	0.1208	0.5132	-0.2948	0.6126	0.8757	0.1664	0.3606	-0.3377	-0.2753	-0.3825	-0.1559

Momentum Bond Fund (B1)	0.1074	0.4974	-0.2934	0.5713	0.8957	0.1717	0.3568	-0.3323	-0.2784	-0.3763	-0.1565
Momentum Bond Fund (B2)	0.1073	0.4936	-0.2948	0.5661	0.8780	0.1671	0.3594	-0.3380	-0.2765	-0.3802	-0.1565
Momentum Bond Fund (B3)	0.1076	0.4945	-0.2946	0.5670	0.8810	0.1682	0.3596	-0.3365	-0.2762	-0.3809	-0.1563
Momentum Bond Fund (B4)	0.1080	0.4907	-0.2951	0.5618	0.8636	0.1630	0.3627	-0.3399	-0.2735	-0.3858	-0.1537
Momentum Bond Fund (B7)	0.1209	0.5138	-0.2949	0.6141	0.8758	0.1667	0.3605	-0.3377	-0.2754	-0.3825	-0.1562
Momentum Bond Fund Class C1	0.1078	0.4928	-0.2951	0.5645	0.8716	0.1652	0.3619	-0.3385	-0.2747	-0.3836	-0.1561
Momentum Inflation Linked Bond	0.1649	0.5032	-0.2735	0.5233	0.7606	0.4804	0.4236	-0.1990	-0.2507	-0.3215	-0.3663
Mom Active Bond Fund	0.1495	0.5927	-0.2634	0.6941	0.6986	0.6385	0.4420	-0.3011	-0.2380	-0.3767	-0.0930
Mom Managed Bond Fund	0.1253	0.5170	-0.2837	0.6167	0.9462	0.1187	0.3420	-0.2949	-0.2643	-0.3952	-0.1364
Nedgroup Core Bond Fund A	0.1228	0.5087	-0.3041	0.6357	0.8620	0.1593	0.3092	-0.3437	-0.2706	-0.4305	-0.1597
Nedgroup Core Bond Fund B	0.1123	0.4966	-0.3038	0.6055	0.8834	0.1716	0.3051	-0.3417	-0.2743	-0.4226	-0.1621
Nedgroup Core Bond Fund R	0.1228	0.5086	-0.3042	0.6356	0.8620	0.1579	0.3093	-0.3441	-0.2705	-0.4306	-0.1598
Oasis Bond Fund	0.1258	0.5198	-0.3216	0.5997	0.8930	0.4393	0.3197	-0.3457	-0.3426	-0.3670	-0.1329
Old Mutual Bond Fund B	0.1169	0.5123	-0.2751	0.6386	0.8118	0.0874	0.4163	-0.2753	-0.2260	-0.4057	-0.1644
Old Mutual Bond Fund C	0.1171	0.5193	-0.2793	0.6418	0.8554	0.0973	0.3987	-0.2868	-0.2354	-0.3973	-0.1696
Old Mutual Bond Fund R	0.1262	0.5288	-0.2756	0.6740	0.8164	0.0883	0.4146	-0.2765	-0.2269	-0.4050	-0.1652
Prescient Bond Quantplus Fund - A1	0.1003	0.4444	-0.2757	0.5387	0.7953	0.1720	0.2548	-0.3223	-0.2978	-0.3599	-0.1191
Prudential High Yield Bond Fund	0.1227	0.5218	-0.3021	0.6509	0.8816	0.1418	0.3389	-0.3248	-0.2959	-0.4110	-0.1278
Sanlam Select Bond Plus Fund B2	0.1066	0.4973	-0.2728	0.6077	0.9014	0.1282	0.3177	-0.3093	-0.2583	-0.3524	-0.1374
Sanlam Select Bond Plus Fund B6	0.1063	0.4972	-0.2714	0.6075	0.9019	0.1278	0.3177	-0.3094	-0.2620	-0.3452	-0.1377
Sanlam Select Bond Plus Fund B8	0.1061	0.4971	-0.2773	0.6078	0.9017	0.1272	0.3175	-0.3094	-0.2568	-0.3545	-0.1601
Sim Bond Plus Fund	0.1273	0.5336	-0.2614	0.6761	0.8258	0.1042	0.4123	-0.2674	-0.2134	-0.4023	-0.1176
Sim Bond Plus Fund B2	0.1191	0.5166	-0.2598	0.6450	0.8104	0.1003	0.4186	-0.2633	-0.2104	-0.4052	-0.1168
Sim Bond Plus Fund B3	0.0506	0.1485	-0.2591	0.1357	0.8031	0.0990	0.4208	-0.2617	-0.2092	-0.4061	-0.1165
Smm Bond Fund B2	-0.0816	-0.0911	-0.2747	-0.1959	1.0002	0.1787	0.2928	-0.3182	-0.2799	-0.3480	-0.1457
Stanlib Bond Fund - Class B4	0.1261	0.5282	-0.2757	0.6180	0.9307	0.2010	0.3662	-0.2975	-0.2731	-0.3795	-0.1014
Stanlib Bond Fund A Class	0.1388	0.5446	-0.2765	0.6613	0.9116	0.1939	0.3697	-0.3016	-0.2705	-0.3848	-0.1001
Stanlib Bond Fund Class B3	0.1262	0.5230	-0.2766	0.6113	0.9048	0.1924	0.3697	-0.3025	-0.2698	-0.3867	-0.0994
Stanlib Bond Fund R Class	0.1388	0.5444	-0.2763	0.6613	0.9107	0.1942	0.3695	-0.3016	-0.2706	-0.3851	-0.0990
Stanlib Income Fund - B1	0.1282	0.4468	-0.3873	0.5687	0.7732	0.1830	0.2327	-0.3033	-0.4720	-0.3462	-0.4545
Stanlib Income Fund - B4	0.1289	0.4525	-0.3974	0.5734	0.7988	0.2305	0.2293	-0.3154	-0.4832	-0.3435	-0.5097
Stanlib Income Fund - Class B2	0.1284	0.4495	-0.3916	0.5703	0.7890	0.1949	0.2317	-0.3081	-0.4754	-0.3455	-0.4749
Stanlib Income Fund Class B5	0.1283	0.4472	-0.3880	0.5691	0.7748	0.1844	0.2326	-0.3034	-0.4724	-0.3464	-0.4583
Stanlib Prudential Bond Fund A	0.1162	0.5295	-0.2700	0.6483	0.8145	0.1675	0.4012	-0.2809	-0.2350	-0.3941	-0.1300
Stanlib Prudential Bond Fund - Class B1	0.1133	0.5406	-0.2792	0.6546	0.7951	0.1568	0.4875	-0.2859	-0.2317	-0.3963	-0.1798

Table B2:
Modified Sharpe ratio performance results

Below I present the performance results as measured by the modified Sharpe ratio of each the evaluation periods. The modified reward-to-variability ratio is calculated for each bond fund in my sample as well as for the market, using the JSE ALBI as a proxy for market benchmark index. The modified Sharpe ratio for the JSE ALBI is presented in black. A value presented in red indicates a ratio below the market ratio (underpoerformance) while that presented in green indicates a ratio above the market ratio (outperformance).

Evaluation periods	Jul '08 to Dec '16	Jul '08 to Dec '12	Jan '13 to Dec '16	Jul '08 to Dec '09	Jan '10 to Dec '10	Jan '11 to Dec '11	Jan '12 to Dec '12	Jan '13 to Dec '13	Jan '14 to Dec '14	Jan '15 to Dec '15	Jan '16 to Dec '16
JSE All Bond Index	-0.1263	-0.1847	-0.0522	-0.3184	-0.1829	0.0484	0.0842	0.2809	-0.2406	-0.1721	-0.1449
Portfolio modified mean ratio	-0.0594	-0.1110	-0.0059	-0.3156	-0.0764	0.1802	0.0212	0.2276	-0.2131	0.0904	-0.0639
Fund name											
Absa Bond Class A	-0.0873	-0.1423	-0.0189	-0.3637	0.0356	0.2930	-0.0427	0.2809	-0.3064	0.2880	-0.0389
Absa Bond Class B	-0.0920	-0.1517	-0.0181	-0.3571	0.0095	0.2899	-0.0283	0.2367	-0.2951	0.2149	-0.0517
Af Investments Pure Fixed Interest A	-0.0719	-0.0941	-0.0435	-0.3116	0.0644	0.7964	-0.1306	-0.1505	-0.2633	0.3267	-0.0529
Allan Gray Bond Fund	-0.0847	-0.1271	-0.0399	-0.3889	-0.0456	0.2925	-0.0753	0.1612	-0.3329	0.2933	-0.0219
Citadel Sa Bond H4 Fund B1	0.0560	-0.1821	0.2584	-0.3840	-0.2267	-0.1359	0.0792	0.5648	0.1865	0.3284	-0.0063
Coronation Bond Fund B	-0.0117	0.0014	-0.0248	-0.2379	0.0885	0.6535	-0.1104	-0.0721	-0.2689	0.3542	0.1078
Coronation Bond Fund R	-0.0601	-0.0863	-0.0241	-0.3195	0.1089	0.6850	-0.1315	-0.1228	-0.2709	0.3517	0.1183
Counterpoint Met Enhanced Income	0.1024	0.0637	0.1701	-0.1286	0.1568	0.3957	-0.8694	0.0241	0.3045	0.2648	0.0107
Investec Corporate Bond Fund Class Z	-0.0168	-0.0998	0.0826	-0.3121	-0.1136	0.2621	-0.0345	0.1478	0.1110	0.3004	-0.0957
Investec Gilt Fund Class A	-0.1119	-0.1521	-0.0555	-0.3366	-0.0523	0.3065	-0.0016	0.1144	-0.3129	0.2416	-0.1024
Investec Gilt Fund Class B	-0.1118	-0.1518	-0.0558	-0.3374	-0.0523	0.3081	-0.0016	0.1144	-0.3127	0.2418	-0.1028
Investec Gilt Fund Class C	-0.0641	-0.0736	-0.0542	-0.2612	-0.0774	0.2938	0.0113	0.1370	-0.3024	0.1995	-0.1092
Investec Gilt Fund Class R	-0.1112	-0.1506	-0.0560	-0.3381	-0.0455	0.3091	-0.0051	0.1067	-0.3156	0.2517	-0.1007
Investec High Income Fund Class A	0.1411	0.1205	0.1588	-0.2019	0.0932	0.2865	0.8534	0.3664	0.2830	-0.4213	0.0019
Investec High Income Fund Class B	0.1259	0.0892	0.1580	-0.3265	0.0922	0.2812	0.8561	0.3602	0.2828	-0.4539	0.0019
Investec High Income Fund Class C	0.1249	0.0852	0.1568	-0.3218	0.0808	0.2848	0.8434	0.3473	0.2831	-0.4508	-0.0071
Momentum Bond Fund (A)	-0.1239	-0.1917	-0.0393	-0.3848	-0.0676	0.1289	-0.0344	0.3244	-0.3285	0.2836	-0.1718
Momentum Bond Fund (B1)	-0.0806	-0.1341	-0.0340	-0.3157	-0.1084	0.0925	-0.0062	0.3527	-0.3154	0.1867	-0.1732
Momentum Bond Fund (B2)	-0.0794	-0.1256	-0.0367	-0.3205	-0.0716	0.1251	-0.0321	0.3374	-0.3238	0.2559	-0.1726

Momentum Bond Fund (B3)	-0.0805	-0.1269	-0.0380	-0.3197	-0.0775	0.1202	-0.0279	0.3325	-0.3252	0.2642	-0.1723
Momentum Bond Fund (B4)	-0.0796	-0.1187	-0.0422	-0.3239	-0.0473	0.1453	-0.0483	0.3065	-0.3349	0.3101	-0.1703
Momentum Bond Fund (B7)	-0.1241	-0.1918	-0.0394	-0.3843	-0.0677	0.1290	-0.0349	0.3243	-0.3284	0.2836	-0.1720
Momentum Bond Fund Class C1	-0.0799	-0.1220	-0.0402	-0.3209	-0.0603	0.1350	-0.0401	0.3180	-0.3307	0.2956	-0.1717
Momentum Inflation Linked Bond A	-0.0351	-0.1158	0.0406	-0.0246	-0.3675	0.0416	-0.1520	0.3893	-0.4850	-0.3204	0.0868
Momentum Mom Active Bond Fund	-0.0574	0.0029	-0.1181	-0.1934	0.0804	0.2139	-0.0308	0.1056	-0.2958	-0.2090	-0.1231
Momentum Mom Managed Bond Fund	-0.1218	-0.1736	-0.0665	-0.2546	-0.1364	-0.2526	-0.0374	0.1389	-0.3077	0.2146	-0.0699
Nedgroup Investments Core Bond Fund A	-0.1213	-0.1526	-0.0842	-0.3861	-0.0006	0.2537	-0.0628	0.0962	-0.3321	0.3180	-0.0975
Nedgroup Investments Core Bond Fund B	-0.0884	-0.0939	-0.0836	-0.3220	-0.0360	0.2320	-0.0413	0.1428	-0.3186	0.2584	-0.1118
Nedgroup Investments Core Bond Fund R	-0.1210	-0.1522	-0.0841	-0.3863	0.0003	0.2546	-0.0624	0.0944	-0.3319	0.3184	-0.0964
Oasis Bond Fund	-0.0332	-0.0727	0.0050	-0.4150	0.0676	0.4091	0.0909	0.3362	-0.1023	-0.2082	-0.1683
Old Mutual Bond Fund B	-0.1233	-0.1955	-0.0497	-0.3403	-0.2841	-0.1261	0.0887	0.5567	-0.3555	-0.2554	-0.0927
Old Mutual Bond Fund C	-0.1197	-0.1940	-0.0474	-0.3263	-0.2874	-0.1238	0.0843	0.5184	-0.3374	-0.2390	-0.1073
Old Mutual Bond Fund R	-0.1516	-0.2410	-0.0497	-0.4132	-0.2846	-0.1259	0.0877	0.5535	-0.3539	-0.2543	-0.0937
Prescient Bond Quantplus Fund - A1	-0.0082	0.0460	-0.0579	-0.2426	0.1468	0.6615	-0.1605	-0.1472	-0.2698	0.3412	-0.1146
Prudential High Yield Bond Fund	-0.1084	-0.1669	-0.0242	-0.3556	-0.0854	0.2810	-0.0392	0.1067	-0.3152	0.2710	-0.0792
Sanlam Select Bond Plus Fund B2	-0.0813	-0.1400	-0.0406	-0.2545	-0.1801	-0.1181	0.1549	0.3420	-0.2458	-0.1996	-0.1514
Sanlam Select Bond Plus Fund B6	-0.0785	-0.1408	-0.0352	-0.2541	-0.1806	-0.1226	0.1537	0.3422	-0.2479	-0.1467	-0.1520
Sanlam Select Bond Plus Fund B8	-0.0837	-0.1402	-0.0454	-0.2544	-0.1798	-0.1196	0.1534	0.3420	-0.2449	-0.2135	-0.1515
Sim Bond Plus Fund	-0.1458	-0.2355	-0.0537	-0.4185	-0.2737	-0.1267	0.1243	0.5212	-0.3462	-0.2694	-0.1096
Sim Bond Plus Fund B2	-0.1224	-0.1933	-0.0545	-0.3429	-0.2732	-0.1272	0.1250	0.5343	-0.3526	-0.2739	-0.1053
Sim Bond Plus Fund B3	-0.1428	-0.2038	-0.0548	-0.2982	-0.2729	-0.1271	0.1256	0.5388	-0.3548	-0.2754	-0.1038
Smm Bond Fund B2	0.0053	0.0112	-0.0626	0.0217	-0.2913	0.0201	0.0685	0.3568	-0.2493	-0.1813	-0.1429
Stanlib Bond Fund - Class B4	-0.0682	-0.1223	-0.0105	-0.3057	-0.1491	0.2309	-0.0298	0.2525	-0.3204	0.2563	-0.0662
Stanlib Bond Fund A Class	-0.1090	-0.1785	-0.0129	-0.3810	-0.1113	0.2448	-0.0423	0.2227	-0.3327	0.3052	-0.0551
Stanlib Bond Fund Class B3	-0.0648	-0.1107	-0.0132	-0.3116	-0.0988	0.2482	-0.0478	0.2142	-0.3363	0.3137	-0.0511
Stanlib Bond Fund R Class	-0.1087	-0.1782	-0.0124	-0.3810	-0.1100	0.2453	-0.0427	0.2234	-0.3327	0.3046	-0.0537
Stanlib Income Fund - B1	0.0365	-0.0268	0.1076	-0.3634	0.0978	0.2953	-0.1600	-0.2369	0.1399	0.2965	0.1923
Stanlib Income Fund - B4	0.0418	-0.0418	0.1322	-0.3577	0.0810	0.3018	-0.1377	-0.2213	0.1918	0.2961	0.1690
Stanlib Income Fund - Class B2	0.0338	-0.0387	0.1118	-0.3622	0.0818	0.2965	-0.1544	-0.2333	0.1565	0.2965	0.1727
Stanlib Income Fund Class B5	0.0364	-0.0282	0.1088	-0.3632	0.0971	0.2938	-0.1588	-0.2368	0.1430	0.2966	0.1889
Stanlib Prudential Bond Fund - Class A	-0.1224	-0.2468	-0.0329	-0.4406	-0.3227	-0.1313	0.0272	0.5251	-0.3613	-0.2750	-0.0705
Stanlib Prudential Bond Fund - Class B1	-0.1037	-0.1852	-0.0417	-0.3897	-0.3141	-0.1305	0.1885	0.5447	-0.3676	-0.2782	-0.1116

Table B3:
CAPM performance results

Below I present the performance results as measured by the CAPM, per Jensen's alpha, for each of the evaluation periods. The alpha ("α_p") is regressed for each bond fund in my sample as well as for the market, using the JSE ALBI as proxy for the market benchmark index. The sign of the alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive alpha (presented in green) would indicate outperformance, and a negative alpha (presented in red) would indicate underperformances.

Evaluation periods	**Jul '08 to Dec '16**	**Jul '08 to Dec '12**	**Jan '13 to Dec '16**	**Jul '08 to Dec '09**	**Jan '10 to Dec '10**	**Jan '11 to Dec '11**	**Jan '12 to Dec '12**	**Jan '13 to Dec '13**	**Jan '14 to Dec '14**	**Jan '15 to Dec '15**	**Jan '16 to Dec '16**
Portfolio mean alpha (α)	0.0004	0.0005	-0.0009	-0.0025	0.0016	0.0014	0.0013	-0.0003	-0.0011	-0.0009	-0.0015
Fund name											
Absa Bond Class A	0.0005	0.0000	-0.0002	-0.0022	0.0001	0.0010	0.0009	-0.0011	0.0002	-0.0004	0.0004
Absa Bond Class B	0.0005	0.0000	-0.0001	-0.0021	0.0001	0.0010	0.0007	-0.0009	0.0002	-0.0001	0.0004
Af Investments Pure Fixed Interest	0.0008	0.0000	-0.0006	-0.0033	0.0021	0.0025	-0.0007	-0.0018	-0.0018	-0.0003	0.0002
Allan Gray Bond Fund	0.0009	0.0010	-0.0008	-0.0014	0.0029	0.0020	0.0009	-0.0005	-0.0007	-0.0012	-0.0014
Citadel Sa Bond H4 Fund B1	0.0009	0.0017	-0.0009	0.0020	0.0015	0.0009	0.0023	-0.0005	-0.0046	-0.0003	0.0010
Coronation Bond Fund B	0.0016	0.0004	0.0006	-0.0011	0.0012	0.0018	0.0004	0.0005	-0.0008	0.0009	0.0015
Coronation Bond Fund R	0.0017	0.0003	0.0005	-0.0016	0.0012	0.0019	0.0003	0.0001	-0.0010	0.0008	0.0016
Investec Corporate Bond Fund Class Z	0.0008	0.0016	-0.0014	0.0005	0.0026	0.0013	0.0017	-0.0012	-0.0035	-0.0012	-0.0003
Counterpoint Met Enhanced Income	0.0009	-0.0001	-0.0034	-0.0017	0.0029	0.0013	-0.0019	-0.0017	-0.0069	0.0006	-0.0066
Investec Gilt Fund Class A	0.0007	0.0008	-0.0005	-0.0002	0.0009	0.0003	0.0017	-0.0008	-0.0002	-0.0012	-0.0004
Investec Gilt Fund Class B	0.0007	0.0008	-0.0005	-0.0002	0.0009	0.0003	0.0017	-0.0008	-0.0002	-0.0012	-0.0004
Investec Gilt Fund Class C	0.0007	0.0008	-0.0004	0.0000	0.0009	0.0003	0.0015	-0.0006	-0.0002	-0.0009	-0.0004
Investec Gilt Fund Class R	0.0007	0.0008	-0.0005	-0.0002	0.0009	0.0003	0.0017	-0.0008	-0.0002	-0.0012	-0.0004
Investec High Income Fund Class A	0.0008	0.0000	-0.0040	-0.0027	0.0027	0.0021	-0.0021	-0.0009	-0.0083	0.0006	-0.0081
Investec High Income Fund Class B	0.0012	0.0002	-0.0040	-0.0015	0.0027	0.0021	-0.0021	-0.0009	-0.0083	0.0006	-0.0081
Investec High Income Fund Class C	0.0012	0.0002	-0.0040	-0.0014	0.0027	0.0021	-0.0022	-0.0009	-0.0083	0.0006	-0.0081
Momentum Bond Fund (A)	0.0004	0.0006	-0.0005	-0.0017	0.0012	0.0011	0.0021	-0.0003	-0.0002	-0.0009	-0.0007
Momentum Bond Fund (B1)	0.0004	0.0006	-0.0005	-0.0017	0.0012	0.0011	0.0021	-0.0003	-0.0002	-0.0009	-0.0007

Momentum Bond Fund (B2)	0.0005	0.0006	-0.0005	-0.0013	0.0012	0.0010	0.0020	-0.0003	-0.0002	-0.0008	-0.0007
Momentum Bond Fund (B3)	0.0005	0.0006	-0.0005	-0.0013	0.0012	0.0010	0.0020	-0.0003	-0.0002	-0.0008	-0.0007
Momentum Bond Fund (B4)	0.0006	0.0007	-0.0006	-0.0014	0.0012	0.0011	0.0022	-0.0005	-0.0002	-0.0011	-0.0007
Momentum Bond Fund (B7)	0.0004	0.0006	-0.0005	-0.0016	0.0012	0.0011	0.0021	-0.0003	-0.0002	-0.0009	-0.0007
Momentum Bond Fund Class C1	0.0005	0.0007	-0.0005	-0.0014	0.0012	0.0011	0.0021	-0.0004	-0.0002	-0.0010	-0.0007
Momentum Inflation Linked Bond	0.0026	0.0033	-0.0012	-0.0003	0.0047	0.0056	0.0049	0.0004	0.0003	-0.0001	-0.0052
Momentum Mom Active Bond Fund	0.0022	0.0042	0.0007	0.0042	-0.0021	0.0073	0.0055	0.0006	0.0015	-0.0006	0.0010
Momentum Mom Managed Bond	0.0013	0.0018	-0.0002	0.0007	0.0016	0.0013	0.0015	0.0007	0.0002	-0.0017	-0.0003
Nedgroup Investments Core Bond A	0.0005	0.0007	-0.0010	-0.0003	0.0010	0.0011	0.0004	-0.0009	0.0000	-0.0032	-0.0010
Nedgroup Investments Core Bond B	0.0007	0.0007	-0.0009	0.0004	0.0009	0.0010	0.0001	-0.0006	-0.0001	-0.0028	-0.0009
Nedgroup Investments Core Bond R	0.0005	0.0007	-0.0010	-0.0003	0.0009	0.0010	0.0004	-0.0009	0.0000	-0.0032	-0.0010
Oasis Bond Fund	0.0006	0.0012	-0.0013	-0.0009	0.0019	0.0036	0.0005	-0.0005	-0.0029	-0.0001	-0.0021
Old Mutual Bond Fund B	0.0011	0.0022	-0.0003	0.0028	0.0015	-0.0001	0.0039	0.0004	0.0022	-0.0024	-0.0015
Old Mutual Bond Fund C	0.0010	0.0020	-0.0001	0.0025	0.0014	0.0000	0.0033	0.0006	0.0018	-0.0018	-0.0013
Old Mutual Bond Fund R	0.0008	0.0021	-0.0003	0.0022	0.0015	-0.0001	0.0039	0.0005	0.0021	-0.0024	-0.0015
Prescient Bond Quantplus Fund - A1	0.0004	-0.0003	-0.0003	-0.0020	0.0007	0.0018	-0.0016	-0.0013	-0.0016	-0.0002	0.0001
Prudential High Yield Bond Fund	0.0005	0.0009	-0.0008	-0.0002	0.0013	0.0007	0.0014	-0.0001	-0.0012	-0.0024	0.0001
Sanlam Select Bond Plus Fund B2	0.0004	0.0002	0.0006	0.0001	0.0000	0.0002	0.0004	0.0007	0.0008	0.0008	0.0001
Sanlam Select Bond Plus Fund B6	0.0004	0.0002	0.0007	0.0001	0.0000	0.0002	0.0004	0.0007	0.0006	0.0012	0.0001
Sanlam Select Bond Plus Fund B8	0.0004	0.0002	0.0004	0.0001	0.0000	0.0002	0.0004	0.0007	0.0008	0.0007	-0.0005
Sim Bond Plus Fund	0.0009	0.0023	0.0004	0.0023	0.0013	0.0002	0.0037	0.0008	0.0029	-0.0023	-0.0001
Sim Bond Plus Fund B2	0.0012	0.0025	0.0003	0.0030	0.0013	0.0002	0.0040	0.0007	0.0031	-0.0025	-0.0002
Sim Bond Plus Fund B3	0.0020	0.0114	0.0003	0.0313	0.0013	0.0002	0.0040	0.0007	0.0031	-0.0026	-0.0002
Smm Bond Fund B2	-0.0266	-0.0417	0.0004	-0.1557	0.0025	0.0007	-0.0005	0.0002	-0.0002	0.0010	-0.0002
Stanlib Bond Fund - Class B4	0.0012	0.0018	0.0003	0.0010	0.0021	0.0016	0.0023	0.0009	-0.0001	-0.0007	0.0008
Stanlib Bond Fund A Class	0.0011	0.0018	0.0001	0.0006	0.0021	0.0017	0.0025	0.0006	0.0000	-0.0010	0.0007
Stanlib Bond Fund Class B3	0.0013	0.0019	0.0001	0.0009	0.0021	0.0017	0.0025	0.0006	0.0000	-0.0012	0.0007
Stanlib Bond Fund R Class	0.0011	0.0018	0.0001	0.0006	0.0021	0.0017	0.0025	0.0006	0.0000	-0.0011	0.0007
Stanlib Income Fund - B1	0.0017	0.0007	-0.0043	-0.0002	0.0030	0.0020	-0.0013	-0.0023	-0.0069	-0.0017	-0.0074
Stanlib Income Fund - B4	0.0016	0.0006	-0.0042	-0.0001	0.0028	0.0019	-0.0016	-0.0019	-0.0070	-0.0013	-0.0076
Stanlib Income Fund - Class B2	0.0016	0.0006	-0.0043	-0.0002	0.0029	0.0019	-0.0014	-0.0022	-0.0069	-0.0016	-0.0076
Stanlib Income Fund Class B5	0.0017	0.0007	-0.0043	-0.0002	0.0029	0.0019	-0.0014	-0.0022	-0.0069	-0.0017	-0.0075
Stanlib Prudential Bond Fund - Class A	0.0005	0.0028	0.0000	0.0023	0.0034	0.0016	0.0033	0.0008	0.0017	-0.0018	-0.0005
Stanlib Prudential Bond Fund - Class B1	0.0010	0.0036	-0.0006	0.0034	0.0033	0.0015	0.0059	0.0004	0.0019	-0.0020	-0.0024

Table B4:
Conditional CAPM performance results

Below I present the performance results as measured by the conditional CAPM, per Jensen's alpha, for each of the evaluation periods. The conditional alpha ("α_p") is regressed for each bond fund in my sample as well as for the market, using the JSE ALBI as proxy for the market benchmark index. The sign of the conditional alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive conditional alpha (presented in green) would indicate outperformance, and a negative conditional alpha (presented in red) would indicate underperformances.

Evaluation periods	**Jul '08 to Dec '16**	**Jul '08 to Dec '12**	**Jan '13 to Dec '16**	**Jul '08 to Dec '09**	**Jan '10 to Dec '10**	**Jan '11 to Dec '11**	**Jan '12 to Dec '12**	**Jan '13 to Dec '13**	**Jan '14 to Dec '14**	**Jan '15 to Dec '15**	**Jan '16 to Dec '16**
Portfolio conditional mean alpha (α)	0.0014	0.0014	0.0019	-0.0009	0.0015	0.0123	0.0002	0.0038	0.0074	0.0088	0.0028
Fund name											
Absa Bond Class A	0.0064	0.0074	0.0037	0.0098	0.0005	0.0147	0.0021	0.0053	0.0063	-0.0019	0.0051
Absa Bond Class B	0.0054	0.0063	0.0030	0.0086	-0.0002	0.0134	0.0010	0.0041	0.0040	0.0006	0.0039
Af Investments Pure Fixed Interest	0.0048	0.0048	0.0031	0.0030	0.0033	0.0110	0.0126	0.0089	-0.0056	-0.0351	0.0070
Allan Gray Bond Fund	0.0022	0.0019	0.0024	-0.0051	0.0011	0.0134	0.0049	0.0061	0.0076	0.0053	0.0038
Citadel Sa Bond H4 Fund B1	-0.0015	-0.0026	0.0025	-0.0058	-0.0042	0.0132	-0.0061	0.0008	-0.0058	-0.0230	0.0074
Coronation Bond Fund B	0.0056	0.0054	0.0045	0.0062	0.0021	0.0093	0.0149	0.0072	-0.0043	-0.0211	0.0075
Coronation Bond Fund R	0.0071	0.0066	0.0051	0.0055	0.0028	0.0109	0.0179	0.0089	-0.0048	-0.0283	0.0085
Counterpoint Met Enhanced Income	-0.0036	-0.0058	-0.0059	-0.0047	-0.0066	0.0053	-0.0154	-0.0112	-0.0177	0.0797	-0.0052
Investec Corporate Bond Fund Class Z	0.0050	0.0065	0.0045	0.0064	0.0042	0.0173	0.0023	0.0107	0.0114	-0.0096	0.0062
Investec Gilt Fund Class A	0.0051	0.0063	0.0042	0.0069	0.0050	0.0096	0.0032	0.0077	0.0095	-0.0058	0.0063
Investec Gilt Fund Class B	0.0052	0.0064	0.0043	0.0071	0.0050	0.0097	0.0032	0.0077	0.0096	-0.0058	0.0063
Investec Gilt Fund Class C	0.0037	0.0047	0.0037	0.0056	0.0045	0.0086	0.0023	0.0067	0.0078	-0.0036	0.0055
Investec Gilt Fund Class R	0.0053	0.0066	0.0044	0.0072	0.0051	0.0100	0.0034	0.0080	0.0100	-0.0065	0.0066
Investec High Income Fund Class A	-0.0042	-0.0050	-0.0081	-0.0067	-0.0065	0.0115	-0.0243	-0.0148	-0.0269	0.0867	-0.0061
Investec High Income Fund Class B	-0.0090	-0.0104	-0.0081	-0.0114	-0.0066	0.0115	-0.0243	-0.0148	-0.0269	0.0870	-0.0061
Investec High Income Fund Class C	-0.0093	-0.0110	-0.0082	-0.0122	-0.0071	0.0105	-0.0235	-0.0151	-0.0271	0.0867	-0.0061
Momentum Bond Fund (A)	0.0067	0.0096	0.0026	0.0092	0.0042	0.0151	0.0072	0.0081	0.0098	-0.0156	0.0003

Momentum Bond Fund (B1)	0.0067	0.0096	0.0026	0.0092	0.0042	0.0151	0.0072	0.0081	0.0098	-0.0156	0.0003
Momentum Bond Fund (B2)	0.0053	0.0081	0.0022	0.0070	0.0041	0.0149	0.0067	0.0076	0.0088	-0.0145	-0.0002
Momentum Bond Fund (B3)	0.0053	0.0080	0.0023	0.0068	0.0040	0.0147	0.0068	0.0078	0.0091	-0.0149	0.0000
Momentum Bond Fund (B4)	0.0060	0.0089	0.0030	0.0076	0.0047	0.0160	0.0080	0.0090	0.0114	-0.0173	0.0011
Momentum Bond Fund (B7)	0.0067	0.0095	0.0026	0.0090	0.0042	0.0151	0.0072	0.0081	0.0098	-0.0157	0.0003
Momentum Bond Fund Class C1	0.0057	0.0085	0.0027	0.0073	0.0044	0.0154	0.0075	0.0084	0.0103	-0.0163	0.0006
Momentum Inflation Linked Bond	0.0030	0.0026	-0.0036	-0.0014	-0.0124	0.0200	0.0029	-0.0025	0.0314	0.0819	-0.0051
Momentum Mom Active Bond Fund	0.0071	0.0075	0.0067	0.0070	0.0099	0.0096	0.0133	0.0068	0.0183	-0.0026	0.0079
Momentum Mom Managed Bond Fund	0.0033	0.0027	0.0058	0.0002	0.0066	0.0089	0.0060	0.0076	0.0174	-0.0098	0.0079
Nedgroup Investments Core Bond Fund A	0.0036	0.0044	0.0023	0.0029	0.0025	0.0134	0.0005	0.0081	0.0113	-0.0032	0.0044
Nedgroup Investments Core Bond Fund B	0.0006	0.0008	0.0012	0.0002	0.0016	0.0117	-0.0011	0.0064	0.0077	0.0003	0.0029
Nedgroup Investments Core Bond Fund R	0.0036	0.0044	0.0023	0.0029	0.0026	0.0134	0.0005	0.0081	0.0112	-0.0032	0.0043
Oasis Bond Fund	0.0003	0.0004	-0.0022	0.0004	0.0021	0.0064	-0.0057	0.0004	0.0085	0.0337	-0.0038
Old Mutual Bond Fund B	0.0058	0.0090	0.0046	0.0104	0.0045	0.0131	-0.0014	0.0055	0.0317	0.0091	0.0052
Old Mutual Bond Fund C	0.0049	0.0079	0.0034	0.0093	0.0037	0.0118	-0.0007	0.0045	0.0243	0.0058	0.0036
Old Mutual Bond Fund R	0.0075	0.0112	0.0045	0.0151	0.0044	0.0130	-0.0014	0.0054	0.0309	0.0086	0.0050
Prescient Bond Quantplus Fund - A1	0.0016	0.0015	0.0023	0.0007	0.0022	0.0147	0.0091	0.0101	0.0033	-0.0469	0.0032
Prudential High Yield Bond Fund	0.0064	0.0077	0.0051	0.0092	0.0042	0.0091	0.0067	0.0085	0.0171	-0.0171	0.0077
Sanlam Select Bond Plus Fund B2	0.0019	0.0032	-0.0005	0.0049	0.0026	0.0091	-0.0007	0.0027	0.0013	0.0027	-0.0033
Sanlam Select Bond Plus Fund B6	0.0016	0.0032	-0.0011	0.0049	0.0026	0.0090	-0.0007	0.0027	-0.0013	0.0007	-0.0034
Sanlam Select Bond Plus Fund B8	0.0016	0.0031	-0.0012	0.0048	0.0027	0.0089	-0.0007	0.0027	0.0022	0.0041	-0.0037
Sim Bond Plus Fund	0.0074	0.0105	0.0057	0.0146	0.0052	0.0129	-0.0048	0.0077	0.0304	0.0101	0.0054
Sim Bond Plus Fund B2	0.0056	0.0080	0.0062	0.0087	0.0055	0.0134	-0.0051	0.0080	0.0331	0.0113	0.0060
Sim Bond Plus Fund B3	0.0041	-0.0053	0.0063	0.0329	0.0056	0.0136	-0.0052	0.0082	0.0341	0.0117	0.0062
Smm Bond Fund B2	-0.0805	-0.1145	-0.0004	-0.2693	-0.0027	0.0063	-0.0050	-0.0006	-0.0073	0.0121	-0.0032
Stanlib Bond Fund - Class B4	0.0064	0.0087	0.0041	0.0099	0.0054	0.0148	0.0066	0.0079	0.0094	-0.0110	0.0050
Stanlib Bond Fund A Class	0.0085	0.0112	0.0048	0.0131	0.0061	0.0161	0.0078	0.0091	0.0116	-0.0136	0.0061
Stanlib Bond Fund Class B3	0.0074	0.0099	0.0050	0.0110	0.0063	0.0165	0.0083	0.0095	0.0124	-0.0146	0.0064
Stanlib Bond Fund R Class	0.0085	0.0112	0.0048	0.0131	0.0061	0.0161	0.0078	0.0091	0.0116	-0.0137	0.0061
Stanlib Income Fund - B1	-0.0050	-0.0073	-0.0026	-0.0073	-0.0054	0.0123	-0.0109	-0.0084	-0.0085	0.0678	0.0021
Stanlib Income Fund - B4	-0.0061	-0.0087	-0.0038	-0.0087	-0.0066	0.0103	-0.0127	-0.0104	-0.0119	0.0717	0.0006
Stanlib Income Fund - Class B2	-0.0053	-0.0077	-0.0030	-0.0077	-0.0057	0.0117	-0.0114	-0.0090	-0.0095	0.0690	0.0017
Stanlib Income Fund Class B5	-0.0050	-0.0073	-0.0027	-0.0074	-0.0055	0.0122	-0.0110	-0.0086	-0.0087	0.0680	0.0020
Stanlib Prudential Bond Fund - Class A	0.0036	0.0053	0.0054	0.0063	-0.0043	0.0130	0.0001	0.0063	0.0275	0.0147	0.0062
Stanlib Prudential Bond Fund - Class B1	0.0005	0.0009	0.0055	-0.0025	-0.0039	0.0135	-0.0067	0.0066	0.0301	0.0158	0.0069

Table B5:
Multi-index model performance results

Below I present the performance results as measured by the multi-index model for each of the evaluation periods. The alpha ("α_p") is regressed for each bond fund in my sample as well as for the benchmark indecies. I consider the JSE ALBI, the JSE ALSI and the default spread as my indecies. The sign of the conditional alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive alpha (presented in green) would indicate outperformance, and a negative alpha (presented in red) would indicate underperformances.

Evaluation periods	Jul '08 to Dec '16	Jul '08 to Dec '12	Jan '13 to Dec '16	Jul '08 to Dec '09	Jan '10 to Dec '10	Jan '11 to Dec '11	Jan '12 to Dec '12	Jan '13 to Dec '13	Jan '14 to Dec '14	Jan '15 to Dec '15	Jan '16 to Dec '16
Portfolio mean alpha (α)	0.0027	0.0027	0.0006	0.0280	-0.0554	-0.0128	0.0047	0.0044	-0.0087	0.0135	0.0099
Fund name											
Absa Bond Class A	0.0019	0.0015	-0.0025	-0.0028	-0.0759	-0.0123	0.0048	-0.0049	0.0009	-0.0021	0.0140
Absa Bond Class B	0.0016	0.0012	-0.0028	-0.0027	-0.0661	-0.0097	0.0040	-0.0036	-0.0034	-0.0053	0.0119
Af Investments Pure Fixed Interest	0.0002	-0.0004	-0.0037	0.0035	-0.1403	0.0101	0.0002	-0.0319	-0.0155	0.0157	-0.0122
Allan Gray Bond Fund	0.0023	0.0023	0.0028	-0.0103	-0.0768	-0.0097	0.0046	-0.0013	-0.0181	0.0241	0.0080
Citadel Sa Bond H4 Fund B1	0.0047	0.0051	-0.0005	0.0144	0.0045	-0.0341	0.0089	0.0344	-0.0594	0.0416	-0.0073
Coronation Bond Fund B	0.0005	-0.0003	-0.0060	0.0087	-0.1505	0.0020	0.0007	-0.0214	-0.0276	-0.0056	-0.0104
Coronation Bond Fund R	0.0004	-0.0006	-0.0064	0.0050	-0.1764	0.0022	0.0007	-0.0277	-0.0272	-0.0023	-0.0124
Counterpoint Met Enhanced Income	0.0007	0.0003	-0.0046	-0.0215	-0.0997	0.0033	-0.0013	0.0075	-0.0859	0.0073	-0.0030
Investec Corporate Bond Fund Class Z	0.0030	0.0036	-0.0048	0.0113	-0.0885	-0.0158	0.0065	-0.0085	-0.0030	0.0160	0.0145
Investec Gilt Fund Class A	0.0022	0.0022	0.0012	0.0017	-0.0596	-0.0134	0.0050	-0.0051	0.0090	0.0158	0.0101
Investec Gilt Fund Class B	0.0022	0.0022	0.0012	0.0016	-0.0596	-0.0134	0.0051	-0.0050	0.0089	0.0158	0.0102
Investec Gilt Fund Class C	0.0020	0.0020	0.0009	0.0076	-0.0521	-0.0114	0.0045	-0.0040	0.0054	0.0131	0.0085
Investec Gilt Fund Class R	0.0022	0.0023	0.0013	0.0017	-0.0618	-0.0140	0.0052	-0.0055	0.0101	0.0167	0.0106
Investec High Income Fund Class A	0.0022	0.0019	-0.0032	-0.0172	-0.0907	-0.0086	0.0013	0.0102	-0.1186	0.0023	-0.0008
Investec High Income Fund Class B	0.0028	0.0024	-0.0032	0.0103	-0.0904	-0.0087	0.0013	0.0104	-0.1189	0.0022	-0.0007
Investec High Income Fund Class C	0.0026	0.0022	-0.0032	0.0089	-0.0830	-0.0067	0.0009	0.0106	-0.1190	0.0023	-0.0006
Momentum Bond Fund (A)	0.0017	0.0018	0.0024	-0.0016	-0.0768	-0.0138	0.0046	-0.0032	-0.0007	0.0244	0.0050

Momentum Bond Fund (B1)	0.0017	0.0018	0.0024	-0.0016	-0.0768	-0.0138	0.0046	-0.0032	-0.0007	0.0244	0.0050
Momentum Bond Fund (B2)	0.0020	0.0019	0.0022	0.0111	-0.0755	-0.0134	0.0045	-0.0031	-0.0028	0.0230	0.0041
Momentum Bond Fund (B3)	0.0019	0.0019	0.0023	0.0108	-0.0739	-0.0130	0.0044	-0.0028	-0.0022	0.0234	0.0044
Momentum Bond Fund (B4)	0.0022	0.0021	0.0027	0.0121	-0.0833	-0.0155	0.0051	-0.0042	0.0026	0.0266	0.0066
Momentum Bond Fund (B7)	0.0017	0.0018	0.0025	-0.0015	-0.0768	-0.0138	0.0046	-0.0032	-0.0008	0.0244	0.0050
Momentum Bond Fund Class C1	0.0021	0.0020	0.0025	0.0114	-0.0791	-0.0144	0.0048	-0.0036	0.0002	0.0252	0.0054
Momentum Inflation Linked Bond A	0.0049	0.0057	0.0033	-0.0219	-0.0189	-0.0235	0.0088	0.0922	-0.0134	0.0275	0.0115
Momentum Mom Active Bond Fund	0.0025	0.0042	0.0027	0.0134	0.1131	0.0029	0.0066	-0.0038	0.0277	0.0238	0.0111
Momentum Mom Managed Bond Fund	0.0030	0.0033	0.0035	-0.0005	-0.0181	-0.0105	0.0053	-0.0010	0.0288	0.0221	0.0129
Nedgroup Investments Core Bond A	0.0022	0.0023	0.0017	-0.0069	-0.0812	-0.0150	0.0043	-0.0032	0.0110	0.0214	0.0138
Nedgroup Investments Core Bond B	0.0022	0.0022	0.0012	0.0068	-0.0691	-0.0116	0.0032	-0.0010	0.0043	0.0167	0.0110
Nedgroup Investments Core Bond R	0.0022	0.0023	-0.0069	-0.0069	-0.0813	-0.0151	0.0043	-0.0032	0.0109	0.0215	0.0135
Oasis Bond Fund	0.0009	0.0016	-0.0040	-0.0109	-0.0733	0.0113	0.0019	0.0135	0.0146	-0.0012	0.0017
Old Mutual Bond Fund B	0.0052	0.0058	0.0080	0.0122	0.0402	-0.0349	0.0104	0.0245	0.0415	0.0071	0.0399
Old Mutual Bond Fund C	0.0042	0.0047	0.0064	0.0096	0.0311	-0.0278	0.0084	0.0204	0.0292	0.0021	0.0311
Old Mutual Bond Fund R	0.0046	0.0054	0.0078	-0.0063	0.0394	-0.0342	0.0102	0.0241	0.0401	0.0068	0.0387
Prescient Bond Quantplus Fund - A1	-0.0001	-0.0007	-0.0010	0.0043	-0.1853	0.0033	-0.0005	-0.0275	-0.0142	0.0324	-0.0123
Prudential High Yield Bond Fund	0.0021	0.0024	0.0009	0.0021	-0.0680	-0.0154	0.0051	-0.0021	0.0096	0.0236	0.0085
Sanlam Select Bond Plus Fund B2	0.0002	0.0001	0.0008	0.0010	-0.0102	0.0002	0.0000	0.0118	-0.0121	0.0003	-0.0011
Sanlam Select Bond Plus Fund B6	0.0002	0.0001	0.0006	0.0010	-0.0101	0.0004	0.0000	0.0118	-0.0128	-0.0028	-0.0012
Sanlam Select Bond Plus Fund B8	0.0002	0.0000	0.0022	0.0010	-0.0104	0.0005	0.0000	0.0118	-0.0116	-0.0001	-0.0014
Sim Bond Plus Fund	0.0048	0.0057	0.0074	-0.0068	0.0425	-0.0332	0.0100	0.0259	0.0335	0.0135	0.0377
Sim Bond Plus Fund B2	0.0057	0.0064	0.0080	0.0147	0.0459	-0.0359	0.0108	0.0274	0.0380	0.0154	0.0409
Sim Bond Plus Fund B3	0.0115	0.0176	0.0082	0.1637	0.0472	-0.0368	0.0111	0.0279	0.0397	0.0161	0.0421
Smm Bond Fund B2	0.0059	-0.0086	-0.0028	1.1587	-0.0233	-0.0004	-0.0003	0.0079	-0.0348	-0.0108	-0.0002
Stanlib Bond Fund - Class B4	0.0027	0.0031	-0.0011	0.0123	-0.0644	-0.0126	0.0054	0.0011	0.0258	0.0044	0.0059
Stanlib Bond Fund A Class	0.0027	0.0032	-0.0008	0.0004	-0.0747	-0.0152	0.0062	-0.0005	0.0303	0.0079	0.0077
Stanlib Bond Fund Class B3	0.0031	0.0035	-0.0007	0.0141	-0.0775	-0.0159	0.0064	-0.0010	0.0318	0.0089	0.0083
Stanlib Bond Fund R Class	0.0027	0.0032	-0.0009	0.0004	-0.0751	-0.0152	0.0062	-0.0006	0.0303	0.0079	0.0075
Stanlib Income Fund - B1	0.0033	0.0029	-0.0025	0.0114	-0.1061	-0.0101	0.0032	-0.0005	-0.0826	0.0222	0.0072
Stanlib Income Fund - B4	0.0029	0.0025	-0.0022	0.0094	-0.0951	-0.0062	0.0020	0.0023	-0.0894	0.0171	0.0082
Stanlib Income Fund - Class B2	0.0032	0.0028	-0.0019	0.0108	-0.0976	-0.0089	0.0028	0.0004	-0.0848	0.0207	0.0094
Stanlib Income Fund Class B5	0.0033	0.0029	-0.0024	0.0113	-0.1051	-0.0099	0.0031	-0.0001	-0.0832	0.0219	0.0076
Stanlib Prudential Bond Fund - Class A	0.0043	0.0062	0.0045	-0.0146	0.0063	-0.0266	0.0105	0.0194	0.0520	0.0118	0.0327
Stanlib Prudential Bond Fund - Class B1	0.0057	0.0076	0.0086	0.0122	0.0096	-0.0291	0.0129	0.0177	0.0566	0.0137	0.0438

Table B6:
Conditional Multi-index model performance results

Below I present the performance results as measured by the conditional multi-index model for each of the evaluation periods. The conditional alpha ("α_p") is regressed for each bond fund in my sample as well as for the benchmark indecies. I consider the JSE ALBI, the JSE ALSI and the default spread as my indecies, with the term spread, the IRW and a dummy variable for the month of January being considered as predetermined information variables applied to the conditional multi-index model. The sign of the conditional alpha indicates whether the fund generated superior risk-adjusted returns to those by the market. As such, a postive conditional alpha (presented in green) would indicate outperformance, and a negative conditional alpha (presented in red) would indicate underperformances.

Evaluation periods	**Jul '08 to Dec '16**	**Jul '08 to Dec '12**	**Jan '13 to Dec '16**	**Jul '08 to Dec '09**	**Jan '10 to Dec '10**	**Jan '11 to Dec '11**	**Jan '12 to Dec '12**	**Jan '13 to Dec '13**	**Jan '14 to Dec '14**	**Jan '15 to Dec '15**	**Jan '16 to Dec '16**
Portfolio conditional mean alpha (α)	0.0037	0.0049	0.0145	0.0331	-0.1629	-0.2012	0.0069	-0.0812	-0.2316	0.0055	-0.0558
Fund name											
Absa Bond Class A	0.0075	0.0092	0.0101	0.0252	-0.2311	-0.2300	0.0077	-0.0550	-0.2477	0.0043	-0.0819
Absa Bond Class B	0.0064	0.0079	0.0075	0.0206	-0.1928	-0.1886	0.0061	-0.0529	-0.2043	0.0062	-0.0751
Af Investments Pure Fixed Interest	0.0040	0.0050	-0.0008	0.0153	-0.4302	-0.3136	0.0056	0.3368	-0.3865	0.0882	-0.0351
Allan Gray Bond Fund	0.0030	0.0030	0.0191	0.0103	-0.1285	-0.2529	0.0117	-0.0380	-0.3438	0.0034	-0.0554
Citadel Sa Bond H4 Fund B1	0.0030	0.0007	0.0081	0.0117	0.1195	-0.1747	0.0095	-0.3080	-0.4938	0.0751	-0.0037
Coronation Bond Fund B	0.0049	0.0056	-0.0070	0.0099	-0.5078	-0.3256	0.0067	0.2620	-0.3674	0.0701	-0.0046
Coronation Bond Fund R	0.0056	0.0061	-0.0070	0.0191	-0.5938	-0.3874	0.0080	0.3211	-0.4297	0.0904	-0.0066
Counterpoint Met Enhanced Income	-0.0052	-0.0071	0.0078	0.0085	-0.0883	-0.3133	-0.0041	0.0048	-0.0162	0.1310	0.0451
Investec Corporate Bond Fund Class Z	0.0073	0.0082	0.0139	0.0251	-0.2366	-0.2679	0.0117	-0.0613	-0.5006	-0.0219	-0.0880
Investec Gilt Fund Class A	0.0062	0.0073	0.0151	0.0240	-0.2483	-0.2121	0.0096	0.0039	-0.3031	-0.0002	-0.0669
Investec Gilt Fund Class B	0.0062	0.0074	0.0151	0.0246	-0.2483	-0.2114	0.0095	0.0038	-0.3043	-0.0002	-0.0673
Investec Gilt Fund Class C	0.0051	0.0057	0.0129	0.0110	-0.2208	-0.1811	0.0083	0.0083	-0.2698	0.0012	-0.0605
Investec Gilt Fund Class R	0.0064	0.0076	0.0158	0.0251	-0.2584	-0.2207	0.0099	0.0099	-0.3125	0.0000	-0.0690
Investec High Income Fund Class A	-0.0041	-0.0043	0.0078	0.0094	-0.0693	-0.2865	-0.0108	0.0297	-0.0699	0.0947	0.0655
Investec High Income Fund Class B	-0.0062	-0.0070	0.0079	-0.0097	-0.0701	-0.2864	-0.0107	0.0301	-0.0716	0.0946	0.0657
Investec High Income Fund Class C	-0.0067	-0.0077	0.0077	-0.0097	-0.0399	-0.2551	-0.0105	0.0301	-0.0718	0.0946	0.0637

Momentum Bond Fund (A)	0.0080	0.0112	0.0107	0.0349	-0.3549	-0.2116	0.0058	-0.1498	-0.2989	0.0165	-0.0978
Momentum Bond Fund (B1)	0.0080	0.0112	0.0107	0.0349	-0.3549	-0.2116	0.0058	-0.1498	-0.2989	0.0165	-0.0978
Momentum Bond Fund (B2)	0.0069	0.0093	0.0095	0.0261	-0.3499	-0.2055	0.0054	-0.1548	-0.2800	0.0172	-0.0926
Momentum Bond Fund (B3)	0.0069	0.0092	0.0098	0.0253	-0.3440	-0.1989	0.0055	-0.1495	-0.2857	0.0167	-0.0941
Momentum Bond Fund (B4)	0.0078	0.0102	0.0127	0.0253	-0.3800	-0.2394	0.0065	-0.1511	-0.3265	0.0154	-0.1061
Momentum Bond Fund (B7)	0.0080	0.0111	0.0107	0.0344	-0.3551	-0.2117	0.0058	-0.1498	-0.2989	0.0164	-0.0975
Momentum Bond Fund Class C1	0.0074	0.0098	0.0114	0.0271	-0.3621	-0.2208	0.0061	-0.1501	-0.3089	0.0164	-0.1000
Momentum Inflation Linked Bond A	0.0044	0.0039	0.0216	0.0189	-0.0503	-0.1618	0.0121	-0.1513	-0.0402	0.0232	-0.0569
Momentum Mom Active Bond Fund	0.0071	0.0074	0.0187	0.0011	0.0279	-0.0375	0.0106	-0.0467	-0.1365	-0.0508	-0.0277
Momentum Mom Managed Bond Fund	0.0053	0.0057	0.0217	-0.0040	-0.0184	-0.1484	0.0123	-0.0425	-0.2603	0.0130	-0.0671
Nedgroup Investments Core Bond Fund A	0.0047	0.0055	0.0208	0.0207	-0.2425	-0.2560	0.0077	-0.0529	-0.2970	-0.0037	-0.0695
Nedgroup Investments Core Bond Fund B	0.0024	0.0026	0.0170	0.0079	0.0079	-0.2014	0.0054	-0.0499	-0.2395	-0.0029	-0.0587
Nedgroup Investments Core Bond Fund R	0.0048	0.0055	0.0207	0.0208	0.0208	-0.2554	0.0077	-0.0515	-0.2978	-0.0037	-0.0691
Oasis Bond Fund	0.0000	0.0005	0.0006	0.0193	-0.1003	-0.1591	0.0023	-0.0326	-0.0201	0.0103	0.0080
Old Mutual Bond Fund B	0.0095	0.0112	0.0343	0.0332	0.0018	-0.1036	0.0150	-0.4011	-0.1852	-0.1183	-0.1069
Old Mutual Bond Fund C	0.0079	0.0096	0.0268	0.0263	-0.0148	-0.0758	0.0122	-0.3217	-0.1529	-0.0928	-0.0852
Old Mutual Bond Fund R	0.0110	0.0137	0.0335	0.0435	-0.0001	-0.1010	0.0122	-0.3936	-0.1829	-0.1161	-0.0852
Prescient Bond Quantplus Fund - A1	0.0017	0.0025	0.0032	0.0006	-0.5406	-0.3697	0.0044	0.2782	-0.3218	0.0932	-0.0339
Prudential High Yield Bond Fund	0.0079	0.0096	0.0164	0.0286	-0.3102	-0.2832	0.0098	0.0035	-0.3398	-0.0185	-0.0447
Sanlam Select Bond Plus Fund B2	0.0018	0.0034	0.0007	-0.0035	-0.0187	0.0581	0.0044	-0.0474	0.0033	-0.0087	-0.0116
Sanlam Select Bond Plus Fund B6	0.0016	0.0034	-0.0018	-0.0035	-0.0182	0.0596	0.0044	-0.0477	0.0008	-0.0290	-0.0114
Sanlam Select Bond Plus Fund B8	0.0016	0.0033	0.0033	-0.0036	-0.0170	0.0592	0.0043	-0.0474	0.0045	-0.0208	-0.0214
Sim Bond Plus Fund	0.0107	0.0127	0.0304	0.0435	0.0131	-0.0900	0.0130	-0.3724	-0.2199	-0.1182	-0.1171
Sim Bond Plus Fund B2	0.0096	0.0104	0.0331	0.0353	0.0188	-0.1008	0.0140	-0.4018	-0.2318	-0.1278	-0.1250
Sim Bond Plus Fund B3	0.0176	0.0204	0.0342	0.1086	0.0220	-0.1044	0.0144	-0.4124	-0.2361	-0.1311	-0.1280
Smm Bond Fund B2	-0.0503	-0.0372	-0.0010	0.7195	0.0164	-0.0082	-0.0007	-0.0603	-0.0727	0.0105	-0.0313
Stanlib Bond Fund - Class B4	0.0078	0.0096	0.0124	0.0224	-0.2689	-0.2021	0.0106	-0.0643	-0.2020	-0.0013	-0.0877
Stanlib Bond Fund A Class	0.0097	0.0123	0.0150	0.0381	-0.3149	-0.2426	0.0123	-0.0653	-0.2450	-0.0023	-0.0957
Stanlib Bond Fund Class B3	0.0091	0.0110	0.0158	0.0274	-0.3257	-0.2549	0.0129	-0.0660	-0.2585	-0.0030	-0.0983
Stanlib Bond Fund R Class	0.0097	0.0123	0.0148	0.0381	-0.3163	-0.2432	0.0123	-0.0653	-0.2451	-0.0026	-0.0952
Stanlib Income Fund - B1	-0.0020	-0.0038	0.0235	0.0037	-0.1329	-0.3392	0.0021	-0.0081	-0.2998	0.0873	-0.0072
Stanlib Income Fund - B4	-0.0035	-0.0055	0.0206	-0.0021	-0.0716	-0.2779	-0.0005	-0.0059	-0.2349	0.0877	-0.0052
Stanlib Income Fund - Class B2	-0.0025	-0.0043	0.0232	0.0020	-0.1289	-0.3200	0.0013	-0.0074	-0.2809	0.0877	-0.0052
Stanlib Income Fund Class B5	-0.0021	-0.0039	0.0234	0.0033	-0.1304	-0.3349	0.0020	-0.0076	-0.2966	0.0869	-0.0066
Stanlib Prudential Bond Fund - Class A	0.0067	0.0069	0.0282	0.0293	0.1824	-0.1749	0.0158	-0.3462	-0.1261	-0.1007	-0.1323
Stanlib Prudential Bond Fund - Class B1	0.0051	0.0043	0.0358	0.0160	0.1845	-0.1842	0.0129	-0.4030	-0.1351	-0.1082	-0.1651

Appendix C – Performance persistence results

Table C1:
Performance persistence results using Contigency Tables and Sharpe ratio as a performance measure

Below I present the performance persistence results for each fund in my sample using the contigency tables and the Sharpe ratio as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	Jul '08 to Dec '12 & Jan '13 to Dec '16	Jul '08 to Dec '09 & Jan '10 to Dec '10	Jan '10 to Dec '10 & Jan '11 to Dec '11	Jan '11 to Dec '11 & Jan '12 to Dec '12	Jan '12 to Dec '12 & Jan '13 to Dec '13	Jan '13 to Dec '13 & Jan '14 to Dec '14	Jan '14 to Dec '14 & Jan '15 to Dec '15	Jan '15 to Dec '15 & Jan '16 to Dec '16
Fund name								
Absa Bond Class A	WW	WL	LL	LL	LL	LW	WW	WW
Absa Bond Class B	WW	WW	WL	LL	LL	LW	WW	WW
Af Investments Pure Fixed Interest	LW	LW	WW	WL	LL	LL	LW	WW
Allan Gray Bond Fund	WW	WW	WW	WL	LL	LW	WL	LW
Citadel Sa Bond H4 Fund B1	LW	WL	LL	LW	WW	WL	LW	WW
Coronation Bond Fund B	LW	LW	WW	WL	LW	WW	WW	WW
Coronation Bond Fund R	WW	WL	LW	WL	LW	WW	WW	WW
Counterpoint Met Enhanced Income A	LL	LL	LL	LL	LW	WL	LW	WL
Investec Corporate Bond Fund Class Z	WL	WW	WL	LW	WL	LL	LL	LW
Investec Gilt Fund Class A	WW	WW	WL	LW	WL	LW	WL	LW
Investec Gilt Fund Class B	WW	WW	WL	LW	WL	LW	WL	LW
Investec Gilt Fund Class C	WW	WW	WL	LW	WL	LW	WL	LW
Investec Gilt Fund Class R	WW	WW	WL	LW	WL	LW	WL	LW
Investec High Income Fund Class A	LL	LL	LW	WL	LW	WL	LW	WL
Investec High Income Fund Class B	LL	LL	LW	WL	LW	WL	LW	WL
Investec High Income Fund Class C	LL	LL	LW	WL	LW	WL	LW	WL
Momentum Bond Fund (A)	WW	WW	WL	LW	WL	LW	WL	LW
Momentum Bond Fund (B1)	WW	LW	WL	LW	WL	LW	WL	LW

Momentum Bond Fund (B2)	WW	LW	WL	LW	WL	LW	WL	LW
Momentum Bond Fund (B3)	WW	LW	WL	LW	WL	LW	WL	LW
Momentum Bond Fund (B4)	WW	LW	WL	LW	WL	LW	WL	LW
Momentum Bond Fund (B7)	WW	WW	WL	LW	WL	LW	WL	LW
Momentum Bond Fund Class C1	WW	LW	WL	LW	WL	LW	WL	LW
Momentum Inflation Linked Bond A	WW	LL	LW	WW	WW	WW	WW	WL
Momentum Mom Active Bond Fund	WW	WL	LW	WW	WW	WW	WL	LW
Momentum Mom Managed Bond Fund	WW	WW	WL	LW	WW	WW	WL	LW
Nedgroup Investments Core Bond A	WL	WW	WL	LL	LL	LW	WL	LW
Nedgroup Investments Core Bond B	WL	WW	WL	LL	LL	LW	WL	LW
Nedgroup Investments Core Bond R	WL	WW	WL	LL	LL	LW	WL	LW
Oasis Bond Fund	WL	WW	WW	WL	LL	LL	LW	WW
Old Mutual Bond Fund B	WW	WL	LL	LW	WW	WW	WL	LW
Old Mutual Bond Fund C	WW	WW	WL	LW	WW	WW	WL	LW
Old Mutual Bond Fund R	WW	WL	LL	LW	WW	WW	WL	LW
Prescient Bond Quantplus Fund - A1	LW	LL	LL	LL	LL	LW	WW	WW
Prudential High Yield Bond Fund	WL	WW	WL	LW	WL	LW	WL	LW
Sanlam Select Bond Plus Fund B2	WW	WW	WL	LL	LW	WW	WW	WW
Sanlam Select Bond Plus Fund B6	WW	WW	WL	LL	LW	WW	WW	WW
Sanlam Select Bond Plus Fund B8	WW	WW	WL	LL	LW	WW	WW	WW
Sim Bond Plus Fund	WW	WL	LL	LW	WW	WW	WL	LW
Sim Bond Plus Fund B2	WW	WL	LL	LW	WW	WW	WL	LW
Sim Bond Plus Fund B3	LW	LL	LL	LW	WW	WW	WL	LW
Smm Bond Fund B2	LW	LW	WL	LL	LL	LW	WW	WW
Stanlib Bond Fund - Class B4	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund A Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund Class B3	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund R Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Income Fund - B1	LL	LL	LL	LL	LW	WL	LW	WL
Stanlib Income Fund - B4	LL	LL	LW	WL	LL	LL	LW	WL
Stanlib Income Fund - Class B2	LL	LL	LW	WL	LW	WL	LW	WL
Stanlib Income Fund Class B5	LL	LL	LL	LL	LW	WL	LW	WL
Stanlib Prudential Bond Fund - Class A	WW	WL	LL	LW	WW	WW	WL	LW
Stanlib Prudential Bond Fund - Class B1	WW	WL	LL	LW	WW	WW	WL	LW

Table C2:

Performance persistence results using Contigency Tables and Modified Sharpe ratio as a performance measure

Below I present the performance persistence results for each fund in the sample using the contigency tables and the modified Sharpe ratio as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	**Jul '08 to Dec '12 & Jan '13 to Dec '16**	**Jul '08 to Dec '09 & Jan '10 to Dec '10**	**Jan '10 to Dec '10 & Jan '11 to Dec '11**	**Jan '11 to Dec '11 & Jan '12 to Dec '12**	**Jan '12 to Dec '12 & Jan '13 to Dec '13**	**Jan '13 to Dec '13 & Jan '14 to Dec '14**	**Jan '14 to Dec '14 & Jan '15 to Dec '15**	**Jan '15 to Dec '15 & Jan '16 to Dec '16**
Fund name								
Absa Bond Class A	LL	LW	WW	WL	LW	WL	LW	WW
Absa Bond Class B	LL	LW	WW	WL	LW	WL	LW	WW
Af Investments Pure Fixed Interest	WL	WW	WW	WL	LL	LL	LW	WW
Allan Gray Bond Fund	LL	LW	WW	WL	LL	LL	LW	WW
Citadel Sa Bond H4 Fund B1	LW	LL	LL	LW	WW	WW	WW	WW
Coronation Bond Fund B	WL	WW	WW	WL	LL	LL	LW	WW
Coronation Bond Fund R	WL	LW	WW	WL	LL	LL	LW	WW
Counterpoint Met Enhanced Income	WW	WW	WW	WL	LL	LW	WW	WW
Investec Corporate Bond Fund Class Z	WW	WL	LW	WL	LL	LW	WW	WL
Investec Gilt Fund Class A	LL	LW	WW	WL	LL	LL	LW	WL
Investec Gilt Fund Class B	LL	LW	WW	WL	LL	LL	LW	WL
Investec Gilt Fund Class C	WL	WL	LW	WL	LL	LL	LW	WL
Investec Gilt Fund Class R	LL	LW	WW	WL	LL	LL	LW	WL
Investec High Income Fund Class A	WW	WW	WW	WW	WW	WW	WL	LW
Investec High Income Fund Class B	WW	LW	WW	WW	WW	WW	WL	LW
Investec High Income Fund Class C	WW	LW	WW	WW	WW	WW	WL	LW
Momentum Bond Fund (A)	LL	LW	WL	LL	LW	WL	LW	WL
Momentum Bond Fund (B1)	LL	LL	LL	LL	LW	WL	LW	WL
Momentum Bond Fund (B2)	LL	LW	WL	LL	LW	WL	LW	WL

Momentum Bond Fund (B3)	LL	LL	LL	LL	LW	WL	LW	WL
Momentum Bond Fund (B4)	LL	LW	WL	LL	LW	WL	LW	WL
Momentum Bond Fund (B7)	LL	LW	WL	LL	LW	WL	LW	WL
Momentum Bond Fund Class C1	LL	LW	WL	LL	LW	WL	LW	WL
Momentum Inflation Linked Bond A	LW	WL	LL	LL	LW	WL	LL	LW
Momentum Mom Active Bond Fund	WL	WW	WW	WL	LL	LL	LL	LL
Momentum Mom Managed Bond Fund	LL	WL	LL	LL	LL	LL	LW	WL
Nedgroup Investments Core Bond A	LL	LW	WW	WL	LL	LL	LW	WL
Nedgroup Investments Core Bond B	WL	LW	WW	WL	LL	LL	LW	WL
Nedgroup Investments Core Bond R	LL	LW	WW	WL	LL	LL	LW	WL
Oasis Bond Fund	WW	LW	WW	WW	WW	WW	WL	LL
Old Mutual Bond Fund B	LL	LL	LL	LW	WW	WL	LL	LL
Old Mutual Bond Fund C	LL	LL	LL	LW	WW	WL	LL	LL
Old Mutual Bond Fund R	LL	LL	LL	LW	WW	WL	LL	LL
Prescient Bond Quantplus Fund - A1	WL	WW	WW	WL	LL	LL	LW	WL
Prudential High Yield Bond Fund	LL	LL	LW	WL	LL	LL	LW	WL
Sanlam Select Bond Plus Fund B2	LL	WL	LL	LW	WW	WL	LL	LL
Sanlam Select Bond Plus Fund B6	LL	WL	LL	LW	WW	WL	LL	LL
Sanlam Select Bond Plus Fund B8	LL	WL	LL	LW	WW	WL	LL	LL
Sim Bond Plus Fund	LL	LL	LL	LW	WW	WL	LL	LL
Sim Bond Plus Fund B2	LL	LL	LL	LW	WW	WL	LL	LL
Sim Bond Plus Fund B3	LL	WL	LL	LW	WW	WL	LL	LL
Smm Bond Fund B2	WL	WL	LL	LW	WW	WL	LL	LL
Stanlib Bond Fund - Class B4	LL	WL	LW	WL	LW	WL	LW	WL
Stanlib Bond Fund A Class	LL	LL	LW	WL	LL	LL	LW	WW
Stanlib Bond Fund Class B3	WL	WL	LW	WL	LL	LL	LW	WW
Stanlib Bond Fund R Class	LL	LL	LW	WL	LL	LL	LW	WW
Stanlib Income Fund - B1	WW	LW	WW	WL	LL	LW	WW	WW
Stanlib Income Fund - B4	WW	LW	WW	WL	LL	LW	WW	WW
Stanlib Income Fund - Class B2	WW	LW	WW	WL	LL	LW	WW	WW
Stanlib Income Fund Class B5	WW	LW	WW	WL	LL	LW	WW	WW
Stanlib Prudential Bond Fund - Class A	LL	LL	LL	LW	WW	WL	LL	LL
Stanlib Prudential Bond Fund - Class B1	LL	LL	LL	LW	WW	WL	LL	LL

Table C3:
Performance persistence results using Contigency Tables and CAPM as a performance measure

Below I present the performance persistence results for each fund in my sample using the contigency tables and the CAPM as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	**Jul '08 to Dec '12 & Jan '13 to Dec '16**	**Jul '08 to Dec '09 & Jan '10 to Dec '10**	**Jan '10 to Dec '10 & Jan '11 to Dec '11**	**Jan '11 to Dec '11 & Jan '12 to Dec '12**	**Jan '12 to Dec '12 & Jan '13 to Dec '13**	**Jan '13 to Dec '13 & Jan '14 to Dec '14**	**Jan '14 to Dec '14 & Jan '15 to Dec '15**	**Jan '15 to Dec '15 & Jan '16 to Dec '16**
Fund name								
Absa Bond Class A	LW	WL	LL	LL	LL	LW	WW	WW
Absa Bond Class B	LW	WL	LL	LL	LL	LW	WW	WW
Af Investments Pure Fixed Interest	LW	LW	WW	WL	LL	LL	LW	WW
Allan Gray Bond Fund	WW	WW	WW	WL	LL	LW	WL	LW
Citadel Sa Bond H4 Fund B1	WL	WL	LL	LW	WL	LL	LW	WW
Coronation Bond Fund B	LW	WL	LW	WL	LW	WW	WW	WW
Coronation Bond Fund R	LW	WL	LW	WL	LW	WW	WW	WW
Counterpoint Met Enhanced Income	WL	WW	WL	LW	WL	LL	LL	LW
Investec Corporate Bond Fund Class Z	LL	WW	WL	LL	LL	LL	LW	WL
Investec Gilt Fund Class A	WW	WL	LL	LW	WL	LW	WL	LW
Investec Gilt Fund Class B	WW	WL	LL	LW	WL	LW	WL	LW
Investec Gilt Fund Class C	WW	WL	LL	LW	WL	LW	WW	WW
Investec Gilt Fund Class R	WW	WL	LL	LW	WL	LW	WL	LW
Investec High Income Fund Class A	LL	LW	WW	WL	LL	LL	LW	WL
Investec High Income Fund Class B	LL	WW	WW	WL	LL	LL	LW	WL
Investec High Income Fund Class C	LL	WW	WW	WL	LL	LL	LW	WL
Momentum Bond Fund (A)	WW	WL	LL	LW	WL	LW	WW	WW
Momentum Bond Fund (B1)	WW	WL	LL	LW	WL	LW	WW	WW
Momentum Bond Fund (B2)	WW	WL	LL	LW	WW	WW	WW	WW

Momentum Bond Fund (B3)	WW	WL	LL	LW	WW	WW	WW	WW
Momentum Bond Fund (B4)	WW	WL	LL	LW	WL	LW	WL	LW
Momentum Bond Fund (B7)	WW	WL	LL	LW	WL	LW	WW	WW
Momentum Bond Fund Class C1	WW	WL	LL	LW	WL	LW	WL	LW
Momentum Inflation Linked Bond A	WL	WW	WW	WW	WW	WW	WW	WL
Momentum Mom Active Bond Fund	WW	WL	LW	WW	WW	WW	WW	WW
Momentum Mom Managed Bond Fund	WW	WW	WL	LW	WW	WW	WL	LW
Nedgroup Investments Core Bond Fund A	WL	WL	LL	LL	LL	LW	WL	LW
Nedgroup Investments Core Bond Fund B	WL	WL	LL	LL	LL	LW	WL	LW
Nedgroup Investments Core Bond Fund R	WL	WL	LL	LL	LL	LW	WL	LW
Oasis Bond Fund	WL	WW	WW	WL	LL	LL	LW	WL
Old Mutual Bond Fund B	WW	WL	LL	LW	WW	WW	WL	LW
Old Mutual Bond Fund C	WW	WL	LL	LW	WW	WW	WL	LW
Old Mutual Bond Fund R	WW	WL	LL	LW	WW	WW	WL	LW
Prescient Bond Quantplus Fund - A1	LW	WL	LW	WL	LL	LL	LW	WW
Prudential High Yield Bond Fund	WW	WL	LL	LW	WW	WL	LL	LW
Sanlam Select Bond Plus Fund B2	LW	WL	LL	LL	LW	WW	WW	WW
Sanlam Select Bond Plus Fund B6	LW	WL	LL	LL	LW	WW	WW	WW
Sanlam Select Bond Plus Fund B8	LW	WL	LL	LL	LW	WW	WW	WW
Sim Bond Plus Fund	WW	WL	LL	LW	WW	WW	WL	LW
Sim Bond Plus Fund B2	WW	WL	LL	LW	WW	WW	WL	LW
Sim Bond Plus Fund B3	WW	WL	LL	LW	WW	WW	WL	LW
Smm Bond Fund B2	LW	LW	WL	LL	LW	WW	WW	WW
Stanlib Bond Fund - Class B4	WW	WW	WW	WW	WW	WW	WW	WW
Stanlib Bond Fund A Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund Class B3	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund R Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Income Fund - B1	WL	WW	WW	WL	LL	LL	LL	LL
Stanlib Income Fund - B4	WL	WW	WW	WL	LL	LL	LL	LL
Stanlib Income Fund - Class B2	WL	WW	WW	WL	LL	LL	LL	LL
Stanlib Income Fund Class B5	WL	WW	WW	WL	LL	LL	LL	LL
Stanlib Prudential Bond Fund - Class A	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Prudential Bond Fund - Class B1	WW	WW	WW	WW	WW	WW	WL	LL

Table C4:

Performance persistence results using Contigency Tables and conditional CAPM as a performance measure

Below I present the performance persistence results for each fund in my sample using the contigency tables and the conditinal CAPM as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	**Jul '08 to Dec '12 & Jan '13 to Dec '16**	**Jul '08 to Dec '09 & Jan '10 to Dec '10**	**Jan '10 to Dec '10 & Jan '11 to Dec '11**	**Jan '11 to Dec '11 & Jan '12 to Dec '12**	**Jan '12 to Dec '12 & Jan '13 to Dec '13**	**Jan '13 to Dec '13 & Jan '14 to Dec '14**	**Jan '14 to Dec '14 & Jan '15 to Dec '15**	**Jan '15 to Dec '15 & Jan '16 to Dec '16**
Fund name								
Absa Bond Class A	WW	WL	LW	WW	WW	WL	LL	LW
Absa Bond Class B	WW	WL	LW	WW	WW	WL	LL	LW
Af Investments Pure Fixed Interest Unit Trust A	WW	WW	WL	LW	WW	WL	LL	LW
Allan Gray Bond Fund	WW	LL	LW	WW	WW	WW	WL	LW
Citadel Sa Bond H4 Fund B1	LW	LL	LW	WL	LL	LL	LL	LW
Coronation Bond Fund B	WW	WW	WL	LW	WW	WL	LL	LW
Coronation Bond Fund R	WW	WW	WL	LW	WW	WL	LL	LW
Counterpoint Met Enhanced Income Fund (A)	LL	LL	LL	LL	LL	LL	LW	WL
Investec Corporate Bond Fund Class Z	WW	WW	WW	WW	WW	WW	WL	LW
Investec Gilt Fund Class A	WW	WW	WL	LW	WW	WW	WL	LW
Investec Gilt Fund Class B	WW	WW	WL	LW	WW	WW	WL	LW
Investec Gilt Fund Class C	WW	WW	WL	LW	WW	WW	WL	LW
Investec Gilt Fund Class R	WW	WW	WL	LW	WW	WW	WL	LW
Investec High Income Fund Class A	LL	LL	LL	LL	LL	LL	LW	WL
Investec High Income Fund Class B	LL	LL	LL	LL	LL	LL	LW	WL
Investec High Income Fund Class C	LL	LL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund (A)	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Bond Fund (B1)	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Bond Fund (B2)	WW	WW	WW	WW	WW	WW	WL	LL

Momentum Bond Fund (B3)	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Bond Fund (B4)	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Bond Fund (B7)	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Bond Fund Class C1	WW	WW	WW	WW	WW	WW	WL	LL
Momentum Inflation Linked Bond Portfolio (A)	WL	LL	LW	WW	WL	LW	WW	WL
Momentum Mom Active Bond Fund	WW	WW	WL	LW	WW	WW	WL	LW
Momentum Mom Managed Bond Fund	WW	WW	WL	LW	WW	WW	WL	LW
Nedgroup Investments Core Bond Fund A	WW	WW	WW	WW	WW	WW	WL	LW
Nedgroup Investments Core Bond Fund B	LL	WW	WL	LL	LW	WW	WL	LW
Nedgroup Investments Core Bond Fund R	WW	WW	WW	WW	WW	WW	WL	LW
Oasis Bond Fund	LL	WW	WL	LL	LL	LW	WW	WL
Old Mutual Bond Fund B	WW	WW	WW	WL	LW	WW	WW	WW
Old Mutual Bond Fund C	WW	WW	WL	LL	LW	WW	WL	LW
Old Mutual Bond Fund R	WW	WW	WW	WL	LW	WW	WL	LW
Prescient Bond Quantplus Fund - A1	WW	WW	WW	WW	WW	WL	LL	LW
Prudential High Yield Bond Fund	WW	WW	WL	LW	WW	WW	WL	LW
Sanlam Select Bond Plus Fund B2	WL	WW	WL	LL	LL	LL	LL	LL
Sanlam Select Bond Plus Fund B6	WL	WW	WL	LL	LL	LL	LL	LL
Sanlam Select Bond Plus Fund B8	WL	WW	WL	LL	LL	LL	LL	LL
Sim Bond Plus Fund	WW	WW	WW	WL	LW	WW	WW	WW
Sim Bond Plus Fund B2	WW	WW	WW	WL	LW	WW	WW	WW
Sim Bond Plus Fund B3	LW	WW	WW	WL	LW	WW	WW	WW
Smm Bond Fund B2	LL	LL	LL	LL	LL	LL	LW	WL
Stanlib Bond Fund - Class B4	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund A Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund Class B3	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Bond Fund R Class	WW	WW	WW	WW	WW	WW	WL	LW
Stanlib Income Fund - B1	LL	LL	LL	LL	LL	LL	LW	WL
Stanlib Income Fund - B4	LL	LL	LL	LL	LL	LL	LW	WL
Stanlib Income Fund - Class B2	LL	LL	LL	LL	LL	LL	LW	WL
Stanlib Income Fund Class B5	LL	LL	LL	LL	LL	LL	LW	WL
Stanlib Prudential Bond Fund - Class A	WW	WL	LW	WL	LW	WW	WW	WW
Stanlib Prudential Bond Fund - Class B1	LW	LL	LW	WL	LW	WW	WW	WW

Table C5:

Performance persistence results using Contigency Tables and multi-index model as a performance measure

Below I present the performance persistence results for each fund in my sample using the contigency tables and the multi-index model as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	**Jul '08 to Dec '12 & Jan '13 to Dec '16**	**Jul '08 to Dec '09 & Jan '10 to Dec '10**	**Jan '10 to Dec '10 & Jan '11 to Dec '11**	**Jan '11 to Dec '11 & Jan '12 to Dec '12**	**Jan '12 to Dec '12 & Jan '13 to Dec '13**	**Jan '13 to Dec '13 & Jan '14 to Dec '14**	**Jan '14 to Dec '14 & Jan '15 to Dec '15**	**Jan '15 to Dec '15 & Jan '16 to Dec '16**
Fund name								
Absa Bond Class A	LL	LL	LW	WW	WL	LW	WL	LW
Absa Bond Class B	LL	LL	LW	WL	LL	LW	WL	LW
Af Investments Pure Fixed Interest Unit Trust A	LL	LL	LW	WL	LL	LL	LW	WL
Allan Gray Bond Fund	LW	LL	LW	WL	LL	LL	LW	WL
Citadel Sa Bond H4 Fund B1	WL	LW	WL	LW	WW	WL	LW	WL
Coronation Bond Fund B	LL	LL	LW	WL	LL	LL	LL	LL
Coronation Bond Fund R	LL	LL	LW	WL	LL	LL	LL	LL
Counterpoint Met Enhanced Income Fund (A)	LL	LL	LW	WL	LW	WL	LL	LL
Investec Corporate Bond Fund Class Z	WL	LL	LL	LW	WL	LW	WW	WW
Investec Gilt Fund Class A	LW	LL	LL	LW	WL	LW	WW	WW
Investec Gilt Fund Class B	LW	LL	LL	LW	WL	LW	WW	WW
Investec Gilt Fund Class C	LW	LW	WW	WL	LL	LW	WL	LL
Investec Gilt Fund Class R	LW	LL	LL	LW	WL	LW	WW	WW
Investec High Income Fund Class A	LL	LL	LW	WL	LW	WL	LL	LL
Investec High Income Fund Class B	LL	LL	LW	WL	LW	WL	LL	LL
Investec High Income Fund Class C	LL	LL	LW	WL	LW	WL	LL	LL
Momentum Bond Fund (A)	LW	LL	LL	LL	LL	LW	WW	WL
Momentum Bond Fund (B1)	LW	LL	LL	LL	LL	LW	WW	WL
Momentum Bond Fund (B2)	LW	LL	LL	LL	LL	LW	WW	WL

Momentum Bond Fund (B3)	LW	LL	LL	LL	LL	LW	WW	WL
Momentum Bond Fund (B4)	LW	LL	LL	LW	WL	LW	WW	WL
Momentum Bond Fund (B7)	LW	LL	LL	LL	LL	LW	WW	WL
Momentum Bond Fund Class C1	LW	LL	LL	LW	WL	LW	WW	WL
Momentum Inflation Linked Bond Portfolio (A)	WW	LW	WL	LW	WW	WL	LW	WW
Momentum Mom Active Bond Fund	WW	LW	WW	WW	WL	LW	WW	WW
Momentum Mom Managed Bond Fund	WW	LW	WW	WW	WL	LW	WW	WW
Nedgroup Investments Core Bond Fund A	LW	LL	LL	LL	LL	LW	WW	WW
Nedgroup Investments Core Bond Fund B	LW	LL	LW	WL	LL	LW	WW	WW
Nedgroup Investments Core Bond Fund R	LL	LL	LL	LL	LL	LW	WW	WW
Oasis Bond Fund	LL	LL	LW	WL	LW	WW	WL	LL
Old Mutual Bond Fund B	WW	LW	WL	LW	WW	WW	WL	LW
Old Mutual Bond Fund C	WW	LW	WL	LW	WW	WW	WL	LW
Old Mutual Bond Fund R	WW	LW	WL	LW	WW	WW	WL	LW
Prescient Bond Quantplus Fund - A1	LL	LL	LW	WL	LL	LL	LW	WL
Prudential High Yield Bond Fund	LW	LL	LL	LW	WL	LW	WW	WL
Sanlam Select Bond Plus Fund B2	LW	LW	WW	WL	LW	WL	LL	LL
Sanlam Select Bond Plus Fund B6	LL	LW	WW	WL	LW	WL	LL	LL
Sanlam Select Bond Plus Fund B8	LW	LW	WW	WL	LW	WL	LL	LL
Sim Bond Plus Fund	WW	LW	WL	LW	WW	WW	WW	WW
Sim Bond Plus Fund B2	WW	LW	WL	LW	WW	WW	WW	WW
Sim Bond Plus Fund B3	WW	WW	WL	LW	WW	WW	WW	WW
Smm Bond Fund B2	LL	WW	WW	WL	LW	WL	LL	LL
Stanlib Bond Fund - Class B4	WL	LL	LW	WW	WL	LW	WL	LL
Stanlib Bond Fund A Class	WL	LL	LL	LW	WL	LW	WL	LL
Stanlib Bond Fund Class B3	WL	LL	LL	LW	WL	LW	WL	LL
Stanlib Bond Fund R Class	WL	LL	LL	LW	WL	LW	WL	LL
Stanlib Income Fund - B1	WL	LL	LW	WL	LL	LL	LW	WL
Stanlib Income Fund - B4	LL	LL	LW	WL	LL	LL	LW	WL
Stanlib Income Fund - Class B2	WL	LL	LW	WL	LL	LL	LW	WL
Stanlib Income Fund Class B5	WL	LL	LW	WL	LL	LL	LW	WL
Stanlib Prudential Bond Fund - Class A	WW	LW	WL	LW	WW	WW	WL	LW
Stanlib Prudential Bond Fund - Class B1	WW	LW	WL	LW	WW	WW	WW	WW

Table C6:

Performance persistence results using Contigency Tables and conditional multi-index model as a performance measure

Below I present the performance persistence results for each fund in my sample using the contigency tables and the conditional multi-index model as a performance measure. Under the contigency tables approach, funds exhibithing performances that are above mean returns in two consecutive periods are categorised as winners ("WW"), while those exhibiting below mean return performances are categorised as losers ("LL"). However, funds that perform above mean peformance during the first period but below average during the second periods are categorised as winner-loser funds ("WL"). Finally, those funds that improve their performance from below average in the first period to above average in the second period are categorised as loser-winner funds ("LW").

Evaluation periods	Jul '08 to Dec '12 & Jan '13 to Dec '16	Jul '08 to Dec '09 & Jan '10 to Dec '10	Jan '10 to Dec '10 & Jan '11 to Dec '11	Jan '11 to Dec '11 & Jan '12 to Dec '12	Jan '12 to Dec '12 & Jan '13 to Dec '13	Jan '13 to Dec '13 & Jan '14 to Dec '14	Jan '14 to Dec '14 & Jan '15 to Dec '15	Jan '15 to Dec '15 & Jan '16 to Dec '16
Fund name								
Absa Bond Class A	WL	LL	LL	LW	WW	WL	LL	LL
Absa Bond Class B	WL	LL	LW	WL	LW	WW	WW	WL
Af Investments Pure Fixed Interest Unit Trust A	WL	LL	LL	LL	LW	WL	LW	WW
Allan Gray Bond Fund	LW	LW	WL	LW	WW	WL	LL	LW
Citadel Sa Bond H4 Fund B1	LL	LW	WW	WW	WL	LL	LW	WW
Coronation Bond Fund B	WL	LL	LL	LL	LW	WL	LW	WW
Coronation Bond Fund R	WL	LL	LL	LW	WW	WL	LW	WW
Counterpoint Met Enhanced Income Fund (A)	LL	LW	WL	LL	LW	WW	WW	WW
Investec Corporate Bond Fund Class Z	WL	LL	LL	LW	WW	WL	LL	LL
Investec Gilt Fund Class A	WW	LL	LL	LW	WW	WL	LL	LL
Investec Gilt Fund Class B	WW	LL	LL	LW	WW	WL	LL	LL
Investec Gilt Fund Class C	WL	LL	LW	WW	WW	WL	LL	LL
Investec Gilt Fund Class R	WW	LL	LL	LW	WW	WL	LL	LL
Investec High Income Fund Class A	LL	LW	WL	LL	LW	WW	WW	WW
Investec High Income Fund Class B	LL	LW	WL	LL	LW	WW	WW	WW
Investec High Income Fund Class C	LL	LW	WL	LL	LW	WW	WW	WW
Momentum Bond Fund (A)	WL	WL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund (B1)	WL	WL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund (B2)	WL	LL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund (B3)	WL	LL	LW	WL	LL	LL	LW	WL

Momentum Bond Fund (B4)	WL	LL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund (B7)	WL	WL	LL	LL	LL	LL	LW	WL
Momentum Bond Fund Class C1	WL	LL	LL	LL	LL	LL	LW	WL
Momentum Inflation Linked Bond Portfolio (A)	LW	LW	WW	WW	WL	LW	WW	WL
Momentum Mom Active Bond Fund	WW	LW	WW	WW	WW	WW	WL	LW
Momentum Mom Managed Bond Fund	WW	LW	WW	WW	WW	WL	LW	WL
Nedgroup Investments Core Bond Fund A	WW	LL	LL	LW	WW	WL	LL	LL
Nedgroup Investments Core Bond Fund B	LW	LW	WL	LL	LW	WL	LL	LL
Nedgroup Investments Core Bond Fund R	WW	LW	WL	LW	WW	WL	LL	LL
Oasis Bond Fund	LL	LW	WW	WL	LW	WW	WW	WW
Old Mutual Bond Fund B	WW	WW	WW	WW	WL	LW	WL	LL
Old Mutual Bond Fund C	WW	LW	WW	WW	WL	LW	WL	LL
Old Mutual Bond Fund R	WW	WW	WW	WW	WL	LW	WL	LL
Prescient Bond Quantplus Fund - A1	LL	LL	LL	LL	LW	WL	LW	WW
Prudential High Yield Bond Fund	WW	LL	LL	LW	WW	WL	LL	LW
Sanlam Select Bond Plus Fund B2	LL	LW	WW	WL	LW	WW	WL	LW
Sanlam Select Bond Plus Fund B6	LL	LW	WW	WL	LW	WW	WL	LW
Sanlam Select Bond Plus Fund B8	LL	LW	WW	WL	LW	WW	WL	LW
Sim Bond Plus Fund	WW	WW	WW	WW	WL	LW	WL	LL
Sim Bond Plus Fund B2	WW	WW	WW	WW	WL	LL	LL	LL
Sim Bond Plus Fund B3	WW	WW	WW	WW	WL	LL	LL	LL
Smm Bond Fund B2	LL	WW	WW	WL	LW	WW	WW	WW
Stanlib Bond Fund - Class B4	WL	LL	LL	LW	WW	WW	WL	LL
Stanlib Bond Fund A Class	WW	WL	LL	LW	WW	WL	LL	LL
Stanlib Bond Fund Class B3	WW	LL	LL	LW	WW	WL	LL	LL
Stanlib Bond Fund R Class	WW	WL	LL	LW	WW	WL	LL	LL
Stanlib Income Fund - B1	LW	LW	WL	LL	LW	WL	LW	WW
Stanlib Income Fund - B4	LW	LW	WL	LL	LW	WL	LW	WW
Stanlib Income Fund - Class B2	LW	LW	WL	LL	LW	WL	LW	WW
Stanlib Income Fund Class B5	LW	LW	WL	LL	LW	WL	LW	WW
Stanlib Prudential Bond Fund - Class A	WW	LW	WW	WW	WL	LW	WL	LL
Stanlib Prudential Bond Fund - Class B1	LW	LW	WW	WW	WL	LW	WL	LL