ALTERNATIVE FIXED INCOME INDEXATION

A STUDY ON FUNDAMENTAL INDEXES IN THE SOUTH AFRICAN CORPORATE BOND MARKET

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ABSTRACT

Indexation serves as a cornerstone of the asset management field. As such, asset managers across the globe are constantly testing different methodologies to find one which provides consistent superior performance against the rest. While previously, market capitalization weighted indexes have been the popular and simpler method to implement, the search of outperformance has evolved from only focusing on picking securities from larger institutions and has expanded to trying out various weighting methods so as to maximize on the best performing instruments. As yet, there is no definite winner, with the success of most methods being largely influenced by the type of market for which the index is intended as well as the macro-economic environment prevailing during the period. However, the fundamental indexation method has recently gained popularity, particularly in the global equity markets. This research paper explores the method of fundamental indexation and applies it to the corporate fixed income section of the South African market. The main aim is to determine whether the significant outperformance, which has been found in global fixed income markets as well as global and domestic equity markets, will hold true when the method is implemented on domestic bonds.

This investigation uses the current domestic market corporate bond index, the OTHI, as a benchmark against two alternative bond indexes created using the fundamental indexing methodology. The first alternative index is a direct replication of the OTHI and has identical constituents to those of the original. This is called the OTHI_ALT. However, finding that the OTHI is heavily influenced by the debt issues of the government and other parastatal companies, a second more diverse index is created. This is named the SAFI_ALT, which maintains the same number of constituents in each period as the OTHI, but uses different universe selection methods and thus has different constituents. The study creates four sub-indexes for both the OTHI_ALT and the SAFI_ALT, using the fundamental metrics of the companies whose securities are included in the index. The fundamentals used are Sales, Cash Flow and Book Value, and in addition a Composite of all three fundamentals.

The cumulative OTHI_ALT returns over 2002 to 2013 are greater than those of the original index; while SAFI_ALT outperformed the original OTHI, but with half the returns premium as the OTHI_ALT. The results also show that in the domestic market, the Book Value indexes outperform the Sales and Cash Flow indexes. This is opposite to what other global studies have found, as they suggest Sales indexes to be the most superior fundamental metric. Domestically, the performance of the Sales index is found to be

markedly smaller compared to more developed economies, such as the United States, or found within equity indexes of most countries. Regression analysis further proves that the returns from all the indexes are significantly greater than zero. However, all these results are before transaction costs have been accounted for.

Furthermore, the main measure of interest rate risk on fixed income securities, duration, reveals that the SAFI_ALT has significantly lower duration than both its counterparts; with the fundamental OTHI_ALT being comparable to the OTHI over most periods. Other forms of performance evaluations are also undertaken, and these reveal that for the most part, the return provided per unit of risk by both sets of alternative indexes is greater than that provided by the original OTHI. As such the study finds evidence in support of the superiority of fundamental indexation in the domestic fixed income market.

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1. INTRODUCTION

1.1. INTRODUCTION

Indexation is a central feature amongst capital markets across the world. Indexes are defined as a combination or portfolio of similar securities, that holds assets which are liquid and can be invested in, (Asness, 2006). The domestic stock exchanges of most economies have developed indexes which are a fair representation of their respective markets. For example, in South Africa, the Johannesburg Stock Exchange (JSE) provides the All Share Index (ALSI) which is used as both an investing vehicle as well as a market representative benchmarking structure for equity securities. The JSE also comprises of the All Bond Index (ALBI) which is the fixed income equivalent of the ALSI, (JSE, 2014). Further to this, most asset managers and unit trusts create their own in-house indexes with the purpose of providing superior performance for their clients. Developing the most consistently outperforming index or portfolio is the main goal for most asset managers and as such many different stock selection and index construction methods have been tried out.

Traditionally, most indexes make use of the capitalization weighting (cap-weighting) method. This is where the market capitalization of a security, as calculated by the number of securities in issue multiplied by the market price of the security, is used to determine the weight of the issue in the index. This has been the most widely accepted and used method, for reasons which are mentioned in the following section. Nonetheless, over the last few years, many innovators of modern finance have put forward new indexing methods which focus on alternative weighting mechanisms that are thought to provide more optimal performance for the investor. Such alternative strategies have been termed smart beta indexation methods and numerous empirical studies have researched their application to many different asset classes. The focus of this paper will be on evaluating the performance and implementation of one such smart beta strategy, namely fundamental indexation, on fixed income securities.

In general, normal indexation methods which are executed using market capitalization tend to be intuitive and easy to implement. Furthermore, they can largely be managed as passive strategies. Nevertheless, in recent times, the optimality of the performance which they provide has been brought into question. Most authors agree that in efficient markets cap-weighting will certainly provide the most ideal performance,

when compared to other strategies. Yet, many studies have concluded empirically that given the reality of the markets, the cap-weightings may not represent the optimal mean variance portfolio under CAPM as previously suggested, (Hsu & Campollo, 2006).

On the other hand, initial research into alternative indexation has indicated that smart beta methods have the potential of producing significant outperformance for the investor, (Arnott, et al., 2008). Numerous alternative indexation methods have been performed on both developed and emerging markets; and have been implemented on a range of asset classes; with the preliminary interest being focused on the equity markets. However, later studies have since moved on to the execution of alternative strategies on different asset classes which include fixed income securities and real estate securities. The topic has raised much interest, particularly given the potential advantages that these strategies could provide to investors.

Following the proposition that cap-weighted indexing provides sub-optimal performance, this paper will construct a set of alternatively-weighted indexes and investigate if they provide performance superior to their cap-weighted counterpart, in the South African market; as has been seen in other markets. The study will focus on the corporate fixed income securities market. Further to the creation of these indexes, the paper will also carry out a comprehensive performance evaluation study across the various indexes created for the domestic corporate bond market.

This first chapter of the research paper serves to introduce the topic of fundamental indexation within the context of the South African corporate bond market. The next section will set out to explain the current fixed income market in the domestic economy and the different types of indexation and benchmarking tools available to investors. Following this, section 1.3 will elaborate on the perceived shortcomings of traditional indexation and benchmarking methods and then introduce the current alternative strategies available to investors. Finally, the last section will plainly state the objectives of this research study and provide guidance as to the organization of the remainder of the paper.

1.2. SOUTH AFRICAN BOND INDEX MARKET

Given that the main purpose of this research paper is to develop an alternatively weighted corporate bond index for South Africa; it is necessary to first understand the current standing of the domestic fixed income market as well as the construction and composition of the main domestic market indexes which are currently available and will be used to measure the performance of the alternative indexes created in this study.

In general, the trading of fixed income securities is unique and significantly different from equities trading. First off due to the size of the issues, fixed income securities are mostly traded in the primary market while equities have a healthy secondary market trade, (Kessler, 2005). Many bond issues are in fact refinancing of earlier debt issues rather than initial offerings. This means that bond trading is usually thin, with the majority of the bonds in issue being illiquid, (Kessler, 2005).

Although most of the corporate bond trading occurs in the primary market, liquidity in the secondary market is increasing as asset managers include more and more corporate fixed income securities in their portfolios. Further to this, the acquisition of the Bond Exchange of South Africa (BESA) by the JSE has led to consolidation within the fixed income market. Previously, the BESA corporate fixed income index included all issued securities, most of which were illiquid. However, this changed upon consolidation of the securities exchange. Since then the indexes have developed a system which enables them to pick out the most liquid of the corporate offerings. Thus, the market has progressed from offering illiquid, unrepresentative indexes which include all the corporate bonds in issue to more concentrated indexes which comprise the most traded securities in the market, (Cadiz Report, 2009)

In South Africa, government bonds tend to be the most liquid with an active, significantly traded secondary market. They constitute over 75% of total bonds which are in issue domestically, (Standard Bank, 2013). However, the corporate bond market is on a steady growth path and over the last few years the number of corporate bonds in issue has increased by over fivefold over the last 10 years, (Standard Bank, 2013). The graph below (Figure 1.1) shows the new issues of corporate bonds in each year, at their nominal issue amount. From the graph, one can notice that the highest amount of bond issues was during 2007 and 2008, which coincides with the period of the global financial crisis.

Figure 1.1: Nominal Corporate Bond Issues

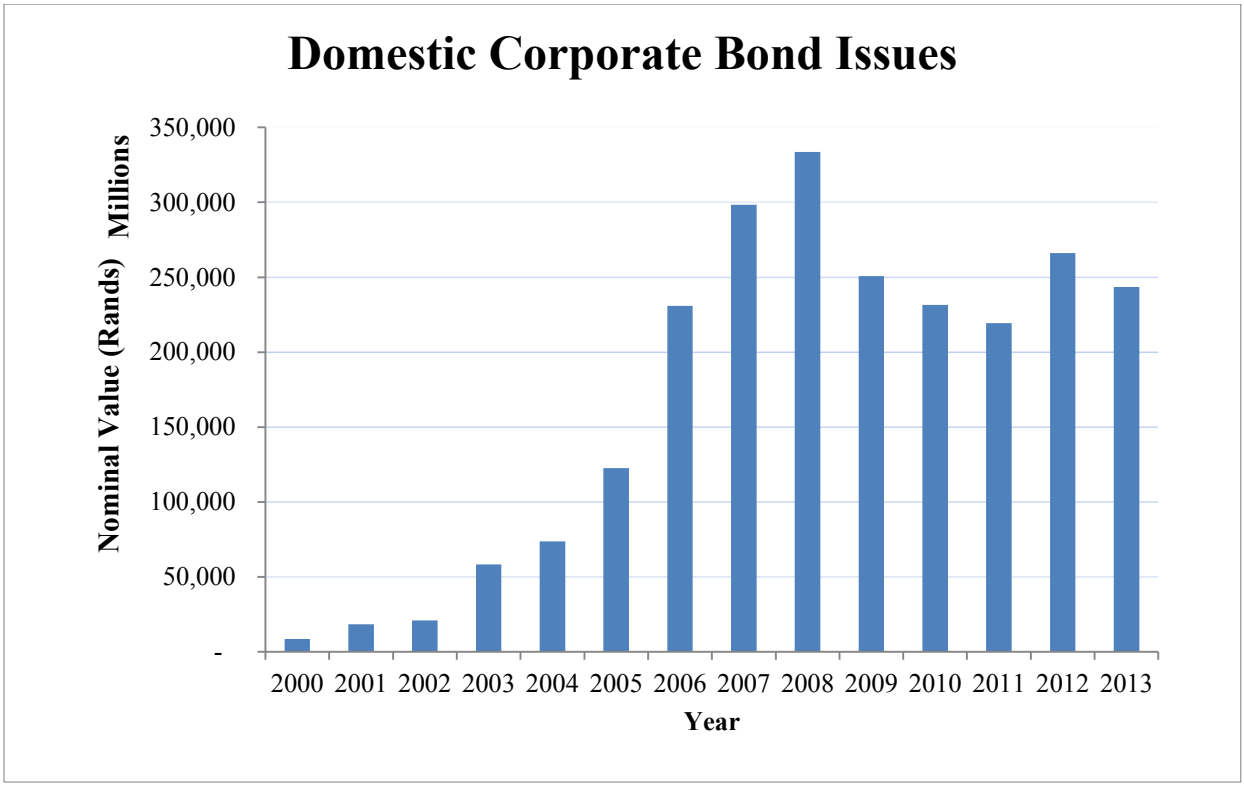


Illustration of the nominal value of new bond issues in the South African market every year. The amount of bonds issued has grown massively over the last decade and can be expected to grow as the domestic debt securities market continues to expand and mature, (Standard Bank, 2013).

The JSE offers three different fixed income indexes which provide a useful measure of the movements in the domestic market. These indexes are the Government Bond Index, (GOVI), the All Bond Index, (ALBI) and the Other Bond Index, (OTHI), (JSE, 2014). The ALBI serves as the main composite index, and the GOVI and the OTHI are collectively exhaustive subsets of the ALBI, (JSE, 2014). The bonds of the ALBI are chosen and ranked according to their liquidity and market capitalization, (JSE, 2014). This index, along with its other two counterparts, is reconstituted every quarter and the security weightings are rebalanced eight months out of the year, (JSE, 2014).

The ALBI comprises the top 20 vanilla bonds in the country, with more than one year left to maturity. Of the twenty bonds which make up the index, at least ten are the government bonds which make up the GOVI. However, over numerous years the number of government bonds constituting the ALBI tends to be greater than 10. As such the GOVI is then made up of the top 10 government bonds. The final JSE

index, comprises those bonds which are part of the ALBI but are not part of the GOVI. Thus, any remaining government bonds as well as any corporate and non-corporate bonds are then included in the OTHI, (JSE, 2014). Currently the domestic market relies on the All Bond Index (ALBI) as its main source of tracking and performance benchmarking. As this paper focuses on corporate bond indexing, the direct benchmark against which it will be measured is the OTHI.

1.3. DOMESTIC INDEX CONSTRUCTION METHODOLOGY

As the OTHI forms the main point of reference for the alternative indexes which will be created in this investigation, it is worth spending time understanding the rules underlying its construction and how this relates to its performance. Because the OTHI is a subset of the ALBI, the construction of one index is akin to the construction of the other.

The index constituents are selected once a quarter according to a dual ranking system which picks the top N bonds ranked according to their nominal values and their market turnover, (JSE, 2014). This system picks up 20 bonds which are eligible for the ALBI. For a bond to be eligible for selection it must be a conventional listed bond with a minimum of R100million in nominal value. The security must also have a remaining life to maturity of at least one year throughout the holding period, (JSE, 2014). Because of the nature of the South African market, the index places no credit restrictions on the bonds which are eligible to be chosen. The holding period is one quarter and the constituents are re-selected in time for implementation in the next quarter. The indexes are reconstituted quarterly, in February, May, August and November, (JSE, 2014).

To remove over-complication of the index, the indexes include only single redemption bonds with fixed coupon payments (this includes zero coupon bonds). The ALBI is made up of 20 of the largest and most liquid bonds, at least 10 of which are typically government issues. However, because of the make-up of the domestic market, government bonds usually constitute more than 50% of the ALBI, and as such, when it is split into its subsections, the OTHI index is usually made up of at least one government bond. This number can increase to up to 4 government bond (as was the case in most quarters of 2005 and 2007). Therefore, while the OTHI captures the corporate bond market, it still faces significant exposure to non-corporate bonds.

Over the years, the OTHI's exposure to non-corporate bonds has considerably increased. To begin with, the proportion of government bonds represented in the index increased. In addition to this, the nature of the corporations which make up majority representation in the index are government-owned or corporations with a large government influence. These include Eskom and Telkom which make up no less than (30%) of the index in any one period. As such, less than 50% of the index is fully corporate exposure, thus indicating that there is little diversification in the index. As such, this may impact the results and returns seen by investors in the index.

1.4. ADVANTAGES AND LIMITATIONS OF TRADITIONAL CAP-WEIGHTED INDEXES

As has been mentioned above, indexes such as those in the previous section are normally constructed by using the market capitalization of the security to determine its weighting within the index. Thus, each individual weighting is highly determinant on the market pricing of the security and the size of the security. As such, in the case of fixed income securities, the weights of each company's debt increases with the issue of more bonds as well as with improved market perception as demonstrated by the bond's market prices, (Lombard Odier Investment Managers Report, 2014).

There is little debate that this index creation method provides numerous benefits to investors. Cap-weighted indexation can be maintained as a largely passive investment strategy which is simple and inexpensive to implement. The strategy incurs minimal transaction costs with most of the costs incurring merely when manual rebalancing becomes necessary. This rebalancing is required only when a security enters or leaves the index. Besides this, changes in market capitalization are automatically self-adjusted within the index, (Hsu, 2006).

When an index is cap-weighted, it ensures that the largest companies in the market hold the largest amount of weight in the index. As the largest companies are usually the most liquid, this method ensures the liquidity of the index. Thus increasing viability of the index as an investment instrument as well as reducing transaction costs incurred by investors, (Hsu, 2006). Another advantage of cap-weighting is captured by the market clearing argument. Cap-weighting allows for the profitable broad market participation for all investors. On the other hand, unconventional strategies tend to be zero-sum games where if one index is overweight a particular security, another must be underweight that same security, (Arnott, et al., 2005).

Cap-weighted indexes are also advantageous in ensuring that the market clearing argument holds. The market clearing argument ensures that it is possible for the all investors in the market to profit from their capital investments. Because cap-weighting allows all investors in the market to hold the same weightings on the same securities, any positive return is seen by all. On the other hand, alternative indexes are designed such that some investors must be over-weight in one security, while other investors must subsequently be under-weight the same security. Thus, while one group will profit, the other will incur an equal but opposite loss.

Given a price efficient market, a cap-weighted portfolio would be a sufficient representation of the market portfolio. In this instance, according to CAPM, the cap weighted index would be optimal, (Hsu, 2006). However, very few people would agree with the notion that the capital markets are efficient. As such, the perceived optimality of cap-weighting has been the subject of much research and as such given that markets are inefficient and as such prices tend to be inefficient as well, cap-weighting does not provide optimal portfolio construction, (Hsu, 2006).

The shortcomings associated with cap-weightings include allocating higher weights to securities which have greater default risk, allowing market perception to be the main influence of the index weights and ultimately having a bias towards overvalued securities which will provide the investor with low returns, (Lombard Odier Investment Managers Report, 2014). Research has found that these shortcomings tend to be more pronounced in markets which are highly inefficiently priced, (Hsu, 2006). The explanations for and implications of the limitations of cap-weighted strategies are further expanded on below:

1.4.1. Bias towards Riskier Fixed Income Securities

The biggest shortcoming of cap-weighted fixed income indexes sighted by most asset managers and academics is that the highest weightings on these indexes constitute bonds from institutions which have the largest credit risk and lowest cash flow coverage. This is because as an institution issues more debt, the nominal value of its debt increases, thus increasing the calculated weightings within the index. At the same time, a larger debt offering by a company results in lower debt servicing ability and thus the greater the exposure to default by the bondholders, (Shepherd, 2014). This problem holds true for sovereign debt as much as it does for corporate bond offers. In a sovereign bond index, the highest weighting would be placed on those countries whose debt to GDP ratio is higher than the rest, (Lombard Odier Investment Managers Report, 2014).

Unfortunately this increasing risk to bondholders is not necessarily matched by an equal increase in the risk premium awarded to them. Studies have shown that investors tend to have a greater desire for securities with higher premiums (as riskier securities are theoretically assumed to have). As such, by tending towards these securities, investors bid up their prices resulting in market prices which are substantially higher than their implied intrinsic value, (Shepherd, 2014).

Fundamental indexation attempts to overcome this limitation by choosing each security's weighting through financial metrics which are directly related to the debt servicing capacity of the organization and which are not easily prone to such biases.

1.4.2. Exposure to Market Perception Biases

The high exposure to market's perceptions and speculation is another crucial limitation posed by cap-weighted indexes, (Lombard Odier Investment Managers Report, 2014). The calculation of the individual weightings is highly dependent on the price of each individual security. However, prices are subject to market's perception of the security and can be easily influenced by issues such as market speculation or market whims. De Bondt and Thaler propose the overreaction hypothesis whereby investors' undue reaction to new information will lead to mispricing of the securities under interest, (De Bondt & Thaler, 1985). This means that the index will likely be overweight those securities which are overvalued and in a similar manner, those securities which are undervalued will be underweight in the index. In this regard, the index and its performance are reduced by failing to appreciate the fair value of securities, (Lombard Odier Investment Managers Report, 2014).

Fundamental indexation, instead, does away with influences brought about due to market perception. The method reasons that the financial metrics are suitable, unbiased proxies for the fair value of the securities. By eliminating the price variable in the calculation of the weighting, fundamental indexation removes any biases which would result due to the correlation between pricing errors and the weightings within the portfolio.

1.5. ALTERNATIVE INDEXATION STRATEGIES

Where the limitations of capitalization weighted indexes have been identified, the superiority of alternative weighting indexation methods comes in. This section explains a few of the most popular unconventional strategies which can be implemented by using different measures to allocate the weightings of the securities. These measures include optimization weightings, equal weighting and fundamental weightings. Of these different strategies, each aims to retain those advantages which can be found in tradition cap-weighted indexes. These advantages include liquidity, ability to maintain passive investments and "access to a wide variety of stocks", (Ferreira & Krige, 2011). The section also provides justification as to why fundamental indexation has been deemed the most appropriate for the purposes of this investigation.

The most common alternative weighting strategies are the equally weighted and fundamentally weighted methods, however there is some research being done on optimization based weighting indexes whereby variance is minimized or the Sharpe ratio is maximized. The equally weighted method is the most simplified of the alternative strategies whereby all the securities which are to be included in the index are assigned an equal weighting. This means that the smaller securities will carry as much weight as the larger securities. However, this strategy may in essence be oversimplified and thus presents a couple of shortcomings to the resultant index.

One such shortcoming is that this strategy may tend to have a great market impact on those securities which are either small in value or generally tend to be illiquid. This means that the prices of such securities may tend to be pushed up merely due to index creation rather than due to any underlying substance, (Asness, 2006). Equal weighting is considered the alternative strategy which least retains the advantages of cap-weighting particularly. This is because its skew towards smaller securities may lead to liquidity issues and also results in it being least representative of the overall market. Further limitations of equal weighting include increased tracking error and high turnover costs. To overcome some of these issues, variations of the equal weighting methods have been proposed one of which is a blend of cap-weighting and equal weighting, (Chow, et al., 2011)

Fundamentally weighted indexation will be the main focus of this research paper. In this strategy the weightings of the securities are determined using the issuer's fundamental values which are deemed to best capture its creditworthiness and ability to meet its payment obligations. The biggest debate with this alternative is which fundamental items are considered to sufficiently capture these factors. While most studies suggest the use of sales, cash flows, dividends and book values; other studies believe that not all of these metrics fully capture the investors' interests. In particular, Eugene Fama dismisses dividend weighting schemes as providing the weakest value premium. His criticisms go on to state that dividend weighting schemes are inadequate as only "22 percent of the firms pay dividends", thus leaving out a significant pool of otherwise good value securities, (Fama & French, 2007). This is further elevated in less mature economies, such as South Africa, where the majority of the companies which make up the indexes do not have dividend payouts.

Despite this, the empirical outperformance which has been found and is laid out in the next section will prove that these fundamental indexes have thus far done a better job than cap-weighting in the previous studies.

1.6. THESIS OBJECTIVES AND ORGANISATION

This research paper will attempt to build on global and domestic studies which have put forward that capitalisation-weighted indexes may be inferior to their alternatively-weighted counterparts. The paper will initiate the study by constructing a fundamentally weighted corporate bond index for the domestic market. After which the study aims to test whether there is truth in the hypothesis that market capitalisation weighted indexes are sub-optimal to alternative weighted indexes as has been found globally; and determine if this hypothesis holds true for an emerging economy such as South Africa. This research paper will attempt to meet the following key objectives:

- Create a smart beta bond index for the South African corporate fixed income market using the alternative fundamental weights. The construction will comprise of an index which follows the composition of the OTHI

- Create an alternative index to the OTHI and investigate if added diversification effects provide any significant increase in outperformance

- Undertake various performance evaluations using the newly constructed indexes evaluated against the traditional market indexes to determine conclusively whether alternative indexes have a substantial advantage over cap-weighted indexes in the domestic market.

- Qualitatively address the controversy regarding the size and value tilt to which critics attribute the outperformance of alternative indexes.

The rest of the paper is organised as follows:

Chapter 2 provides a critical analysis of the literature and academic writing which surrounds the creation and performance of alternatively weighted indexes. The section examines the academic arguments put forward in favour of the outperformance of these alternative strategies. In order to provide a balanced representation, the section also presents the arguments which find no theoretical basis for the superior performance of smart beta indexes over the cap-weighted indexes. The section then provides a look into global literature and where alternatively weighted indexes have been used to create superior benchmarks in the equities, real estate and fixed income sectors. The section will also present literature which attempts to argue the shortcomings of these alternative strategies and remain convinced that the traditional cap-weighted indexes provide sufficient performance.

Chapters 3 and 4 introduce the data and methodology that this study uses in order to investigate the hypothesis that smart beta strategies would produce superior results in the South African fixed income market. The section presents the way this investigation has dealt with various shortcomings in the data available domestically, such as the liquidity issue. The section also follows a path similar to more recent studies to determine the optimal way in which to develop the alternative fundamental weightings which make up the crux of the research. The bulk of the empirical research undertaken in these sections is carried out in Microsoft Excel.

Chapter 6 presents the results obtained from the investigation and tests their significance and practicality for implementation in the domestic market. The section provides conclusive responses to the initial hypotheses laid out in this paper and deals with any potential shortcomings which reveal themselves during the investigation. In addition, this section outlines what implications the results have on the domestic market.

Chapter 7 presents the conclusion and summary of the investigation. It conclusively determines whether alternative fundamental indexes can be considered superior within the domestic market. Finally, this section proposes any potential areas of further academic research.

2. LITERATURE REVIEW

Implementing alternative indexation strategies within the equity markets and other asset classes has been the point of recent interest both academically and practically amongst many asset managers. There has been much global debate regarding the performance and costs of these indexes especially when evaluated against the traditional practice of cap-weighted indexes. Debates between academics on this topic have ranged from the soundness of the underlying theory supporting fundamental indexation; to the originality of these alternative indexation strategies; to questioning the robustness of the empirical results given in their support.

This chapter will provide a balanced evaluation of the relevant academic literature on the topic and will objectively highlight arguments posed for and against the subject matter across different markets and securities. The literature review is divided into the following sub-sections: the next section provides an overview of the current theory available on the subject matter; the groundbreaking studies which were performed in the United States (US) and other global equity markets are then laid out; followed by literature on alternative asset classes combined with relevant studies based on findings in the emerging markets; the fourth section highlights literature which presents opposing views on the topic of fundamental indexation and lastly, section five explains in what manner this particular research paper will make a significant contribution to current literature.

2.1. THEORETICAL OVERVIEW

There is much deliberation behind whether there exists any principal academically sound theory which can be used to substantiate the performance provided by alternative, non-cap-weighted indexation. On one hand, pioneers of alternative indexation provide the noise in price framework and the return drag to explain what induces inferiority in the cap-weighted and as such renders alternative indexation methods optimal, (Arnott, et al., 2010). On the other hand, critics of these modern strategies tend to pick out various flaws in the framework proposed and dismiss the supposed performance of alternative strategies as glorified value investment strategies. The next few sections outline the two different schools of thought on this matter.

2.1.1. NOISE-IN-PRICE FRAMEWORK

To provide fundamental theory in support of the superior performance of alternative strategies Arnott, Hsu, Li and Shepherd, (2008), put forward the noise-in-price framework. Under this theory, market prices are regarded as noisy and thus each price constitutes a fair value (V) as well as a random error term (ϵ) such that:

(2.1) $$P = V + \epsilon$$

The random error signifies that some stocks are overpriced while others are underpriced. This pricing inefficiency passes over to the capitalization weightings calculated for indexes. Thus, cap-weighted portfolios tend to place more weighting to the overvalued securities and underweight undervalued securities, (Arnott, et al., 2010). If the errors in the prices are not persistent then over time as securities tend to their fair value, cap-weighted portfolios will produce a lower appreciation than those which are fundamentally weighted, (Hsu, 2006). Arnott et al. (2010) thus put forward that in the absence of an efficient market and fair value pricing, indexes which move away from including these valuations in their calculations tend to provide better results.

The noise-in-price framework is based on the proposition that the error term is correlated with the market value of the security, but is independent to the security's fair value. Unfortunately, this reasoning is not without dispute and these reasons are outlined in section 2.5.

2.1.2. RETURN DRAG

Given the noisy pricing proposed above, the resultant feature on cap-weighted indexes is the return drag. Return drag is the term used to illustrate the situation whereby the cap-weighted portfolio underperforms because it is highly weighted in stocks which are overvalued and underweighted in undervalued stocks which tend to provide greater price appreciation than their overvalued counterparts, (Hsu & Campollo, 2006). Thus, in order to avoid the potential of a return drag, the authors advocate, instead, for the use fair value weighting or in this case, the closest option which can be found in fundamental weighting, (Hsu & Campollo, 2006).

The proponents of fundamental indexing primarily attempt to prove the sub-optimality of cap-weighting. They find a return drag on cap-weighted indexes as overpriced assets are overweight, while underpriced assets are underweight in the index, (Kaplan, 2008).

2.1.3. VALUE INDEXING (TILT) ARGUMENT

An alternative framework vehemently denies any theoretical support for the noise in price framework as a superior method, and instead claims that any superior performance obtained using this method is merely due to repackaging of the old method of value investing instead of a new and revolutionary finding as smart beta proponents claim. Thus, since portfolios that are biased towards value tend to outperform those which are not, then it is not unusual that fundamentally indexed portfolios would exhibit a similar outperformance, (Kaplan, 2008).

This is the value tilt argument, and while it makes no attempt to disprove the empirical results of the alternative indexation methods, it merely argues against this method being a revolutionary academic discovery. They recognize that the outperforming stocks in the alternative method of index creation are merely value stocks as opposed to growth stocks and thus this new famed strategy is essentially considered to be a tilt on value investing rather than a revolutionary practice. However, proponents of alternative indexation have been quick to defend their stance by claiming that the strategy takes advantage of mispricing in securities rather than exploiting their value premiums, (Kaplan, 2008).

2.1.4. SUMMARY AND CONCLUSION

Whatever the basis of the performance of these alternative strategies, there is overwhelming proof that they provide massive potential in improving returns and risk performances for investors all around the world. Whether this improvement in return is due to increased holding of small capitalization stocks which tend to provide greater value, or if it is due to the returns drag theory which explains the sub-optimality of the market capitalization weighting method

Due to its purpose, this study has merely attempted to provide a more general overview of the different theories underlying alternative indexation methods. The paper makes no attempt to definitively prove that one or the other schools of thought holds true. Instead, having established that one way or the other,

alternative weighting methods have the potential of providing superior returns, despite not entirely agreeing on the theory underlying the source of this value. The next section looks at various literature and empirical studies which have investigated the implementation of such strategies. The next section will divide these sections by geographical area as well as by finding and alternative weighting methods and provide an objective view of what existing literature provides.

2.2. LITERATURE ON US & GLOBAL EQUITY MARKETS

Arguably, the largest pioneer of alternative indexation strategies is Robert Arnott and his research has inspired many subsequent studies into the matter. The basis of his work is found in a 2005 paper on fundamental indexation implemented in the US equities market. The study begins with substantiating the need for alternative strategies by putting forth the notion that market portfolios and similarly, capitalization weighted portfolios are not mean variance efficient. This indicates that portfolios which use cap-weighting as their strategies are therefore, not optimal portfolios, (Arnott, et al., 2005). The study puts forth that if cap-weighted indexes cannot be academically considered to be entirely adequate proxies for CAPM, then it is possible that there exists a more optimal weighting strategy which can be adopted for indexation. It is this thought that triggers and fuels the study into alternative strategies, in particular, fundamental indexing, as potentially more optimal approaches, (Arnott, et al., 2005).

This study by Arnott, Hsu and Moore, (2005) looks at fundamental indexation using metrics which include book value, cash flow, revenue, sales, dividends and total employment, (with five year trailing averages for cash flows, revenues, sales and dividends). The authors find that over an investment period of 43years the return advantages, using the above fundamental metrics as weightings, are significantly greater than the returns produced by cap-weighted indexes. In this same study the authors make an attempt to create a fundamental index which retains all the advantages of their cap-weighted counterparts which are required by a passive market investor. The authors thus identify their chosen metrics as being highly correlated with size and liquidity of the equity securities, (Arnott, et al., 2005).

Of the six metrics used, four of them provide returns which are significantly greater than those from the capitalization weighted index, (Arnott, et al., 2005). On average, the outperformance of the fundamental index relative to the cap-weighted index was close to 2%, with the composite index information ratio being 0.6, (Arnott, et al., 2005). The authors credit these excess returns and significant alphas to one or a

combination of the following: superior market construction, price inefficiencies in the market as well as additional exposure to distress risk in their alternatively constructed portfolio, (Arnott, et al., 2005). The authors additionally note that had such performance been compounded over the 43 year period of their study, the portfolio value would be over double the value of the reference cap-weighted portfolio, (Arnott, et al., 2005).

Another key result emerging from this groundbreaking study is the comparison of the liquidity as well as risk and volatility levels of the two different indexation methods. The authors find that within the US market, the alternative strategy portfolio does not pose a significant liquidity issue. This finding also has bearing on any perceived increase in transaction costs required to implement the fund, (Arnott, et al., 2005). While this finding may hold for the US market, it should be noted that this is likely to be a more significant constraint within a smaller market such as South Africa. Furthermore, the authors find that their newly implemented index provides lower beta when compared to the original cap-weighted index. Thus implying that fundamental indexation tends to produce less risky portfolios than its cap-weighted counterpart, (Arnott, et al., 2005).

This initial study reveals the potential supremacy of fundamental indexation methods, and has therefore been the basis of many future research papers on this topic. However, it does leave a few flaws worth noting. Firstly, the study does not delve sufficiently into the transaction costs required to implement the indexation strategy. A potential shortcoming of non-cap-weighted strategies is that they tend to require more rebalancing than their substitute, and as such increase the implementation costs to the investor. Thus, while outperformance has been proven annually, the authors have not provided us with sufficient reason to believe that costs to implement will not erode most of the indexes outperformance. The second flaw is that the authors acknowledge that their chosen metrics introduce a value bias on the index and thus the results, (Arnott, et al., 2005). As explained in the theory section above, many critics of fundamental indexation tend to reason that it is merely a glorified value strategy. Thus, by acknowledging a value bias, the authors manage to fuel the opposition's argument.

Hsu & Campollo (2006), produce their study in direct response to some of the flaws identified above: specifically addressing increasing transaction costs and the issue of the value and size bias introduced in the initial study. The authors implement a similar study to their predecessors. However, they examine the fundamental indexation method by examining its performance over a 20 year period and including both

the US and global equity markets as measured by the MSCI World Index, (Hsu & Campollo, 2006). The authors take directive from the Arnott et al. study and choose the same metrics as those in the initial paper. However, the study differentiates itself from its predecessors by dividing their analyses into different market periods, namely bull and bear periods, recession and expansion periods as well as value cycles and growth cycles, (Hsu & Campollo, 2006). The study finds that overall, the fundamental index outperforms its cap-weighted alternative by 2% in the US and 3.5% globally, results similar to its predecessor paper, (Hsu & Campollo, 2006).

An interesting and crucial discovery in this paper is that the fundamentally weighted indexes fail to outperform during the presence of an asset bubble within the market, (Hsu & Campollo, 2006). This is so because in such irrational market periods, P/E values tend to become very large, and fundamental metrics are such that the index would rebalance away from large market capitalization securities. Instead, the fundamental index goes against the momentum of the market and invests in stocks with large fundamental values. During a bubble, the correlation between market capitalization and fundamental values decreases, and thus the resulting performance of the fundamental index is diminished, (Hsu & Campollo, 2006). A similar observation will be made in this research paper in order to determine if this phenomenon holds true in the South African market.

The paper concludes that cap-weighting indexes have the potential to incur more turnover costs than its alternative which only requires rebalancing costs. This is found to be so because cap weighted indexes tend to require rebalancing when a new stock enters or leaves the index, other than that it rebalances automatically: “It is worth noting that much of the cap index turnover is spent on tiny names at the bottom of the list. These stocks are particularly expensive to purchase and sell,” (Hsu & Campollo, 2006). However, regardless of the potential for the costs incurred by alternative indexation to be greater than the cap-weighting, the paper also highlights that these costs do not erode the sufficient alpha which is brought about by the superior strategies of fundamental indexing, (Hsu & Campollo, 2006).

Finally, the study also puts to rest the question of whether fundamental indexation is merely a glorified value strategy. The authors undertake a performance evaluation between the Russell 1000 Value Index and their own developed US 1000 Fundamental Index, (Hsu & Campollo, 2006). The authors find that fundamental indexes outperform value indexes in most of the different macroeconomic environments. In addition, the authors also note the limited diversification and limited allowance for broad market

participation which is offered by value indexes when compared to fundamentally weighted indexes, (Hsu & Campollo, 2006).

A slightly more sophisticated approach to alternative indexation is adopted by Chen, Chen and Bassett, (2007). The authors attempt to estimate fundamental weights using a smoothed average of the original capitalization weightings. In so doing, the authors replace the use of accounting data in estimating each security's fundamentals and instead, they argue that current fundamentals can be estimated by smoothing the time series of a stock's noisy prices, (Chen, et al., 2007). The price smoothing method put forth in this paper definitely simplifies the process of fundamental indexation and removes the debate on which fundamentals metrics should the investor's portfolio be based on as well as removes the need for a lot of data. However, it is highly dependent on the assumption that the underlying security's fundamentals change slowly over time, (Chen, et al., 2007).

In their study, Chen et al. (2007), identify the observed price as the fundamental value plus a normally distributed noise with mean equal to zero. As such the authors assume that the current market prices of the securities are unbiased but noisy estimates of the actual intrinsic price of the security. Thus to smooth out this noise, the authors propose a five year moving average approach of past prices to calculate a fair value pricing. Using this simplified alternative indexation methods on an index with 1000 stocks from the US market over a period of 40 years, the authors find that the resulting outperformance of this index is comparable to those created by Arnott et al (2005) and Hsu & Campollo (2006), (Chen, et al., 2007). This study has the advantage that such a simplified approach may be useful for markets in which all the extra data which is required by the fundamental indexing strategy is difficult to come by.

2.3. LITERATURE ON ALTERNATIVE SECURITIES AND EMERGING MARKETS

Having pioneered the research of fundamental indexation in the equity markets, Arnott (2010) & Hsu (2010), separately extend their studies further to include other types of securities; specifically fixed income and real estate securities. These studies are direct attempts to disprove the notion that fundamental indexation is merely successful due to the resulting value and size tilts that present themselves when the strategy is implemented. Thus the authors test the alternative indexation strategy on asset classes which are not part of the equity market realm and as such asset classes which are presumably void of value and size factors, (Hsu, et al., 2010).

In a 2010 study, Hsu, Li and Kalesnik, test the performance of the fundamental indexation strategy on listed commercial real estate holding and investment companies as well as Real Estate Investment Trusts (REITs). The authors identify the importance of real estate inclusion in portfolios due to the fact that real estate has low correlation with other asset classes as well as because real estate provides an effective inflation hedge, (Hsu, et al., 2010). In maintaining the spirit of fundamental indexing which attempts to remove the bias introduced by noisy prices in indexation; the authors used metrics which comprised of sales, book value, cash flow and dividends. The authors further differentiate their research in US real estate index as well as a global (excluding US) real estate index, (Hsu, et al., 2010).

Using monthly data from 100 securities from the US market and 148 securities in the non-US category, the authors find that the two fundamental indexes outperform their cap-weighted counterparts by 3.96% and 2.90% respectively, (Hsu, et al., 2010). The research also reveals that the real estate fundamental indexes only marginally increase the risk of the portfolio by around 0.39%, however, the resulting Sharpe ratio, shows a substantial increase in reward per unit risk for both the US and the global portfolio, (Hsu, et al., 2010).

The study observes these indexes over inflationary and deflationary market cycles to determine the strength of these portfolios as inflationary hedges. The authors find that the fundamental indexation outperforms cap weighted indexes in both macroeconomic periods. However, it must be noted that the outperformance of this strategy in inflationary periods is significantly less than its outperformance during deflationary periods. Specifically, in the US, fundamental indexation provides a 12.7% return versus 10.4% return given by the cap-weighted index during an inflationary period. However, the margin between the two increases during deflationary periods with the fundamental index providing a 10.4% return while the cap-weighted index provides a 4.8% return, (Hsu, et al., 2010).

A cornerstone to the research on fundamental indexing is found in a valuation indifferent indexation strategy on corporate bonds proposed by Arnott et al. (2010). Their research applies fundamental indexation to investment-grade and high yield corporate bonds in the US as well as emerging market sovereign bonds. The authors believe that that should fundamental indexation outperform cap-weighting in the bond markets then the size and value argument posed by their critics will fall short, (Arnott, et al., 2010).

For corporate bonds, the authors determine that the fundamental metrics which are appropriate for the index construction are similar to those used in earlier studies applied to equity markets. This is because, both debt (bond) and equity financing pose similar claims on the company's future cash flows and thus the larger the possibility of continuity of these flows, the larger the valuations of both the company's debt and equity, (Arnott, et al., 2010). The research thus uses book value, dividends, cash flows, sales and face value of the debt issue, (Arnott, et al., 2010).

However, Arnott et al. (2010) highlights the differences in the variables considered by equity and bond market investors. For example, while companies usually have one issue of stock, it is common practice for companies to have multiple bond offers in the market. In this instance, an investor or an index creator then faces the decision regarding which bond offer is suitable for his portfolio. In cases where more than one bond is included in the index, the authors suggest dividing the fundamental weight of the institution amongst the different bond offers, according to the ratios of their nominal values, (Arnott, et al., 2010). In doing this, the authors ensure that they do not overweight a single company simply due to it having multiple fixed income offers.

The empirical results from the study indicate that the corporate fixed income asset class provides significant outperformance when valuation indifferent weighting is used to create the index rather than when cap-weighting is used, (Arnott, et al., 2010). Having put forward the noise in price framework which was laid out in the previous section of this chapter, the study also investigates what drives the source of this outperformance, through using Fama and French as well as CAPM analysis.

In creating a valuation indifferent index for the emerging market bonds, the study follows a similar logic to the one previously laid out. However, as sovereign countries do not provide sales or pay out dividends, the authors combine metrics which indicate the "current and potential importance" of a nation, (Arnott, et al., 2010). These metrics include size of the country's population, a proxy for the resources available in that economy as well as the GDP and energy consumption of the country, (Arnott, et al., 2010). The authors find that the metrics for sovereign bonds are more stable than the metrics for corporate bonds and thus there is less need for rebalancing the weights of the index, (Arnott, et al., 2010). As is the trend with previous studies on this matter, the results from the paper show superiority of the performance of fundamental indexes over cap-weighted indexes, (Arnott, et al., 2010).

The Arnott et al. (2010) paper forms the fundamental basis of this research study and as such it is referenced numerous times over the different sections of this investigation.

Despite very minimal academic research available from South Africa on this topic, Ferreira and Krige (2011) publish a study on fundamental indexing within the South African equities sector for the period between 1996 and 2009. Following closely from Arnott et al., (2005), the authors use sales, book values, dividends and cash flows as their metrics for the index. This South African Fundamental index was found to outperform the cap weighted JSE All Share Index by 4.7% on a compounded annual basis over the period under observation, (Ferreira & Krige, 2011). The study also finds that the fundamental index outperforms the ALSI in ten of the fourteen years under review. However, there is no further attempt to investigate the cause behind this phenomenon. The authors also calculate risk adjusted ratios such as the Sharpe, Treynor and Sortino ratios. In all cases, the fundamental indexes are found to outperform the cap-weighted benchmark with the best performing index comprising the one created using either the sales metric or the dividend metric, (Ferreira & Krige, 2011).

Taking prior global and domestic research further, Hsieh (2013), attempts to incorporate more advanced performance evaluation studies on domestic alternative indexes. Hsieh attempts to investigate the value and size effects of fundamental indexation outperformance on the South African equities market over the 15 year period ending December 2010, (Hsieh, 2013). He carries out performance attribution using the Fama and French 3 factor model on the fundamental indexes. Contrary to the allegations from Hsu & Campollo (2006) as well as Arnott et al. (2010), Hsieh finds that once size and value are controlled for, the indexes exhibit highly negative returns.

This seems to suggest that there is little truth to the hypothesis that fundamental indexation is a modern revolutionary strategy and instead suggests that the reason for the any outperformance is due to the tilt towards small cap stocks which is provided by fundamental indexation. However, they do find that the results are slightly different for the sales index, whose results are less skewed towards the value and size biases. Hsieh attributes this phenomenon to the predictability of the sales line item compared to the other fundamentals, (Hsieh, 2013). This result confirms the superiority of the sales index found by previous papers.

The paper also looks at the performance of fundamental indexes during different macro-economic periods. The study finds that a result similar to Hsu & Campollo, (2006), regarding the performance of this alternative equity index during the internet bubble in 2000. It is found that during times of high crisis or incredible asset bubbles, the fundamental indexes are found to have extremely poor performance and experience significant drawdowns, (Hsieh, 2013). This phenomenon indicates that such alternative indexes provide massive exposures to risk especially for emerging markets in times of financial uncertainty.

2.4. CRITICISMS TO ALTERNATIVE INDEXATION STRATEGIES

The arguments against indexing strategies which are indifferent to market capitalization are as fervent as the arguments which glorify them. Disputes range from the theoretical soundness of the proposed alternative strategies to the validity of the empirical results provided by those studies which claim the supremacy of alternative indexation. Fama and French, (2007) describe fundamental weighting and other such form of alternative indexation as "a repackaging of old ideas". Their dispute is not that these strategies do not work; instead they argue that they are well marketed ways of capturing the value premium, a strategy which has been in use for many years, (Fama & French, 2007). This criticism is one which has been echoed numerous times by other authors who suggest that fundamental indexes are biased towards known anomalies and thus their outperformance is not revolutionary. The authors further dismiss the use of dividends as a key fundamental metric in these indexes. According to the two, dividends provide the least value premium and in most markets, dividend paying firms are in the minority; with only 22% of US firms paying dividends during the time of their publication, (Fama & French, 2007).

Perold (2007) takes a much stronger stance against fundamental indexation and he argues that the proposed inferiority of cap-weighted indexes, as put forth by the advocates of fundamental indexing, is entirely false, (Perold, 2007). In his research paper, Perold (2007) puts forward the fallacy in the noisy pricing theory as follows: while fundamental indexing is justified by identifying that most securities carry a pricing error which is correlated with the market value of the security and thus leading to a performance bias when capitalization weighting is used.

However, Perold disagrees with this notion and claims that if pricing error is uncorrelated with the security's fair value (as is agreed upon by proponents of fundamental indexing), then the same pricing

error must also be uncorrelated with the security's current market value, thus removing the alleged bias on cap-weighted indexes as explained by Hsu (2007) termed the return drag, (Perold, 2007). Perold (2007) explains his position by citing that holding a cap-weighted index does not change the probability that a security is over or undervalued. As such Perold [2007] "pointed out that the valuation-indifferent weighting scheme can outperform only if the pricing error is correlated with the market value of the stock in the cross-section. In other words, for this outperformance to occur, stock returns would have to be negatively auto correlated (mean reverting), but academic evidence for autocorrelation in stock returns is inconclusive. Perold concludes that, in the absence of negative autocorrelation in returns, the advantage of valuation-indifferent indexing is suspect," (Perold, 2007).

Blitz and Swinkels bring another angle to the attack against fundamental indexation, and dismisses the practicality of the implementation of these strategies as passive strategies. He argues that fundamental indexes are more likely to be active management strategies as they do not align with market equilibrium, neither do they allow the investor to simply buy-and-hold and finally to fully optimize these indexes requires that the investor make numerous subjective choices and as such they are at odds with the traditional passive management portfolios that their proponents are trying to put them across as, (Blitz & Swinkels, 2008).

Kaplan (2008) also makes a direct criticism against the statistical soundness of the theoretical basis of fundamental indexing. He argues against the validity of a key assumption put forward to justify the superiority of fundamental indexation. This is the assumption that the fundamental weights are unbiased estimators of the true fair values of the securities and as such are statistically independent from the market values, (Kaplan, 2008). "Kaplan [2008] argues that the company financial variables used in alternative indexes would likely have had positive correlation with prices, which could produce correlations with pricing errors. Therefore, the Fundamental Index might not be the optimal valuation-indifferent weighting methodology."

2.5. CONTRIBUTIONS TO LITERATURE

Given the breadth of academic work that has been undertaken globally and particularly in the United States, the research in this paper aims to make a significant addition on this topic to the South African pool of literature. Currently, no insight has been provided on whether this newly popular fundamental

indexing method can be successfully implemented in the fixed income sector of a young, emerging market such as South Africa, given unique shortcomings which include liquidity and a small sample of securities. This study aims to provide clarity on this issue. Where successful, this research paper will aim to make a recommendation to asset managers as well as provide guidance on things which must be watched out for during implementation. Above all, the paper aims to bring forth a topic of much global interest and debate and determine if it holds any merits within the context of the South African market, specifically in the corporate bond market.

3. DATA AND DESCRIPTIVE STATISTICS

This chapter introduces the data required to proceed with the proposed investigation in this paper. For an accurate and reliable study, much care is taken to ensure that the data is both error-free and standardized such that it is comparable across the different categories. Data for this study was obtained from the Johannesburg Stock Exchange (JSE), as well as the Datastream, Bloomberg and McGregor terminals from the University of Cape Town.

The rest of the chapter is organized as follows: the first section explains the pool of data gathered for the study; this is divided into the data required for index creation and the data required for performance evaluation. Following this, biases which could potentially present themselves in this study are discussed, along with the steps taken to reduce the impact of any biases in the sample. In the final section of this chapter, descriptive statistics are provided for relevant components of the data. Except were stated otherwise, the data was gathered in its monthly format and the analysis is undertaken from January 2002 to December 2013. The collection and handling of the data laid out in this section along with its subsequent analysis was carried out using the Microsoft Excel package.

3.1. DATA

The data required for this study is divided into three subsets. To begin with, fixed income data which fully outlines the specific constituents and price history of the bonds in the indexes to be replicated; the second subset is the fundamental data of the issuing institutions which are required to compute the index metrics and weightings, and finally extra data, such as additional macroeconomic variables as well as information on other indexes, is gathered for performance evaluations.

To determine which data is necessary, this study takes directive from the most relevant predecessors on the topic, namely: Arnott et al. (2010) as well as Ferreira & Krige (2011). These papers provide specific guidelines regarding the variables required and the most optimal metrics needed for the construction of an alternative index such as this. Arnott et al. are chosen due to their groundbreaking research and

contribution to the topic, while Ferreira & Krige are chosen due to their South African focus on the topic. The details of the various variables gathered for this study are found below:

3.1.1. FIXED INCOME DATA

Due to the nature of this study, fixed income data forms the cornerstone of the analysis. To begin with the bonds to be included in the index are decided upon. The initial subset of indexes are simply a replication of the JSE listed OTHI Index. For the purpose of this replication, historical data detailing the constituents of the OTHI was provided by the JSE market series data department, for each quarterly period under the twelve year analysis window. A detailed annual breakdown of these constituents is given in Appendix A1. In order to distinguish the fundamental index from its original, the alternative replication is named OTHI_ALT.

An extension to the index analysis is the creation of a more diverse alternative index to compare to the OTHI_ALT and to determine if stricter universe selection methods would provide better index returns. This index is named the South African Fixed Income Alternative Index and is denoted SAFI_ALT in this study. The full dataset of the listed bonds as provided by the JSE is used to determine the constituents of the alternative indexes, the methodology and considerations of which are outlined in the bond-index construction section of the methodology chapter. The constituents of this subset of indexes are outlined in Appendix A2.

Following the determination of the bond constituents which form the indexes in each period, historical all-in price data was gathered. This was obtained from the JSE, with Datastream providing any additional data information. From these two sources complete historical price data was gathered. The final aspect of fixed income data required was the total return data for the JSE ALBI and OTHI indexes, which would be used as a benchmark comparison for the alternatives. This data was also provided by Datastream and the JSE respectively and was obtained in monthly form for the period from November 2000 to December 2013.

3.1.2. INDEX METRICS

The second aspect of the data collection involved the collecting of the various index metrics. Prior studies on fundamental indexes use six metrics, which are: sales, cash flows, dividends, book value, total employment and earnings. The various fundamental metrics are chosen as they are considered to offer a diverse yet representative view of the company's underlying performance and as such ability to meet their debt obligations. While this paper intends on mostly replicating prior studies on this topic, it makes use of only three of the six metrics; namely: sales, cash flows and book values. This is due to the following reasons:

- The earnings metric is excluded due to its significant similarity with the sales metric. As such it is deemed adequate to only have one of these two and for this study. The sales metric is therefore chosen as it is less prone to accounting manipulation than the earnings metric.

- As cited by Ferreira & Krige (2011), accurate information regarding total employment data is difficult to obtain within the South African domestic market. Due to this reason, this metric is not included.

Below are explanations regarding each metric as well as details regarding the collection and handling of its data:

- SALES

The sales metric is perhaps the most important of all three. Prior studies have found that the sales index provides the greatest outperformance of all the fundamental indexes, (Arnott, et al., 2005). While most companies in the US find this metric the most difficult to standardize, this concern is less important in the local market. This is because due to the IFRS accounting rules used in South Africa, companies are faced with fewer options for revenue recognition. Despite this, obtaining sales values from one database tends to ensure a uniform standardization. For this reason sales data was obtained from the McGregor BFA database. To remove cyclical fluctuations and ensure smoothed weightings, a five year trailing average of the sales values is used for all securities. A scatter plot of the sales values of the index constituents is given in Appendix B1.

- CASHFLOWS

Unlike sales, cash flows are considered the least susceptible to manipulation by different accounting techniques. Cash flows are most directly indicative of the ability of the company, which has issued the underlying security, to meet any payment obligations to the security's holders. Cash flows were obtained from the McGregor database and where any blanks needed to be filled out the Bloomberg database was used. The specific metric captured is the net cash flow before operating income as was done in prior studies, (Ferreira & Krige, 2011). For the purposes of this index, the cash-flow values are taken as five year averages. This makes sure that yearly and cyclical fluctuations do not cause "noise" in the weighted values, and thus ensuring that the target weights are more stable. As with the other metrics used on five year values, taking these averages also ensures that re-balancing effects and subsequently costs associated with this are not as pronounced as they would otherwise be. A scatter plot of the sales values of the index constituents is given in Appendix B2.

- BOOK VALUE

Book value represents the collateral available to the holders of the debt. In essence, should the company fail to meet its cash/payment obligations or should it face bankruptcy or liquidation, the bond holders would have a claim on the long term assets of the company. As such the book value of these assets would then be received and used to provide any outstanding payments. Of the three fundamental metrics include in this study, Book Value is the only one which considers the nominal amount of the debt issued by the security, and as such can be considered to be related to the nominal value of the debt. Book value is calculated as the assets of the company less the value of its issued debt. Unlike the other metrics, book values are not calculated using their trailing averages. This is because book values tend to be more stable and their values are therefore less susceptible to changes in the business cycles. A scatter plot of the sales values of the index constituents is given in Appendix B3.

In addition to these three metrics, a fourth composite index is created which is made by determining the average weights from those calculated using all the three groups of fundamentals which were described above.

3.1.3. PERFORMANCE EVALUATION DATA

To capture the various components and tests to be undertaken in performance evaluation, macroeconomic and benchmark variables are obtained from the Bloomberg database. The total return data of the OTHI and ALBI as collected in its monthly format. These returns constitute the benchmarks against which any performance will be measured against. Another fundamental variable for the performance evaluation section is the risk-free rate. This is normally defined as the yield on the ten year government bond and thus historical data on this yield over the period of the analysis was obtained from Bloomberg.

3.2. DESCRIPTIVE STATISTICS

The data required for this type of replication and investigation is intensive, as such descriptive statistics are necessary to provide the reader with a clear overview of the data pool. The data statistics encompassed in this section include statistics from the raw data such as the distribution of the metrics as well as analytical data which includes looking at the correlations between the weightings from the original OTHI index to the replication OTHI_ALT. Also included are statistics and characteristic data for data used for any performance analysis.

The study looks at fixed income data over a 12 year quarterly period from February 2002 to November 2013. In each period, at least 10 bonds are included in the replication index. A list of all the member bonds in each year has already been provided in Appendix A. However, Table 3.1 provides a summary of the basic characteristics of the OTHI, the OTHI_ALT and the SAFI_ALT indexes. The characteristics are quoted in annual terms rather than in their quarterly format. While in each quarter the OTHI comprises 10 securities with the majority of them being corporate, it must be noted that the index frequently includes on average two government bonds in its make-up. The maximum number of government bonds included in the index was 4 in the year 2003. As such from Table 3.1, one can see that on average, the OTHI has 14 different corporate securities in a year, and can include up to 4 different government securities in a year. On the other hand, the alternative index provides a wider mix of corporate bonds and is completely free from the influence of government bonds. The table also indicates that all three indexes are comparable in size and as such the results obtained will not be distorted towards the larger or smaller indexes.

Table 3.1: OTHI Replicated Index Characteristics

CHARACTERISTICS	OTHI	OTHI_ALT	SAFI_ALT
Average Number of Corporate Bonds	8	8	10
Maximum number of Bonds	10	10	10
Minimum Number of Bonds	6	6	10
Average Number of Government Bonds	2	2	NIL
Maximum Number of Government Bonds	4	4	NIL
Minimum Number of Government Bonds	NIL	NIL	NIL

The table above illustrates the comparison of key index composition characteristics. While all the indexes are the same size, the newly created alternative index, the SAFI_ALT ensures that its composition does not carry any government securities and is thus exclusively a corporate bond index.

The following table provides a breakdown of the sectors which make up the indexes. From Table 3.2 it is clear to see the large government influence in the indexes which are currently available. This is visible particularly through the high number of securities on average which are from parastatals i.e. government owned enterprises. This is further supported by Table 3.1 which shows that the OTHI index can incorporate up to 4 government bonds in a period, in addition to any other parastatals present. This phenomenon can largely be attributed to the selection criteria of the OTHI. The liquidity aspect imposed by the selection criteria suggests that large-sized bonds tend to be favored. Such bonds are typically issued by state-owned enterprises.

The table also indicates that there is very little representation from the mining sector, despite its importance in the domestic economy. However, this may be attributed to the availability of project finance and asset-backed finance, which are the preferred funding methods within the mining sector. Finally, one would expect a larger component of the indexes to come from the financial sector, as this is the largest issuer of debt securities in the domestic market (40%), (Standard Bank, 2013). However, this is not the case with only three securities from the financial sector in the index on an annual average.

The creation of the SAFI_ALT clears some of the issues regarding lack of diversity, with greater representation from the mining, services and manufacturing sectors. However, a different bias is introduced with most of the securities coming from the financial sector. Despite issuing 40% of the

corporate debt securities, (Standard Bank, 2013), the financial sector has on average 50% representation in the new alternative index.

Table 3.2: Average Sector Distribution for the Indexes

SECTOR	# IN OTHI	# IN OTHI_ALT	# IN SAFI_ALT
Agriculture	0	0	0
Financial	3	3	5
Government	2	2	0
Manufacturing	0	0	1
Mining	0	0	1
Parastatals	4	4	2
Services	1	1	1

The table shows the sector distribution of all the indexes, as defined by the JSE. The SAFI_ALT has less exposure to parastatals than the OTHI indexes, but has greater exposure to securities from the financial sector than the other indexes.

It is also worth taking some time to denote the descriptive statistics of the three different fundamental metrics i.e. sales, cash flows and book values. This is done in two phases. Firstly, Tables 3.3 to Table 3.5 indicate the annual mean, median and standard deviation of each of the metrics. Secondly, scatterplots of the moving averages of the individual metrics shown at a company level are shown in Appendix B1 to B3. These scatterplots reveal the dominant companies under each metric and the performance of the bonds of the dominant companies will be highly correlated to the performance of the index.

Table 3.3: Sales Metrics Descriptive Statistics

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean	16.1	25.4	23.0	29.0	31.1	38.2	50.0	50.0	48.6	47.4	56.8	92.5
Median	7.6	19.4	17.9	34.4	26.4	28.2	29.1	35.9	37.4	29.8	33.2	11.5
Std Dev	18.7	24.1	22.5	26.7	31.3	38.4	56.8	51.2	46.3	52.0	63.6	64.2
Skew	1.25	0.44	0.45	0.30	0.79	0.67	1.21	0.83	0.46	0.82	0.71	0.65

An illustration of the annual distribution of the sales values of the securities in the OTHI indexes.

**Values quoted in billions of Rands*

Table 3.3 shows the mean, median and standard deviation of the fundamental sales values which are used to determine the weightings in the fixed income index. Of significant interest is the level of standard deviation present. The difference between the highest and lowest values ranges from R11.4 billion in the early years to R64.2 billion in the final year of the analysis. This indicates that there is a substantially high level of variation amongst the size and capacity of the companies in the study. It is worth noting at this stage that for Tables 3.3 – 3.5 the fundamental values of a company are only included if the company has a debt security in issue in that particular year.

Following from the above, Table 3.4 provides the mean, median and standard deviations of the cash flows of the companies included in the OTHI. Unlike the significant range which was seen in the descriptive statistics for Sales, the cash flow values seem to be less deviated away from the mean with the maximum being a R12.6 billion deviation. This illustrates that cash flow values are less varied across the different company sizes. The table also illustrates that the cash flow values have shown a less dramatic growth than the other two fundamentals, with an increase of 6 times over the 14 year period which is much less than the 9 times growth shown by sales or the 12 times growth shown by the book values in the following tables.

Table 3.4: Cash flow Metrics Descriptive Statistics

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean	3.9	3.8	4.2	7.1	6.2	6.5	6.9	9.1	6.7	9.0	13.3	17.6
Median	1.3	1.4	1.7	4.1	1.9	1.5	1.6	2.7	1.0	5.2	7.4	15.8
Std Dev	5.7	5.7	5.6	8.2	7.3	8.3	8.9	12.6	10.4	9.5	14.6	12.0
Skew	1.03	0.70	0.52	0.73	1.09	0.88	1.54	1.18	1.50	0.74	0.74	0.57

An illustration of the annual distribution of the cash flow values of the securities in the OTHI indexes.

**Values quoted in billions of Rands*

Finally, Table 3.5 below illustrates the mean, median and standard deviation of the company's book value fundamental metric. As mentioned above the book values have shown the most dramatic growth. In addition, the large deviations seen from the table indicate that the range of the companies whose securities are included in the index varies significantly in size.

Table 3.5: Book Value Metrics Descriptive Statistics

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean	7.0	6.6	6.8	12.0	13.8	21.9	26.5	27.8	41.0	50.1	45.1	60.1
Median	2.2	2.3	2.3	2.4	2.9	12.8	15.0	20.3	37.2	40.0	47.5	63.0
Std Dev	10.3	10.5	11.1	17.5	19.4	23.7	28.2	28.9	41.6	48.7	36.7	38.5
Skew	1.81	2.38	2.58	1.73	1.50	0.68	0.46	0.45	1.12	1.07	0.10	0.08

An illustration of the annual distribution of the book values of the securities in the OTHI indexes.

**Values quoted in billions of Rands*

The three tables above also indicate the skewness of the distribution of each metric. While the general trend amongst the three metrics is that of positive skewness, the book value table illustrates that they are the most positively skewed.

Another point of interest is the similarity between the resultant weights from this new study, and the original weights of the OTHI. The acclaimed superiority of the alternative indexes arises from the hypothesis that using fundamental data will result in the higher weights being placed on the securities which are more likely to produce a greater return. Thus, if significantly better results are to be used there must be a noticeable difference between the weights of the replicated index and those of the original. This is best illustrated by examining the correlations between the weightings of the two indexes.

Table 3.6 below shows the overall correlations of the weightings between the four sub-indexes of the OTHI_ALT and the original OTHI index. This matrix indicates that overall all the indexes have a correlation of 0.25 or less with the OTHI. However, amongst the sub-indices the sales and cash flow indices have the highest correlation with each other at 0.872. All three sub-indices also have high correlations with the composite, as to be expected.

Table 3.6: Correlation of OTHI_ALT Weightings to OTHI weightings

	OTHI	Sales	Cash Flow	Book Value	Composite
OTHI	1.000	-	-	-	-
Sales	0.130	1.000	-	-	-
Cash Flow	0.242	0.872	1.000	-	-
Book Value	0.249	0.457	0.581	1.000	-
Composite	0.242	0.876	0.930	0.804	1.000

The above table illustrates the correlation between the average weightings of the original OTHI against the indexes of the OTHI_ALT across the entire sample period of February 2002 to November 2012. A more descriptive annual breakdown is shown in Appendix C.

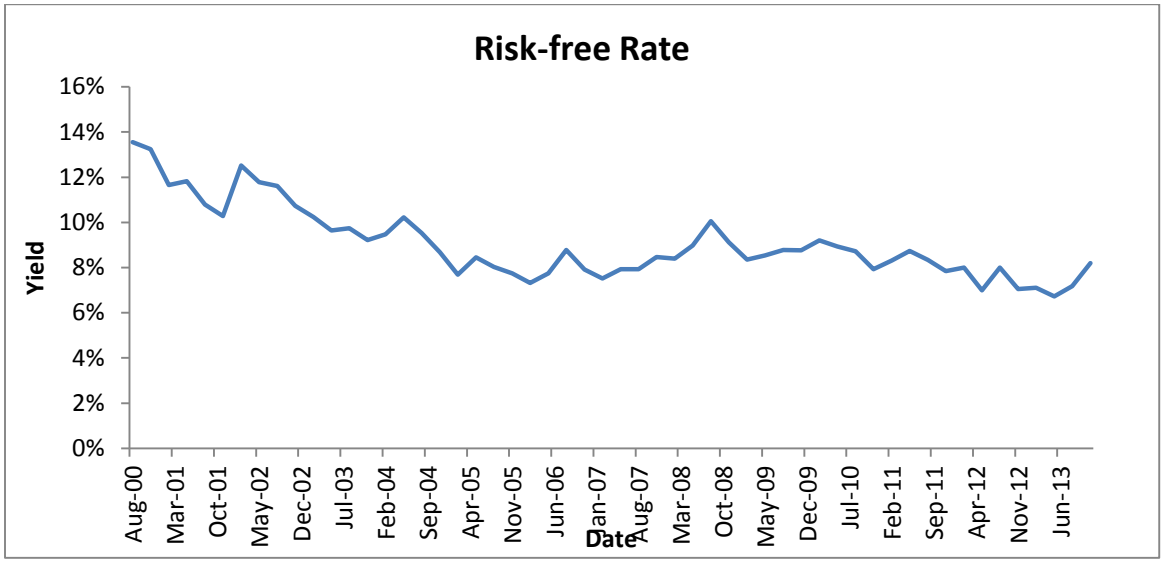
Another interesting observation from the table is that the sales index seems to be the least correlated with the OTHI index. Assuming that the lower, the correlation the better the outperformance; this observation supports the hypothesis that the sales metric provides the most superior performance of all the fundamental metrics.

A more detailed correlation matrix is included in Appendix C which illustrates the annual correlations of all the indexes and sub-indexes against each other. From this table, it is clear that there is variation between which sub-index has the overall highest correlation with the original. However, for the most part, the correlation between the indexes tends to be low and at times even negative. As seen from the appendix, the highest correlation with the original OTHI index is with the book value index in 2004 of 0.714.

The final part of this section provides the descriptive statistics of some of the data used in the performance evaluation portion of this research undertaking. A key variable in this study is the risk free rate which is taken as the yields on 10 year government yields. Figure 3.1 below illustrates the trend of the risk free yields over the 14 year period between 2000 and 2013, shown at each quarter. Besides being useful for the performance tests on the indexes, the risk-free trend is also a good indication of the prevailing macro-economic conditions in each period. High interest rates are usually associated with possible tightening of liquidity and economic conditions; while low interest rates usually symbolize improved economic conditions. However, on the whole, the South African yields are seen to have a

declining trend, despite short term deviations. The nature of the macroeconomic conditions will be useful when analyzing the trend of returns from the indexes.

Figure 3.1: Graph illustrating 12 year trend on 10 year government bond yield



The graph above illustrates the movement and trend of the South African risk free rate, during the sample period beginning August 2000 and ending November 2013.

All the descriptive statistics which have been laid out above provide a clear understanding of the nature of the data collected for the research overview of the type and magnitude of data used in the analysis section of this paper. The next section lays out some difficulties and biases which may appear when working with financial data.

3.3. POTENTIAL BIASES AND CORRECTION

To ensure that the empirical results are as accurate as possible, potential biases must be noted and corrected for where possible. While many biases can present themselves when dealing with financial data, the ones which are most likely to occur with this type of study are survivorship bias and data snooping bias. These are explained below:

3.3.1. *Survivorship Bias*

Survivorship bias is found when securities which have not survived are removed from the database. This leaves only successful companies in the sample, meaning that any performance analysis tends to have an upward bias as they do not factor the failures of the de-listed companies, (Ferreira & Krige, 2011).

Survivorship bias is usually the biggest cause of inaccurate or insufficient conclusions drawn in financial analysis. However, because this study is taking the historical components of each data and building them up individually, there is little potential for survivorship bias. In this analysis all prior index constituents are included despite their success or lack thereof. A further measure against survivorship bias is use of the JSE methods of choosing the bonds which will constitute the index. Because the method uses both sizes of the security as well as its liquidity, most of the securities chosen are unlikely to fall in the non-survivor bracket under the period in question. In addition to this, the constituents are re-assessed and re-constituted every quarter allowing for continuous checking and testing of the survivability of each security that is allowed in the index.

3.3.2. *Data Snooping*

This occurs when a study is performed within a particular database, and the results are tested within the sample of that same database. This leads to possibly unrepresentative results which may be due to the inherent nature of the data instead of any fundamental reasoning, (LSE, 2014). This is a bias which may present itself in this research investigation. To remove the effects of data snooping, out-of-sample tests can be conducted to ensure validity and robustness of any findings in the study. However, due to their complexity, out-of-sample tests are excluded from this study. Instead, this study follows the selection and testing rules set up by domestic and international market indexes; and in doing so believes that any potential biases in this stead are minimized.

3.3.3. *Omitted Variable Bias*

While this is an exploratory study and thus a number of different variables are put forward towards performance attribution, omitted variable bias is always a potential threat. This is a bias that presents itself during regression analysis, due to a regression specification leaving out one of the explanatory variable which is needed for the model. In an attempt to ensure that this does not result in incorrect estimates of

the model, this investigation follows closely in the paths of other comprehensive studies for the return breakdown of the indexes. As such we ensure that the possibility of introduction of biases is drastically reduced.

3.4. SUMMARY AND CONCLUSION

This chapter has introduced and described the myriad of data which is used for the purposes of this investigation. The sources of each individual variable were laid out. Through the use of data straight from the JSE as well as from reliable financial databases, there is reasonable expectation that the data collected is accurate. Further to this, justification was provided regarding the choice of using three metrics instead of the usual six.

The chapter put also forward selected descriptive statistics of the data pool which it uses for the various aspects of the investigation. The characteristics of the indexes where fully laid out in terms of the spread of securities which make up the indexes and their shortfalls where pointed out. In addition, summary statistics regarding the mean and spread of the fundamental metrics was provided. As well as details regarding the similarity of the original OTHI index and the alternative indexes created in this study. From these statistics and descriptions, it is hoped that the reader gains an appreciation of the quantity of data that is required for this type of analysis as well as the quality of the treatment of the data and the results it produces. It is also hoped that this chapter has laid out a structure which will be useful to the reader as they read the methodology and results sections which follow.

Finally, the chapter has also addressed the issue of biases which could affect the integrity of the data and the reliability of the results. The data snooping, omitted variable and survivorship biases were explained, and their possible effect on this study was fully stated. In each instance, however, remedies to combat these biases were laid out, or alternatively, valid reasons given as to why the mentioned bias would not be considered as a substantial problem in the analysis.

4. METHODOLOGY

This chapter sets out the methodology and tests that are put in place to carry out the core investigation of this paper - checking the performance of alternative indexes against traditional ones. An understanding of the methodology is a crucial component in determining the validity and level of accuracy of the results and conclusions drawn out in this paper. Further to this, the fact that this is an initial study of this kind means that in setting out a firm foundation for future research of its kind, and so a clear basis must be given regarding the investigation methods.

The tests and methods set out in the methodology of this study are based on those used in the prior fixed income fundamental indexes. Specifically, a paper by Arnott et al. (2010) is used as it was the pioneer study of this topic. Furthermore, to cater for specific South African market factors, the methodology also incorporates ideas used by the local asset management house, Cadiz (2009), in an in-house report detailing the development of an investible corporate bond index; as well as tests carried out by Hsieh (2013) in a similar study in the domestic equities market.

The procedure followed is laid out in the following sections and is divided into two subsections: the methodology for the construction of the index and the methodology used when undertaking various forms of performance evaluation of the created indexes. The chapter will begin by setting out the methodology put in place in the creation of the index. This includes the manner in which the index components are selected as well as the method in which index re-constitution and coupon re-investment are carried out. Following this, a description of all the tests to be carried out in the performance evaluation component is included, with emphasis on what the tests imply and the components and variables included for each test.

4.1. BOND INDEX CONSTRUCTION METHODOLOGY

4.1.1. Universe Selection

Given the nature of the South African corporate bond market, a lot of care must be taken in determining bonds which are eligible to include in the index. The output from the construction must be a liquid corporate bond index, which is investible by general investors and replicable by fund managers. The methods used by the JSE indexes has been detailed in the Chapter 1.3, however the key points are re-iterated below.

As the first index replicates the JSE's OTHII, the bonds which are eligible for this index must therefore be corporate bonds which exhibit the following properties:

- All bonds must be vanilla bonds which follow standard pricing rules
- Each bond must pay a fixed coupon
- Each bond must have a remaining time to maturity greater than one year

(JSE, 2011)

These guidelines are set to ensure that the instruments selected are those which have potential to trade in the secondary market and can thus be sold with relative ease during any index reconstitution period. From these basic guidelines, bonds are then selected according to a dual ranking system which is given by liquidity of the instrument as well as nominal issue amount of the bond. The alternative index desires to maintain some of the advantages of the cap-weighted indices; the top of which is liquidity. By following the same bond selection process, it is assured that the liquidity advantage is retained.

For the JSE indices, this ranking process includes both corporate and government securities, and from these the top 20 bonds are incorporated into the ALBI of which the OTHI is a subset. An example of the output of this process is given in the form of the dual ranking graph shown below. The graph is an illustration of the bond selection process using the securities from the 2010 first quarter reconstitution period. The inner blue line encloses those bonds which would be included in the GOVI, while the outer blue line adds the components of the OTHI, both combined to make the ALBI.

Figure 4.1: Dual Ranking Bond Selection Process

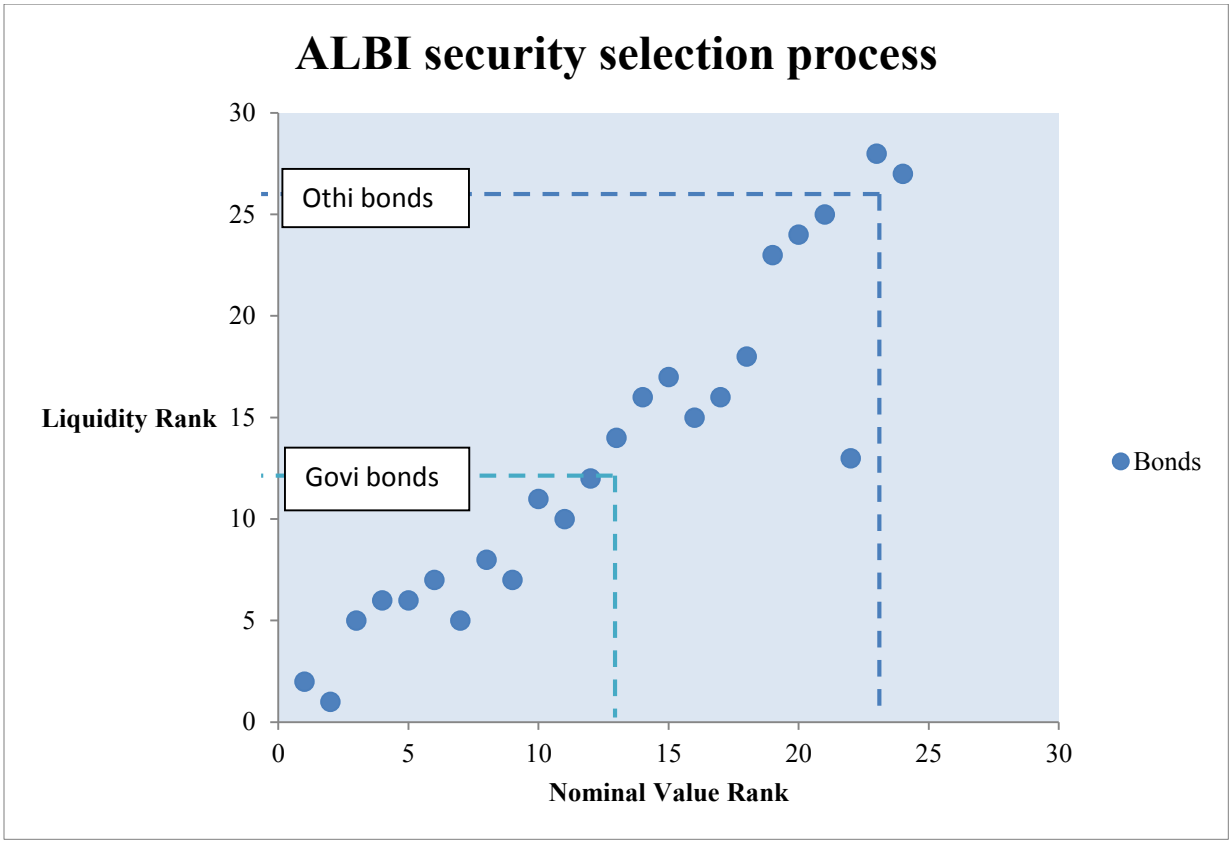


Illustration of the security selection process for the ALBI index, and as such for its subset indexes, the GOVI and the OTHI. Bonds are arranged from the largest and the most liquid (bottom left corner), and decrease in size and in turnover further up the graph.

A point of interest with bond indexes is the credit risks imposed by the underlying securities. Thus, the creation of fixed income indexes includes the determination of an appropriate credit restriction which is placed before securities can be included in the index. The credit restriction is based on the credit ratings given to the institutions by one of the major rating agents, i.e. Standard & Poors, Moodys or Fitch. While this is good practice, the extent of the restriction is based on the market in which the index is created. Given the thin nature of the South African corporate bond index, this research study places no credit restrictions on the securities which it allows in its index. This approach is deemed most appropriate for both simplification purposes, as well as because this is the same approach used by the ALBI and its sister indexes as well as by Cadiz (2009).

Using the processes detailed in chapter 1.3 and further summarized above, the corporate index is reduced from over 500 corporate issues which meet the three initial guidelines to less than 20 bonds which will make up the index at any one quarter in the study.

The creation of the SAFI_ALT was adapted to the normal rules in order to accommodate the availability of data. While the rules pertaining to vanilla and minimum time to maturity were maintained, the bonds were ranked according to their nominal value, with only bonds greater than R1 billion being considered. While most financial institutions consider R300 million as adequate to ensure liquidity, a stricter rule was applied in this investigation. This was done for two reasons. Firstly, the ALBI and OTHI usually provide a liquidity rank as well as a nominal rank. However, the trading volume turnover data required or the liquidity rank is unavailable for the most part and as such was omitted from the process. The lack of turnover data on the securities is the biggest limitation which presents itself in the creation of the SAFI_ALT. As such, the index has the potential of holding bonds which are not liquid enough to be viable inclusions in an investible index. The use of large nominal values as a cut-off attempts to mitigate this limitation.

Taking nominal values only may seem somewhat counterintuitive given that the main purpose of this study is to remove the effect of nominal data from indexes. However, one must remember that nominal effects are still excluded from the determination of weightings and as such the argument against cap-weighted indexes is still uncompromised. The SAFI_ALT was also stricter in the industries of the bonds which could be considered. Any government and government related companies where excluded from the selection sample. This was to increase diversification of the index and reduce the massive government influence which can be found on the OTHI and as such the OTHI_ALT.

4.1.2. Calculation of Weights

This study consists of three financial metrics being used to create three fundamental indexes. In addition to these three indexes, a composite index is created using an equally weighted combination of the cash flow, sales and book value indexes. The study uses fundamental weightings methods and as such the index construction considers the company's specific accounting variables. Therefore, once the financial variables stated in the previous chapter have been gathered, the weights for each index are calculated using the following formula:

(4.1) $$w_{ij} = \frac{company\ specific\ financial\ variable}{\sum[company\ financial\ variables]}$$

Once the different weightings are calculated, the composite weightings can be formulated as follows:

(4.2) $$w_{composite} = \frac{\sum w_{ij}}{3}$$

For companies with more than one listing in any period, Arnott (2010) puts forth two possible ways in which to deal with them. The first is to divide the corporate weighting amongst the issues according to the ratio of their nominal values in such a way that the highest nominal value gets the largest portion of the weighting. The second method is to simply equally distribute the weighting allocated to the security, (Arnott, et al., 2010). The authors suggest that there is no statistically significant difference in the returns noted using these two methods. Therefore, this paper follows the simpler method of apportioning the weight allocated to a corporation equally amongst all its bond issues.

4.1.3. Index Rebalancing

Most US and global studies suggest annual rebalancing of the index in an attempt to reduce transaction costs incurred by the investor. For purposes of this study, it is best to take lead from the domestic indexes. In this regard, the index is rebalanced quarterly, on dates which align with the rebalancing of the three JSE indexes as well as various mutual fund indexes. Rebalancing thus occurs on 1st February, 1st May, 1st August and 1st November, (JSE, 2011). At rebalancing the dual ranking process explained above is re-done, and some bonds which do not make the cut are replaced. At each rebalancing, new instrument weightings are also calculated, and re-investment of any received coupons is taken into account. This last point is expanded on in the section which follows.

4.1.4. Return

As with everything else, the total returns of the fundamental indexes created must closely follow the calculation method set out by the JSE to allow for accurate comparison against the OTHI. As with the OTHI; the indexes consider price, accrued interest and reinvestment of coupons into the index when considering the total return. Thus at each time period, the value of the index is calculated as in the following equation:

(4.3) $$I_t = \sum_{i=1}^{n} w_{it} P_{it} CP_{it}$$

Where: I_t = Index value in time t

w_{tt} = the weighting of security *i* at time t

P_{it} = the all in price of security *i* at period t

CP_{it} = any coupon payments received for instrument *i* during period t

Two things must be noted about the formula stated above. Firstly, for simplicity purposes, any coupons received are taken as reinvested at the end of each quarter and no attempt is made to distinguish reinvestment on the exact date at which the coupon is received. At the end of the quarter, the coupons are re-invested in the portfolio according to their weightings. The second noteworthy point is the treatment of the accrued interest which is included in the all in price. A double counting issue may arise in which a bond whose accrued interest was accounted for in the previous period subsequently receives a coupon payment in the following period and no adjustment is made for this. To prevent instances of such double counting, the accrued interest portion is accounted for as follows:

- For securities which are sold at the end of the period, the inclusion of accrued interest is deemed appropriate as the all in price is the value received at sell
- For securities which re-enter the index in the following period and subsequently receive a coupon payment, the accrued interest value is subtracted from the security and as such double counting is avoided from one period to the next, (JSE, 2011).

Following the calculation of the index at each quarter, the performance/return of the index is calculated using the following equation:

(4.4) $$R_t = \frac{I_t}{I_{t-1}}$$

The resulting returns are calculated for each quarter within the sample period, and this is then compared to the returns of the OTHI index. For consistency during the performance, returns for each quarter are annualized.

4.2. PERFORMANCE EVALUATION METHODOLOGY

Following from the construction of the indexes, the study goes on to pursue a performance evaluation to investigate the source and stability of any present outperformance. This section thus expands on the tests and models used to undertake various tests on the risk and return characteristics of the index. These tests will comprise CAPM analysis, as well as various performance indicators. The indexes constructed in the prior section will be measured against the benchmark of the traditional JSE index, the OTHI.

As the basis of the performance evaluation, general bond index characteristics are pitted against each other to compare the new indexes with those currently available. Besides looking at return, performance will also be measured according to the duration of each index. Duration measures the sensitivity of the index to changes in interest rate; as such a shorter duration is possible. Calculation of duration for an index is slightly different from the duration calculation of a single bond and the formula used is as follows:

(4.5) $$Duration = \sum_{t=1}^{n} \frac{PV(CF_t) * t}{Market\ Price\ of\ Bond}$$

Where PV (CF_t) is the present value of coupon at time t, t is the time to each cash flow of the security and n is the number of periods to maturity, (CDIAC, 2007). From equation 4.5 above, the duration of each security is obtained and these are then combined using the different weightings to get the duration of each index in any particular period.

The Capital Asset Pricing Model (CAPM) serves as the starting point of the regression analysis on the indexes. Equation 4.6 states the return adjusted version of the CAPM formula. Using this equation, the study aims to decompose the outperformance (alpha) of the alternative indexes as well as determine their level of exposure to the general bond market (beta), (Cadiz Report, 2009).

(4.6) $$r_p - r_f = \alpha_i + \beta(r_b - r_f) + \varepsilon$$

In the equation above, $r_p - r_f$ represents the difference between the annualized portfolio return and the risk free rate, in the case of this study, this is the difference between the alternative indexes and the risk

free rate. The second subset is: $r_b - r_f$, which is the difference between the benchmark OTHI return and the risk-free rate. A regression of equation 4.6 then produces α_i as the outperformance of the alternative indexes and β as the sensitivity of the new index to the market. These variables will help in revealing if alternative indexes are superior. For this regression as well as the others which follow, the return on the composite index is used as r_p.

The performance evaluations also measure the following statistical variables in order to unequivocally determine which of the indexes provides the best overall performance. These measures included in the performance evaluations include the Sharpe ratio, tracking errors, and Treynor ratios as well as the information ratios, (Grinold & Kahn, 2004). These ratios are represented in the equations 4.7 – 4.11 shown below:

(4.7) Standard deviation: Std Dev. = σ_{rp}

(4.8) Sharpe Ratio: $SR = \frac{r_i - r_f}{\sigma_{(rp-rb)}}$

(4.8) Treynor Ratio: $TR = \frac{r_i - r_f}{\beta}$

(4.9) Information Ratio: $IR = \frac{\alpha}{\sigma_{(rp-rb)}}$

(4.10) Tracking Error: $\sigma_{(rp-rb)}$

The standard deviation is taken on the raw returns and measures how far the returns deviate from the mean. Sharpe ratio and tracking errors are a measure of risk of the index, with Sharpe indicating the return per unit risk of the portfolio. Tracking error measures how closely the new indexes follow the benchmarks. Information ratio is a measure of skill embodied by the outperformance of the index, α, over the standard deviation of the portfolio performance. The treynor ratio measures the reward to volatility ratio of the index, (Grinold & Kahn, 2004). All these ratios are performed for both the alternative indexes and the benchmark index and performance is compared across the board.

This chapter presents the tests and models used to aid the research investigation, and attempts to provide a full explanation of the purpose of each equation and test as well as a full explanation of all the variables which are combined in the different models. The models outlined in this chapter are used in combination to determine the truth to the allegation that alternative indexes created using fundamental weightings will significantly outperform the traditional cap-weighted indexes. The next section provides the results output from all the tests above and is a lead up to the conclusion section.

5. RESULTS

This chapter examines and explains the empirical outcomes of the performance of the alternative indexes against the cap-weighted alternative. The results laid out in this section follow from the construction and tests explained in the methodology chapter above using the data outlined in chapter 3. Overall, the chapter will attempt to provide an unequivocal answer as to whether alternative fixed income securities outperform cap-weighted indexes in the South African market. The results are presented in two parts: firstly the return and direct comparison results are laid out, and then performance evaluation results are presented.

The results chapter is laid out as follows: the next section presents results on the returns of the alternative indexes constructed in chapter 4, comparing these to the traditional OTHI historical returns. The following section then presents and analyses the results revealed by the various tests undertaken by the performance evaluation component of the empirical analysis. Section 3 briefly addresses the issue of fundamental indexation being a re-packaged version of value investing. Finally, section 4 brings all the results together and provides a concise, high level summary on the implications of the results.

5.1. RETURN ON ALTERNATIVE INDEXES

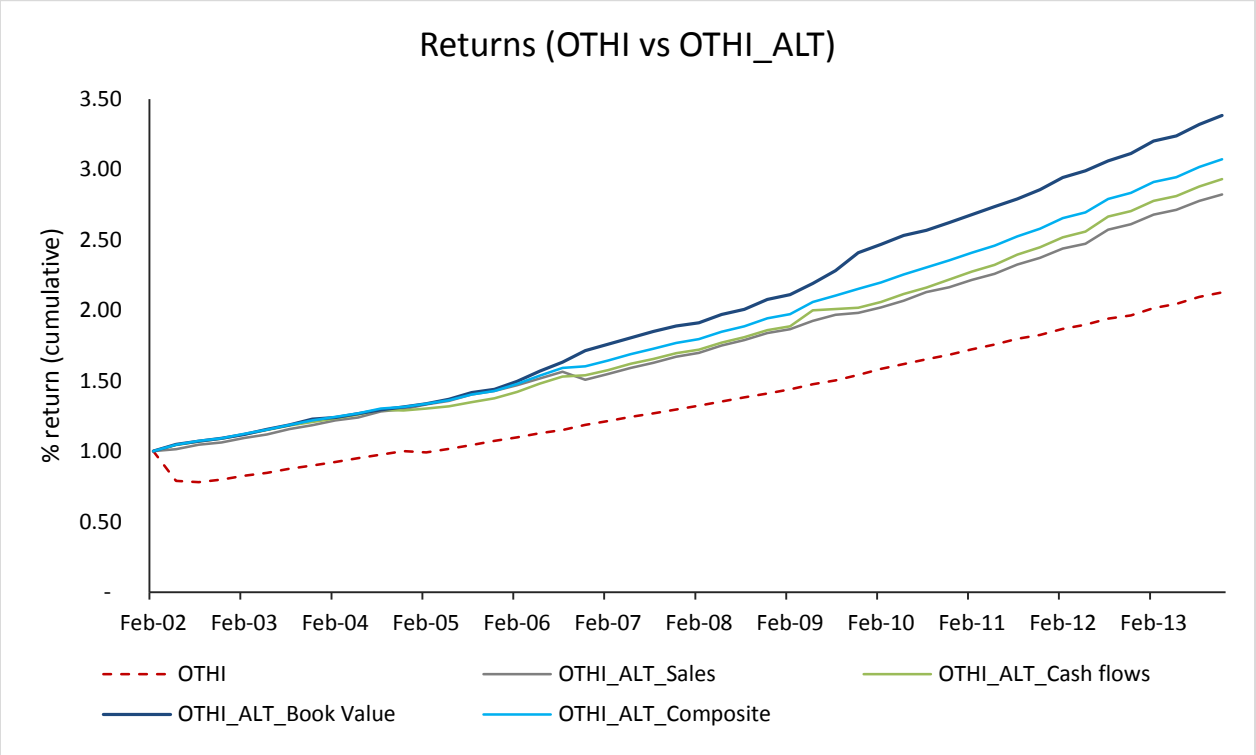
To set off the results section, a graphical comparison of returns on the different alternative indexes against the traditional benchmark returns is provided. Figure 5.1 shows the cumulative returns of the four sub-indexes of the alternative OTHI replication (OTHI_ALT), overlaid against the original OTHI. Following this, Figure 5.2 illustrates the cumulative of the four sub-indexes of the SAFI_ALT overlaid against the original OTHI. For a closer comparison, Appendix D shows returns of the individual sub-indices of the alternative indexes compared with each other as well as against the OTHI returns.

Figure 5.1 shows the cumulative index returns over the 12 year period between February 2002 and November 2013. Over the entire period, the cumulative results show that the alternative indexes outperform the OTHI. If one had invested one rand in the OTHI index in 2002, one would have a cumulative return of R2.13 while a similar investment would have yielded R3.38 during the same period

had they invested in the fundamental book value index. In contrast the Sales and Cash Flows indexes are the lowest performing, with a one rand investment yielding R2.82 and R2.93 respectively.

Figure 5.1 reveals an interesting finding regarding the performance of the replication indexes. Unlike prior studies which name the Sales Index as the one with the greatest outperformance, this study finds that the Book Value index performs better than any of the others. This result is somewhat peculiar as a company's book value is the only fundamental value that has any relation to the nominal value of the company's debt issues. However, this is easily explained through understanding how an investor chooses from various investment vehicles. While equity investors choose to participate in the upside of a company's performance, fixed income investors are looking instead to protect their downside. As such, the lean towards indexes with higher book values indicates that investors tend towards better protection as offered by greater net asset value.

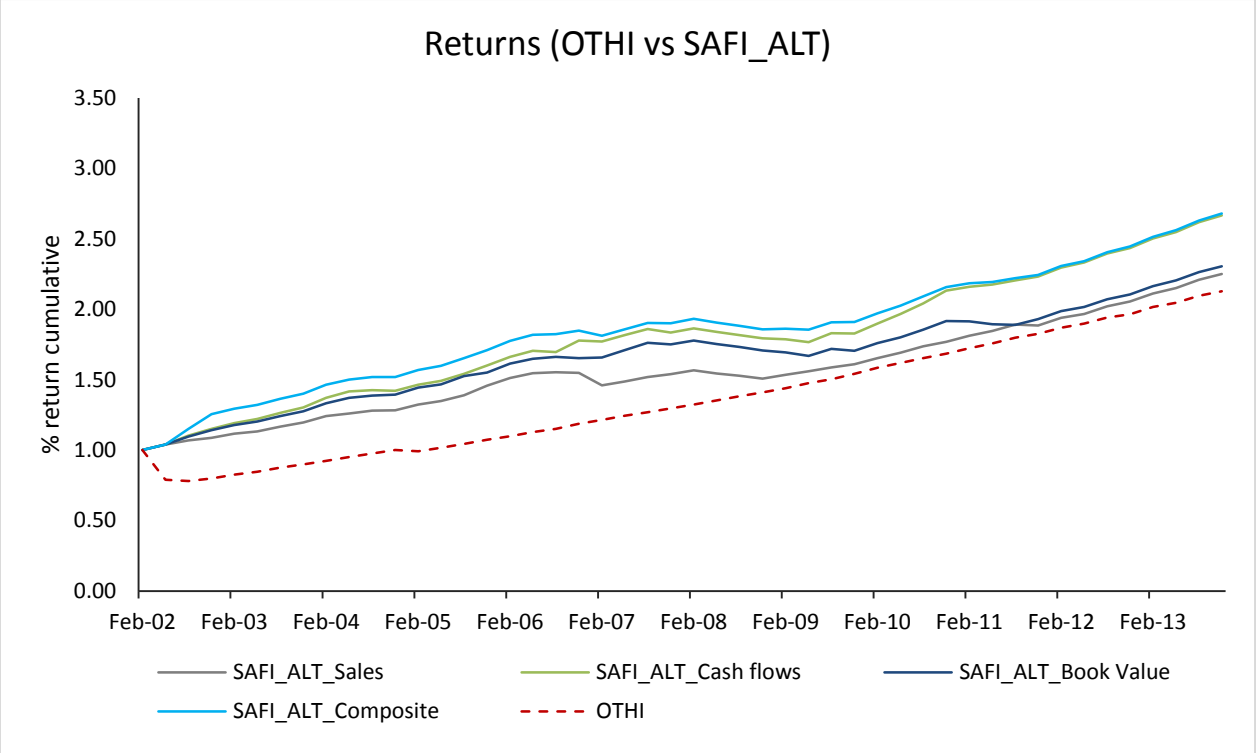
Figure 5.1: Historical Index Returns: OTHI vs OTHI_ALT Indexes



A graphical representation of the cumulative returns from the alternative index, the OTHI_ALT compared against the original OTHI for the 12 year period between February 2002 and November 2013. The Book Value sub-index is shown to have the highest performance. However, all four alternative sub-indexes are seen to be superior to the original cap-weighted index. A more detailed graphical comparison is shown in Appendix D.

Figure 5.2 reveals the results of the second set of alternative indexes, the SAFI_ALT, against the original OTHI indexes over the same period as above. The cumulative returns from below show that the SAFI_ALT indexes outperform the original OTHI index, despite the differential between the returns of the two groups being lower than was seen in the first graph. A one rand investment in the best performing SAFI_ALT index would yield R2.68, compared to the R2.13 obtained from an investment in the original OTHI index. Surprisingly, the graph below also reveals the Sales Index to have lower performance than the other 3. The best performing index is the Composite Index, followed by the Cash Flow Index with a cumulative return of R2.67, then the Book Value Index with a return of R2.31 and finally the Sales Index with a return of R2.25 over the period.

Figure 5.2: Historical Index Returns: OTHI vs SAFI_ALT Indexes

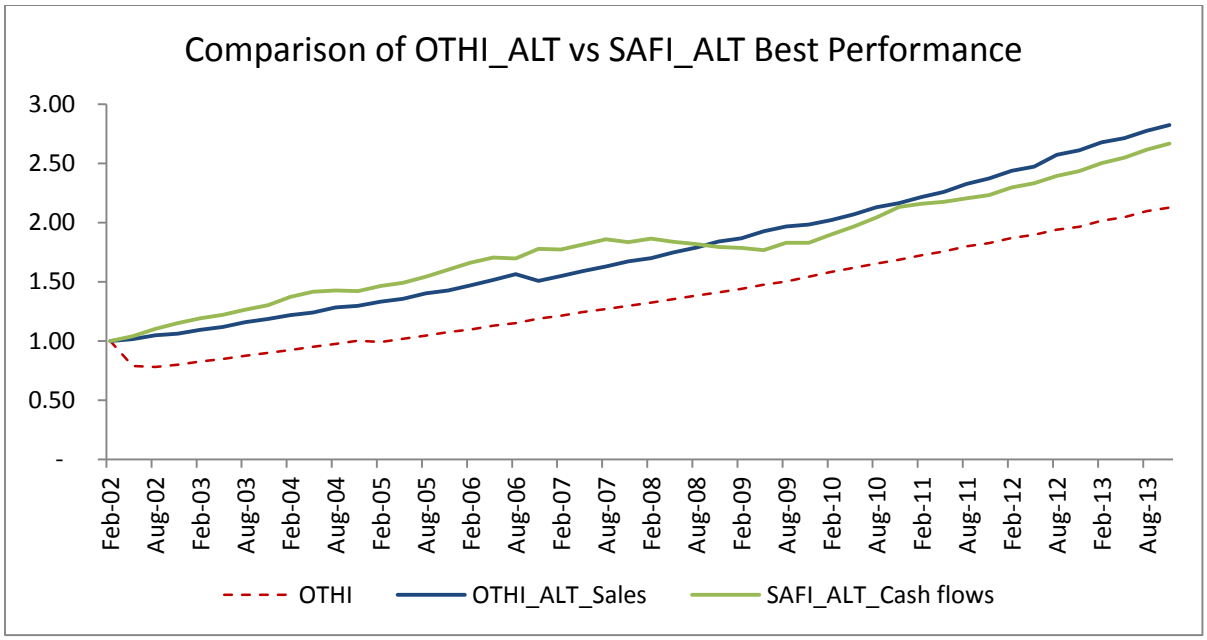


A graphical representation of the cumulative returns from the alternative index, the SAFI_ALT compared against the original OTHI for the 12 year period between February 2002 and November 2013. The Composite and Cash-value sub-indexes are shown to have the highest performance. However, all four alternative sub-indexes are seen to be superior to the original cap-weighted index. A more detailed graphical comparison is shown in Appendix D.

For a closer comparison of how the SAFI_ALT and OTHI_ALT perform head-to-head, the following graph illustrates the best performing sub-index from each, overlaid against the original OTHI index. As such, the graph below shows the performance of the SAFI_ALT_Cashflows index against the OTHI_ALT_Book Value index.

This analysis yields interesting results. To begin with, if one was to invest one rand in the OTHI_ALT, the cumulative return would be merely 15cents greater than the person who invested in the SAFI_ALT. It is also interesting to note that prior to the reversal of performance, the SAFI_ALT was outperforming the OTHI_ALT but a greater margin than the margins reached by the OTHI_ALT after the performance reversal. This suggests that if the markets did not experience a crisis of similar magnitude to that experienced in 2007/2008, the outperformance of the SAFI_ALT has the potential to be greater than that of the OTHI_ALT.

Figure 5.3: Historical Index Returns: OTHI_ALT vs SAFI_ALT



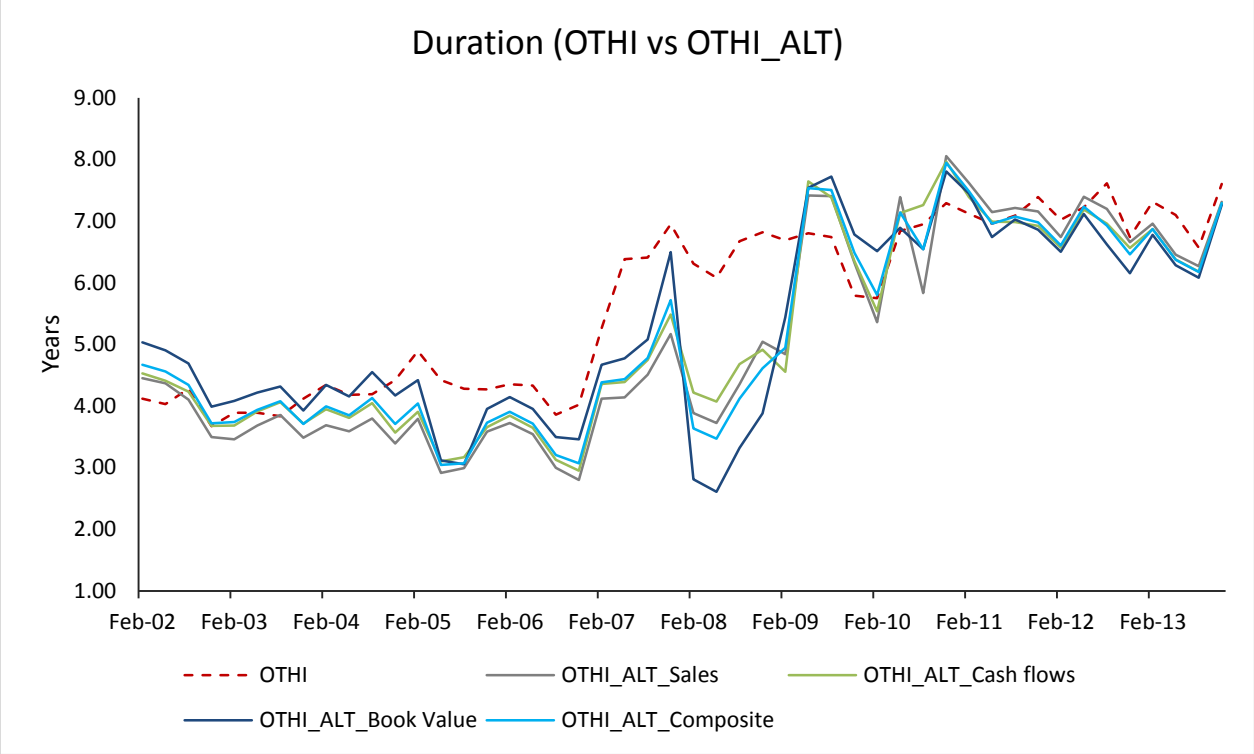
The graph above shows a graphical representation of the cumulative returns from the best performing alternative sub-indexes from the SAFI_ALT and the OTHI_ALT for the 12 year period between February 2002 and November 2013. The SAFI_ALT cash flows index is seen to outperform, the OTHI_ALT book value only up to the period of the financial crisis (2008). A more detailed graphical comparison is shown in Appendix D.

A look at Appendix D, allows one to undertake a wider comparison between the different sub-indexes of the OTHI_ALT and SAFI_ALT against the original OTHI as well as each other. In line with the graph in Figure 5.3, the OTHI_ALT outperforms both the SAFI_ALT and the original OTHI for the most part but the SAFI_ALT performs greater than the OTHI_ALT until about February 2008. At this point, the SAFI_ALT takes a huge dip and thereafter recovers slowly but fails to regain its earlier highs.

A simple explanation to this phenomenon comes from the composition of the indexes. As was mentioned in the data section, the SAFI_ALT has a majority representation from corporations in the financial sector, thus the financial crisis of 2008 can be seen to affect it to a much greater extent than the OTHI. On the other hand, the less risky securities which make up the OTHI serve as a buffer to this and the OTHI_ALT during this period. One may speculate that the SAFI_ALT may have continued having the higher outperformance had the crisis not hit; however, it is more concerning to note the extremely slow pace of recovery that the index has faced. A potential solution to this issue may be more sophisticated security selection methods, which would allow for a wider diversity regarding the sectors which make up the securities in the indexes; and as such reduce any extreme negative impact brought about by one sector of the economy.

After analysing the returns of the indexes, the risk levels of the indexes are the next point of interest. To start this off the duration of the indexes is illustrated in the following two graphs. Duration symbolises how long the index is at risk for interest rate risk. Thus, a lower duration is preferable than a higher one. These are shown in the graph below. Figure 5.3 shows the duration of the OTHI against the four sub-indexes of the OTHI_ALT over the period between February 2002 and November 2013. Figure 5.4 shows the duration of the OTHI against that of the four sub-indexes of the SAFI_ALT. Once again for closer comparison, Appendix E shows the duration of the individual sub-indices of the alternative indexes compared with each other as well as against the OTHI duration.

Figure 5.4: Index Durations: OTHI vs OTHI_ALT



A graphical representation of the index durations from the alternative indexes of the OTHI_ALT compared against the original OTHI for the 12 year period between February 2002 and November 2013. The best performing index is less clear-cut in the illustration as various indexes move from being much lower in duration at times to having higher duration than the OTHI at some points. A more detailed graphical comparison is shown in Appendix D.

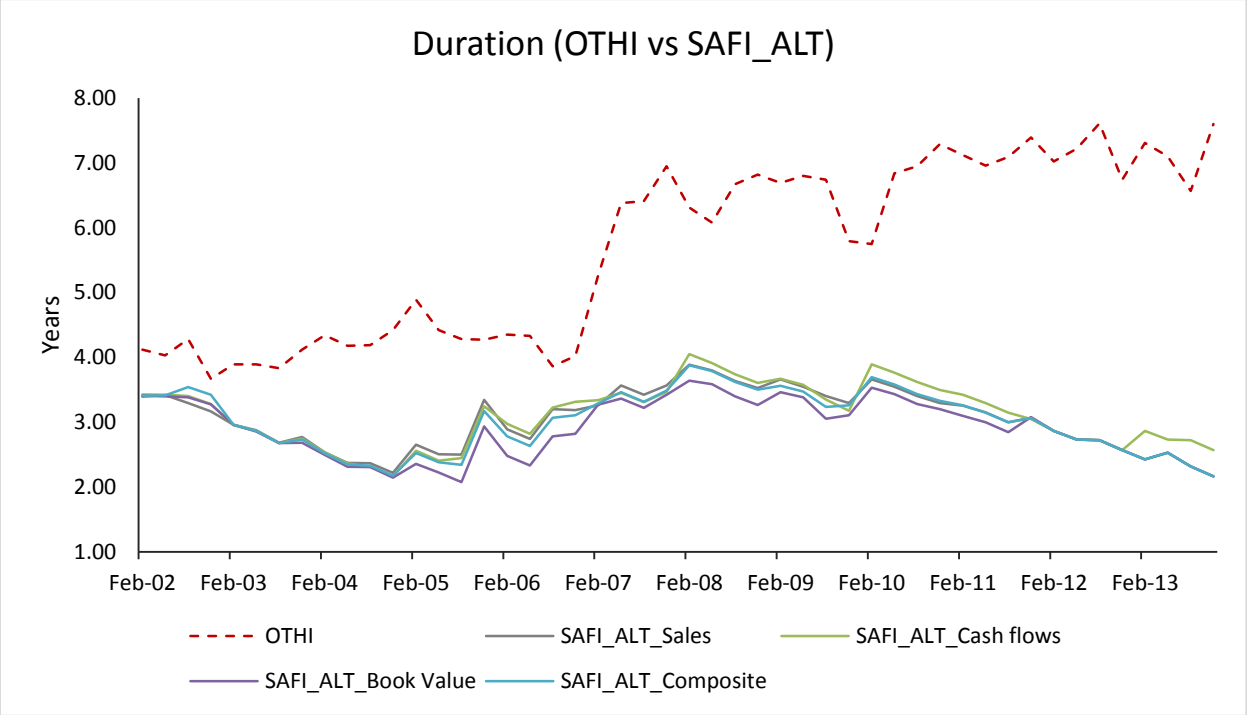
The graph above shows that the alternative indexes have slightly lower duration except for two periods, between February 2002 and November 2004, as well as between November 2009 and February 2011. However, except for a brief period between 2008 and 2009, the differences in the duration levels of the two sets of indexes are small. This means that while the OTHI_ALT provides a greater outperformance than the original index, the duration levels are comparable. In the final quarter, the OTHI duration level stood at 7.6 years, the Sales Index having duration of 7.31 years, both Cash Flows and Composite indexes at 7.29 years and the Book Value Index at 7.26 years.

Figure 5.5 below tells a much more convincing tale, as it illustrates a significant difference between the duration of the OTHI and the SAFI_ALT indexes. The graph shows that the duration of the SAFI_ALT is

close to a quarter of the value of the original OTHI. In the final quarter of the analysis, the OTHI duration was 7.6 years, with the SAFI_ALT Book Value Index having duration of 2.57 years and the remaining three indexes having duration of close to 2.2 years. Therefore, one can conclude that while the SAFI_ALT does not provide returns which are as high as its other alternative counterpart, it has a significant advantage when it comes to duration, assuming an expected increase in interest rates.

It is worthwhile noting that the shorter duration observed on the SAFI_ALT indexes may be as a result of the selection criteria imposed. In the domestic market, government issued bonds tend to have a longer term to maturity than their non-government counterparts. As such, exclusion of these government issued bonds means that the new indexes have a bias towards short-dated bonds, i.e. bonds with term to maturity of less than 5 years. Thus, the lower duration illustrated below, would be a direct consequence of this.

Figure 5.5: Index Durations: OTHI vs SAFI_ALT



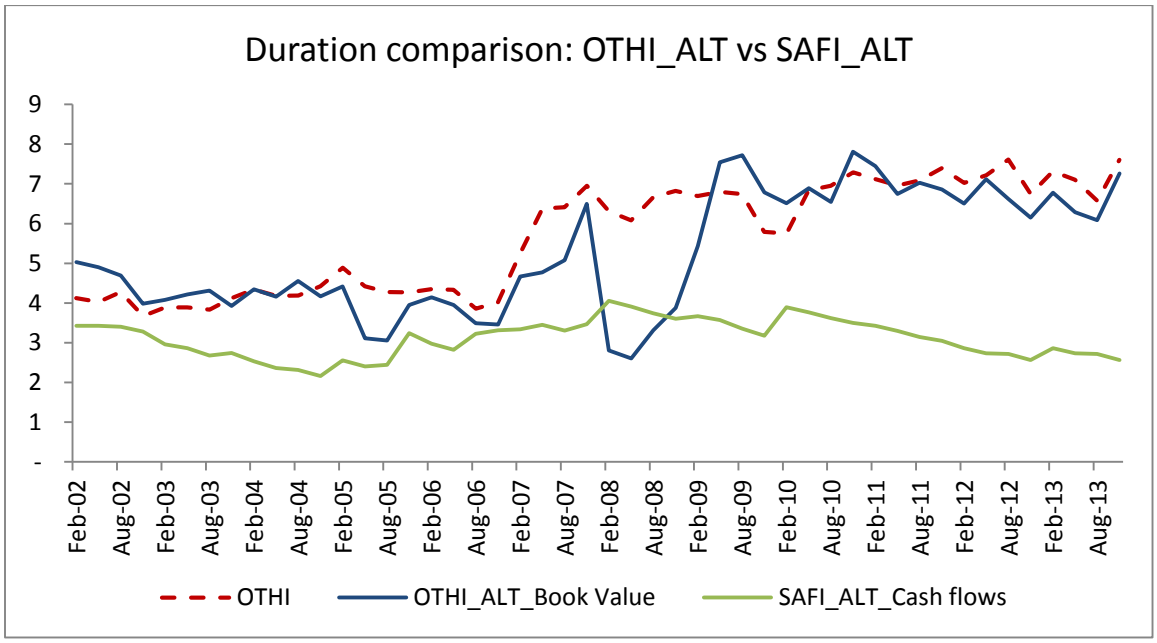
A graphical representation of the index durations from the alternative indexes of the SAFI_ALT compared against the original OTHI for the 12 year period between February 2002 and November 2013. The alternative indexes consistently exhibit lower duration than the OTHI over the sample period. A more detailed graphical comparison is shown in Appendix D.

Similarly, Appendix E shows that the SAFI_ALT has the lowest duration amongst all four sub-indexes of

the OTHI_ALT as well as the OTHI. The 2008/2009 period is noteworthy in the analysis. For most of the sub-indexes, the duration of the OTHI takes a significant dip at this point while the duration of the SAFI_ALT increases. For some of the indexes it is the only point at which the OTHI_ALT has a lower duration than the SAFI_ALT. Once again, this can be attributed to the financial crisis which would have a larger impact on the SAFI_ALT than it would on the OTHI_ALT as the SAFI_ALT holds substantially more financial instruments than its counterpart. It is also notable that the duration of the SAFI_ALT recovers much quicker from this decline in performance than was observed in the SAFI_ALT returns above.

For a closer comparison of how the SAFI_ALT and OTHI_ALT perform head-to-head, the following graph illustrates the best performing sub-index from each, overlaid against the original OTHI index. As such, the graph below shows the performance of the SAFI_ALT_Cashflows index against the OTHI_ALT_Book Value index. The graphs show that the SAFI_ALT index provides better duration than the OTHI_ALT excluding the 2008 period during the global financial crisis.

Figure 5.6: Index Durations: OTHI vs OTHI_ALT vs SAFI_ALT



A graphical representation of the index durations from the best performing alternative sub- indexes of the SAFI_ALT compared against the OTHI_ALT and the original OTHI for the 12 year period between February 2002 and November 2013. The SAFI_ALT cash flow index consistently provides lower duration than both the OTHI_ALT book value and the original OTHI. A more detailed graphical comparison is shown in Appendix D.

The results above seem to show superior performance from the two sets of alternative indexes, either through increased returns or through lower duration. However, it remains to be seen whether this outperformance is significant to the investor. This is investigated in the next section.

5.2. PERFORMANCE EVALUATION RESULTS

This section begins by providing the output from the regression analysis, after which it provides the performance evaluation statistics from the two sets of indexes. The next two tables have selected results from the regression analysis shown by equation 4.6. The chosen output is shown in the tables: alpha (α), showing the outperformance of the index; the beta (β), showing the indexes' sensitivity to the market as well as the R^2 which shows what percentage of performance variation explained by the equation. Table 5.1 has the summary results from the regression of the four OTHI_ALT sub-indexes and Table 5.2 has the summary regression output from the SAFI_ALT indexes. The complete regression output for all the indexes is provided in Appendix E.

To a large extent the results shown in Table 5.1 corroborate the graph shown earlier. The alphas of the four different indexes are all positive and have a comfortable level of significance. The highest alpha is seen to be that of the OTHI_ALT book value index, on which one can expect an outperformance of 2.26% from the alternative index. This value is significant to the 1% level. The lowest outperformance is provided by the OTHI_ALT Cash Flow index which provides an alpha of 1.41% at a 5% significance level. These performance levels are only marginally lower than those found by Arnott et al (2010), as well as Hsu & Campollo (2006), where United States fixed income markets recorded up to 3.4% outperformance.

Table 5.1: Regression Analysis Output: OTHI Alternative Indexes

	α	B	R^2
OTHI_ALT_Sales	0.0172***	0.0159	0.023%
OTHI_ALT_CF	0.0141**	0.1612	2.34%
OTHI_ALT_BV	0.0226***	0.2113	2.062%
OTHI_ALT_Composite	0.0173***	0.1497	2.034%

The table represents selected values from the regression analysis of the OTHI_ALT indexes against the OTHI, for the returns generated over the 12year period between February 2002 and November 2013.

- Dependent Variable = $(r_p - r_f)$
*indicates significance at 10% level
**indicates significance at 5% level
***indicates significance at 1% level

Table 5.1 also shows the beta and the R^2 values from the regression. None of the betas shown below recorded any reasonable level of significance. In addition, all the values are close to zero. Therefore, the fundamental indexes are not significantly affected by market movements. Perhaps the most concerning results are the R^2 values from the CAPM regression which are all below 2.5%. This means that the regression analysis explains very little in the variation of the results.

Following from above, Table 5.2 illustrates the results from the SAFI_ALT regressions. Once again, the results are in line with the graphs shown earlier in this section, and follow the trend set by the OTHI_ALT results. Contrary to the OTHI_ALT results, the best performing index from the SAFI_ALT is the cash flows index. The cash flows index provides an alpha of 1.59% with a 1% significance level. The lowest performing fundamental index is the SAFI_ALT sales index, which provides a return of 0.53% at a 10% significance level. Similar to above, the SAFI shows little sensitivity to market movements as indicated by low, insignificant beta values. Furthermore, the regression analysis only explains a little more than the one above, with the highest R^2 being less than 3.5%

Table 5.2: Regression Analysis Output: SAFI Alternative Indexes

	α	β	R^2
SAFI_ALT_sales	0.0053*	0.1974	2.624%
SAFI_ALT_CF	0.0159***	0.2556	3.240%
SAFI_ALT_BV	0.0111***	0.1413	1.643%
SAFI_ALT_Composite	0.0108**	0.2143	2.600%

The table represents selected values from the regression analysis of the SAFI_ALT indexes against the OTHI, for the returns generated over the 12year period between February 2002 and November 2013.
- Dependent Variable = $(r_p - r_f)$
*indicates significance at 10% level
**indicates significance at 5% level
***indicates significance at 1% level

The results shown above reveal two important facts. The first is the level and significance of alpha of the alternative indexes. The graphs shown earlier in this chapter shows higher returns for all the alternative indexes. This regression analysis then goes to prove that these various returns are significantly different from zero. This is in line with the results found by many of the earlier studies, despite the return level being lower than global studies. The second insight is on the best performing indexes amongst the fundamental indexes. Earlier, global studies found that the sales and cash flow indexes were the best performing of the alternative indexes. However, this study finds that the sales and cash flow indexes are the lowest performers of the OTHI_ALT indexes; while the sales index is the lowest performing of the SAFI_ALT indexes.

In order to reach a clear and conclusive opinion, the next part of this section looks at the results from key performance indicators performed on all of the OTHI_ALT and SAFI_ALT indexes. Table 5.3 illustrates the results from various performance ratios across all four alternative OTHI_ALT indexes; while Table 5.4 shows the performance results of all four alternative SAFI_ALT indexes.

Table 5.3 shows that the overall mean returns of the indexes are superior to the mean return of the original OTHI. Once again the Book Value index proves to be ahead of the rest with a mean return of 10.75% against the OTHI's 7.13%. More interesting are how the risk measures compare against the original. The OTHI_ALT indexes have less than half the standard deviation of that of the original OTHI. The Sharpe ratio is also an important measure of return per unit of risk. From all the indexes, the highest Sharpe ratio is from the book value index which has a return of 0.9 for each unit of risk.

The additional statistics shown in Table 5.3 below prove that the alternative indexes provide positive returns given their volatility levels. Perhaps the most noteworthy of these is that the high performing Book Value index has the lowest Treynor ratio. While the Treynor ratio has a similar interpretation to the Sharpe ratio, the difference comes about in that Treynor uses beta as a measurement of volatility instead of the standard deviation. Therefore, this shows that the Book Value index has a much higher beta than all the other indexes and is therefore is most sensitive to market movements. The final two ratios are the tracking error and the information ratio. Tracking error is the difference between the return received and the return of the benchmark index. As such, a lower tracking error is preferred, and in this case this is provided by the sales and composite indexes. The information ratio is another measure of risk adjusted return and once again, the Book Value index is found to be the best performing of all 4.

Table 5.3: Summary of OTHI_ALT Performance Evaluation Statistics

	OTHI	OTHI_ALT_Sales	OTHI_ALT_Cash flows	OTHI_ALT_Book Value	OTHI_ALT_Composite
Arithmetic mean	7.13%	9.44%	9.48%	10.75%	9.94%
Std Dev (σ_p)	10.13%	4.64%	4.50%	4.43%	3.10%
α	-	1.72%	1.41%	2.26%	1.73%
β	-	0.0159	0.1612	0.2113	0.1497
Sharpe ratio	-	0.4342	0.5601	0.9112	0.7203
Treynor ratio	-	0.0469	0.0462	0.0353	0.0498
Tracking error	-	4.80%	5.99%	5.00%	4.75%
Information ratio	-	0.3575	0.2361	0.4519	0.3642

The table represents selected values from the performance ecaluations of the OTHI_ALT indexes against the OTHI, for the returns generated over the 12year period between February 2002 and November 2013.

The SAFI_ALT indexes show a similar mean return trend to the one shown above, albeit at lower levels. However, the standard deviations of the SAFI_ALT indexes are higher than those of the OTHI_ALT shown above. However, the risk adjusted returns for the SAFI_ALT as shown by the Sharpe ratio are higher in comparison than the OTHI_ALT. Surprisingly, the SAFI_ALT sales index has the highest Sharpe ratio of a return of 1.74 per unit of risk, in comparison to 0.43 per unit of risk offered by its OTHI_ALT counterpart. On the other hand, the Treynor ratios of the SAFI_ALT indexes are lower than those of the OTHI_ALT; while the tracking error is higher.

Table 5.4: Summary of SAFI_ALT Performance Evaluation Statistics

	OTHI	SAFI_ALT_Sales	SAFI_ALT_Cash flows	SAFI_ALT_Book Value	SAFI_ALT_Composite
Arithmetic mean	7.13%	8.73%	8.31%	9.00%	8.69%
Std Dev (σ_p)	10.13%	7.33%	6.83%	7.22%	4.21%
α	-	1.59%	1.11%	1.08%	0.53%
β	-	0.2556	0.1413	0.2143	0.1974
Sharpe ratio	-	1.7384	1.1180	1.4670	1.4163
Treynor ratio	-	0.0292	0.0528	0.0348	0.0378
Tracking error	-	6.97%	5.72%	5.93%	5.03%
Information ratio	-	0.2282	0.1941	0.1822	0.1053

The table represents selected values from the performance ecaluations of the OTHI_ALT indexes against the OTHI, for the returns generated over the 12year period between February 2002 and November 2013.

From a risk perspective, the fundamental indexes exhibit lower risk measures than the OTHI, using standard deviation as a proxy for risk levels. With the OTHI_ALT indexes recording less than half of the standard deviation of the original OTHI. The risk adjusted returns of the indexes are positive, showing that before accounting for transaction costs, alternative indexes perform better than the original domestic fixed income index.

It is interesting to note that, although the SAFI_ALT provided significantly lower duration than its counterpart, when compared using other performance statistics, it does not prove to provide any substantial performance benefits beyond those of lower duration, which may be a contribution of the nature of the bonds selected in the index. The SAFI_ALT indexes also win when observed using the Sharpe ratio as a risk adjusted return measure, providing over double the return per unit risk than the OTHI and the OTHI_ALT.

5.3. VALUE AND SIZE ARGUMENT

A final point of interest in this study is the argument made by those against fundamental indexation arguing that the success of this methodology is merely due to its tilt towards small cap securities which are inclined to exhibit size benefits as well as its inclusion of value securities whose intrinsic value is

greater than the market price, (Asness, 2006). The value and size benefits hold in that these securities will appreciate significantly as the company underlying the security grows and thus provide the investor with excess returns. Briefly, the argument presenting alternative indexation as a subset of value and size investing states: that the superior performance is due to the greater weight given to smaller securities which would otherwise not be well represented in the cap-weighted method. This argument can easily be dismissed in the domestic market. Testing this hypothesis empirically poses a difficulty in the South African market. This is due to lack of data and the fact that a significant number of the companies with bond issues are not publically listed.

However, while lack of proper data prevents us from exploring this theory empirically; a qualitative analysis can be presented. The argument for the size effect can easily be dismissed by looking at the constituents of the indexes. For both the OTHI replication and the new SAFI_ALT indexes, the bonds constituting them tend to lean towards the largest institutions in the country. This includes a significant number of large banks (e.g. Standard Bank, Investec) as well as numerous national entities and parastatals (e.g. Eskom, Telkom). While this will certainly affect the index in other regards, it certainly does not provide the indexes with the size benefits as critics would claim.

5.4. RESULTS SUMMARY AND IMPLICATIONS

The results shown above prove to be mostly in line with those found by prior global studies on alternative fixed income indexes. The results shown are of a higher level than those provided by the OTHI, and are significantly higher than zero for all the indexes. In addition, when these returns are looked at from a risk adjusted performance, their performance is far superior to the market benchmark.

However, the results are slightly lower than those found in other countries and in the equities markets. This is perhaps understandable given the nature of the domestic market. This is due to a number of reasons which includes the fact that the majority of the securities have large exposure to government influences. As such, the benefits of holding an authentic corporate bond index are somewhat diluted. It is not far-fetched to suggest that using fundamental indexation in a more sophisticated fixed income market, on an index with more exposure to corporate securities would provide significantly greater outperformance than those shown in this study.

An overview of value and size implications was also offered, and it was noted that given the methodology presented and the sample of the securities in the South African market, the index is tilted towards larger securities. Despite this, the alternative indexes still outperform and as such this outperformance cannot be attributed to the bias presented by growth securities. Finally, the impact of transaction costs was not explicitly accounted for in the investigation. Introducing transaction costs would decrease the returns and one must bear in mind this possible effect on the final results.

6. SUMMARY & CONCLUSION

After carrying out a thorough analysis, this chapter attempts to provide a succinct and accurate summary of all the findings, as well as conclude the investigation of this research paper. The chapter is arranged as follows: the next section provides a recap of the objectives of this paper and the subsequent findings relating to these objectives; section 6.2 sets out suggestions for future research aligned to this topic and provides ideas on how the scope of this topic can be expanded; finally section 6.3. will provide a general summary of the chapter and the entire research study.

6.1. SUMMARY OF FINDINGS

To fully appreciate the findings of this study, it is necessary to revisit the objectives which were laid out at the beginning. The first objective was to replicate the existing OTHI index with a set of fundamental bond indexes for the South African corporate fixed income market using alternative bond weighting methods different from the capitalization method currently used for the original OTHI. From this construction, four alternative indexes were created using sales, cash flows and book values as weights as well as a composite index of all the three fundamentals. These indexes were created for the twelve-year period between February 2002 and November 2013.

The second objective was to create another alternative set of indexes which incorporated different selection rules, in order to determine if diversification effects would improve the nature of the results. To this regard, the SAFI_ALT was created with another set of four fundamental sub-indexes. The selection of the SAFI_ALT was based on nominal values of the bonds, with a cut-off at any bonds below the one billion rand mark, a value larger than the cut-off on the original OTHI. This selection method yielded a different set of constituents to the first set. And these were weighted using similar fundamentals as those used on the OTHI_ALT. These indexes were created for the twelve-year period between February 2002 and November 2013.

The third objective was to investigate if these alternative indexes could provide significantly greater returns than the cap-weighted indexes which are currently in place, as well as compare this performance across various macro-economic cycles. Furthermore, the study was to undertake performance evaluations using the newly constructed indexes evaluated against the other indexes which are available in the market. And in line with this, a qualitative arguments was to be presented on the value and size effects which most critics use to dismiss the innovation of fundamental indexing. Overall, the objective of this study was to take on the newly popular method of fundamental indexation and determine if its relevance stood in the domestic South African market. The main intention of this paper was to expand from prior numerous studies carried out in the South African equity markets by investigating the response of fundamental indexing in the domestic corporate bond markets.

The results in the section above seemingly favour the other predeceasing studies on the topic. Returns from both sets of indexes show superior performance to the original OTHI, with the OTHI_ALT outperforming the SAFI_ALT. The OTHI_ALT returns are also seen to be consistent across periods of crisis, such as the financial crisis of 2008. On the other hand, those of the SAFI_ALT seem to suffer considerably at this stage. This phenomenon is attributed to the constituents which form the two indexes. In particular, holding majority of its securities from the financial sector is given as the main reason the SAFI_ALT indexes suffer during the period of the financial crisis. As such, to avoid this type of bias more sophisticated indexation methods are suggested, such as including a liquidity rank to the analysis as well as restricting multiple securities from one institution or industry.

The positions of the two sets of fundamental indexes are reversed when the duration analysis is carried out. The SAFI_ALT shows the added benefits of diversification with a duration which is significantly lower than the OTHI and the OTHI_ALT. The OTHI_ALT is seen to have a duration which is comparable to that of the original OTHI. As was seen with the returns, the duration of the SAFI_ALT deteriorates during the financial crisis, and the OTHI_ALT holds an advantage during this period. Therefore, from an overall basic risk and return perspective, the alternative indexes seem to hold an advantage over the cap-weighted OTHI index.

The study then proceeded to test the significance of the outperformance from both sets of fundamental indexes. The returns proved to have positive alphas with a high level of significance. This supports prior studies on the matter despite the fact that the alphas are lower than those which have been found in equity

markets as well as in the fixed income markets of other countries. In addition, the strongest performing index in this study was found to be the Book Value index, unlike previous studies which found the sales and cash flow indexes to be the best performers.

A look at the performance evaluation statistics found that from a risk-adjusted return perspective, the two indexes are comparable. While the OTHI_ALT has lower standard deviation and tracking errors, the SAFI_ALT records superior Sharpe ratios and duration levels. However, the differentiation was not convincing enough to declare that the SAFI_ALT is superior to the OTHI and its OTHI_ALT replication, despite its proven diversification features.

6.2. SUGGESTIONS FOR FUTURE RESEARCH

This research study has made reasonable attempts to be thorough regarding the topic of alternative indexation. However, there always remain various branches which can be explored in order to expand the scope of future studies, particularly in the fixed income section of the domestic market. While this branch of study is relatively new in the South African bond market and as such faces a number of limitations, the continuous growth of the domestic bond market will make room for further studies to explore a larger variety of channels.

A particularly interesting one would be to pursue the implications of the added effects of diversification within the indexes. As was noted in the previous chapter, perhaps the greatest shortcoming of the OTHI index is that it is heavily weighted towards government owned and government related companies. This fact has likely result in diminished returns from the index. A potential path of research would be to include bond issues from other non-parastatal companies which would likely increase the index returns.

While the new alternative SAFI_ALT index attempts to correct this, it introduces a new bias towards financial securities and this is seen to substantially affect returns during recession periods. Thus a way to incorporate a more diverse range of bonds is required. For example, a limit to the number of bonds which can be included from a particular company or sector can be introduced as an added selection constraint. Another simple way to increase diversification would be to increase the sample size of the index from ten securities per quarter to a larger sample of twenty or twenty-five securities.

A more quantitative investigation on the value and size effects could also be introduced. This would statistically present what portion of the outperformance of alternative indexes can be attributed to the greater weight of value securities and the securities from smaller companies. And in addition how significant (if at all), this attribute carries.

A further potential extension would be to pursue this study using government bonds of different emerging and developing markets. A similar study was undertaken by Arnott et. al (2010). However, it is believed that this study can be extended with a particular focus on sovereign bonds issued from Africa. From this study, suggestions of fundamentals would be GDP, size of country or the country's exchange rate. More direction in this regard can be found in the 2010 study by Arnott et. al.

A final suggestion for future research would be to introduce extended measures into the selection of index securities. These could be restrictions regarding nominal value of the instrument, minimum credit rating as well as minimum amount of volume traded in a month. Restrictions on how many securities from the same institution are allowed may also be helpful. These added restrictions could likely improve the liquidity of the bonds included in the sample and as such influence the index to show improved returns. While the current South African corporate bond market may make it difficult for some of these restrictions to be implemented immediately; it is believed that with the maintained growth of the market it is only a matter of time before these restrictions become viable.

6.3. CONCLUSION

With its superiority having been proven across the world, this study introduces fundamental indexation in the South African corporate bond market. The study finds evidence which suggests that the popularity of this method is justified as a superior indexation method. The study finds that before transaction costs, the fundamental indexes provide highly significant returns when compared against the current market benchmark, the JSE's OTHI index. The study also finds that the risk adjusted performance of these indexes is positive and as such they are more likely to provide greater return per unit of risk than the current market benchmark.

An element of diversification was introduced into the study with the creation of an alternative index using a different universe of corporate bonds than those found in the original OTHI. However, the more diverse indexes fail to provide convincing outperformance against the fundamental indexation using the original components of the OTHI. The inclusion of more sophisticated bond selection methods were put forward as ways in which the overall performance of all the indexes could improve. In conclusion, the study proves that there is room for fundamental indexing in the South African economy and an investor may stand to make considerable benefits from employing this method.

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APPENDIXES

Appendix A: *Annual Breakdown of index constituents*

Appendix A1: OTHI ALT Constituents

BOND CODE	NAME	BOND CODE	NAME
2002		*2004*	
TL03	TELKOM	WS01	TRANS-CALEDON
BOE1	Board of Executors	T017	TRANSNET
TL08	TELKOM	R184	RSA
WS01	TRANS-CALEDON	TK01	TELKOM
TK01	TELKOM	T004	TRANSNET
T004	TRANSNET	E168	ESKOM
E168	ESKOM	T011	TRANSNET
T011	TRANSNET	WS03	TRANS-CALEDON
LB01	LANDBANK	DV07	DEVELOPMENT BANK
WS03	TRANS-CALEDON	IN03	INFRASTRUCTURE
DV07	DEVELOPMENT BANK	SZ18	SA Roads Board
IV01	INVESTEC BANK LTD	WS04	TRANS-CALEDON
SZ18	SA Roads Board	E170	ESKOM
E170	ESKOM	DV23	DEVELOPMENT BANK
T017	TRANSNET	IV01	INVESTEC
WS04	TRANS-CALEDON	R203	RSA
R006	RSA	SZ25	SA Roads Board
R151	RSA		
R152	RSA		
2003		*2005*	
TL08	TELKOM	IN02	INFRASTRUCTURE
R151	RSA	TK01	TELKOM
WS01	TRANS-CALEDON	T004	TRANSNET
R152	RSA	E168	ESKOM
T017	TRANSNET	T011	TRANSNET
R184	RSA	WS03	TRANS-CALEDON
TK01	TELKOM	DV07	DEVELOPMENT BANK
T004	TRANSNET	IN03	INFRASTRUCTURE
E168	ESKOM	IV01	INVESTEC
T011	TRANSNET	SZ18	SA Roads Board
WS03	TRANS-CALEDON	WS04	TRANS-CALEDON
DV07	DEVELOPMENT BANK	R204	RSA
SZ18	SA Roads Board	E170	ESKOM
WS04	TRANS-CALEDON	SZ25	SA Roads Board
E170	ESKOM	SFL2	Sasol Ltd
TL06	TELKOM	SBS1	STANDARD BANK OF SA LTD
UG65	UMGENI WATER	R207	RSA
R201	RSA		

BOND CODE	NAME	BOND CODE	NAME
2006		*2008*	
TK01	TELKOM SA	SBS1	STANDARD BANK
T004	TRANSET	MTN01	MOBILE TELEPHONE NETWORKS
E168	ESKOM	WS03	TRANS-CALEDON
T011	TRANSNET	SZ18	SA NATIONAL ROADS AGENCY
SBS1	STANDARD BANK OF SA LTD	WS04	TRANS-CALEDON
WS03	TRANS-CALEDON TUNNEL AUTHORITY	E170	ESKOM
DV07	DEV BANK OF SOUTHERN AFRICA	R208	RSA
IN03	INFRASTRUCTURE FINANCE LTD	DV23	DEVELOPMENT BANK
IV01	INVESTEC BANK LTD	SZ25	SA NATIONAL ROADS AGENCY
R206	RSA	ES26	ESKOM
WS04	TRANS-CALEDON TUNNEL AUTHORITY	ES33	ESKOM
R207	RSA	R209	RSA
E170	ESKOM	TN17	TRANSNET LIMITED
MTN01	MOBILE TELEPHONE NETWORKS		
		2009	
2007		MTN01	MOBILE TELEPHONE NETWORKS
E168	ESKOM HOLDINGS LIMITED	WS03	TRANS-CALEDON
T011	TRANSNET LIMITED	SZ18	SA NATIONAL ROADS AGENCY
SBS1	STANDARD BANK SA LIMITED	WS04	TRANS-CALEDON
MTN01	MOBILE TELEPHONE NETWORKS	TN17	TRANSNET LIMITED
WS03	TRANS-CALEDON TUNNEL AUTHORITY	E170	ESKOM HOLDINGS LIMITED
DV07	DEVELOPMENT BANK	R208	REPUBLIC OF SOUTH AFRICA
IN03	INFRASTRUCTURE FINANCE	COJ05	CITY OF JOHANNESBURG MUNICIPALITY
IV01	INVESTEC BANK LIMITED	SZ25	SA NATIONAL ROADS AGENCY
WS04	TRANS-CALEDON TUNNEL AUTHORITY	ES26	ESKOM HOLDINGS LIMITED
E170	ESKOM HOLDINGS LIMITED	ES33	ESKOM HOLDINGS LIMITED
ES33	ESKOM HOLDINGS LIMITED	IN03	INFRASTRUCTURE FINANCE
R209	REPUBLIC OF SOUTH AFRICA	TN27	TRANSNET LIMITED
ES09	ESKOM HOLDINGS LIMITED	NRA018	SA NATIONAL ROADS AGENCY
SZ25	SA NATIONAL ROADS AGENCY	DV22	DEVELOPMENT BANK O
R208	REPUBLIC OF SOUTH AFRICA	NRA028	SA NATIONAL ROADS AGENCY
SZ18	SA NATIONAL ROADS AGENCY	R155	REPUBLIC OF SOUTH AFRICA
ES26	ESKOM HOLDINGS LIMITED	ES18	ESKOM HOLDINGS LIMITED

BOND CODE	NAME	BOND CODE	NAME
2010		*2012*	
R155	REPUBLIC OF SOUTH AFRICA	ES15	ESKOM HOLDINGS LIMITED
WS04	TRANS-CALEDON TUNNEL AUTHORITY	WS04	TRANS-CALEDON
SBS9	THE STANDARD BANK	ES18	ESKOM HOLDINGS LIMITED
TN17	TRANSNET LIMITED	DV22	DEVELOPMENT BANK OF SOUTHERN AFRICA
ES18	ESKOM HOLDINGS LIMITED	TN20	TRANSNET SOC LIMITED
DV22	DEVELOPMENT BANK	ES23	ESKOM HOLDINGS LIMITED
DV23	DEVELOPMENT BANK	DV23	DEVELOPMENT BANK OF SOUTHERN AFRICA
ES26	ESKOM HOLDINGS LIMITED	ES26	ESKOM HOLDINGS LIMITED
TN27	TRANSNET LIMITED	ES33	ESKOM HOLDINGS LIMITED
NRA028	SA NATIONAL ROADS AGENCY	R214	REPUBLIC OF SOUTH AFRICA
ES33	ESKOM HOLDINGS LIMITED	TN23	TRANSNET SOC LIMITED
HWAY20	SA NATIONAL ROADS AGENCY LIMITED	HWAY20	SOUTH AFRICAN NATIONAL ROADS AGENCY LTD
ES23	ESKOM HOLDINGS LIMITED	R2023	REPUBLIC OF SOUTH AFRICA
NBK2A	NEDBANK LIMITED		
TN23	TRANSNET LIMITED		
SZ25	SOUTH AFRICAN NATIONAL ROADS		
R213	REPUBLIC OF SOUTH AFRICA		
2011		***2013***	
WS04	TRANS-CALEDON TUNNEL AUTHORITY	ES18	ESKOM HOLDINGS LIMITED
ES18	ESKOM HOLDINGS LIMITED	DV22	DEVELOPMENT BANK
HWAY20	SOUTH AFRICAN NATIONAL ROADS AGENCY LIMITED	TN20	TRANSNET SOC LIMITED
TN20	TRANSNET LIMITED	ES23	ESKOM HOLDINGS LIMITED
ES23	ESKOM HOLDINGS LIMITED	DV23	DEVELOPMENT BANK
DV23	DEVELOPMENT BANK	R2023	REPUBLIC OF SOUTH AFRICA
SZ25	S A NATIONAL ROADS AGENCY	TN23	TRANSNET SOC LIMITED
ES26	ESKOM HOLDINGS LIMITED	ES26	ESKOM HOLDINGS LIMITED
TN27	TRANSNET LIMITED	ES33	ESKOM HOLDINGS LIMITED
R213	REPUBLIC OF SOUTH AFRICA	R2048	REPUBLIC OF SOUTH AFRICA
ES33	ESKOM HOLDINGS LIMITED	R201	REPUBLIC OF SOUTH AFRICA
ES15	ESKOM HOLDINGS LIMITED	TN27	TRANSNET SOC LIMITED
R214	REPUBLIC OF SOUTH AFRICA	R2037	REPUBLIC OF SOUTH AFRICA
DV22	DEVELOPMENT BANK		

Appendix A2: SAFII_ALT Constituents

BOND CODE	NAME	BOND CODE	NAME
2002		***2004***	
NED2	NEDBANK LIMITED	BAW1	BARLOWORLD LIMITED
AB02	ABSA BANK LIMITED	NED2	NEDBANK LIMITED
TL06	Telkom	AB02	ABSA BANK LIMITED
NED1	NEDBANK LIMITED	TL06	Telkom
SBK3	STANDARD BANK OF SA LTD	NED1	NEDBANK LIMITED
SBK2	STANDARD BANK OF SA LTD	SBK3	STANDARD BANK OF SA LTD
AB01	ABSA BANK LIMITED	SBK2	STANDARD BANK OF SA LTD
SBK1	STANDARD BANK OF SA LTD	AB01	ABSA BANK LIMITED
IPL2	IMPERIAL GROUP LIMITED	SBK1	STANDARD BANK OF SA LTD
DC01	DAIMLERCHRYSLER SA PTY LTD	IPL2	IMPERIAL GROUP LIMITED
PROA11	PROCUL LIMITED	AG01	ANGLO GOLD ASHANTI LIMITED
SBK4	STANDARD BANK OF SA LTD	SFL2	Sasol Ltd
		IV02	Investec bank Ltd
2003		***2005***	
NED2	NEDBANK LIMITED	NED2	NEDBANK LIMITED
AB02	ABSA BANK LIMITED	SBS1	STANDARD BANK OF SA LTD
TL06	Telkom	AB02	ABSA BANK LIMITED
NED1	NEDBANK LIMITED	SBK7	STANDARD BANK OF SA LTD
SBK3	STANDARD BANK OF SA LTD	OML01	OLD MUTUAL LIFE ASSURANCE
SBK2	STANDARD BANK OF SA LTD	TL06	Telkom
AB01	ABSA BANK LIMITED	LGL1	THE LIBERTY GROUP LIMITED
SBK1	STANDARD BANK OF SA LTD	SBK5	STANDARD BANK OF SA LTD
IPL2	IMPERIAL GROUP LIMITED	NED1	NEDBANK LIMITED
AG01	ANGLO GOLD ASHANTI LIMITED	SBK3	STANDARD BANK OF SA LTD
SFL2	Sasol Ltd	AG01	ANGLO GOLD ASHANTI LIMITED
IV02	Investec bank Ltd	SFL2	Sasol Ltd
		FRB03	FIRSTRAND BANK LIMITED
		AB05	ABSA BANK LIMITED
		IV02	Investec bank Ltd

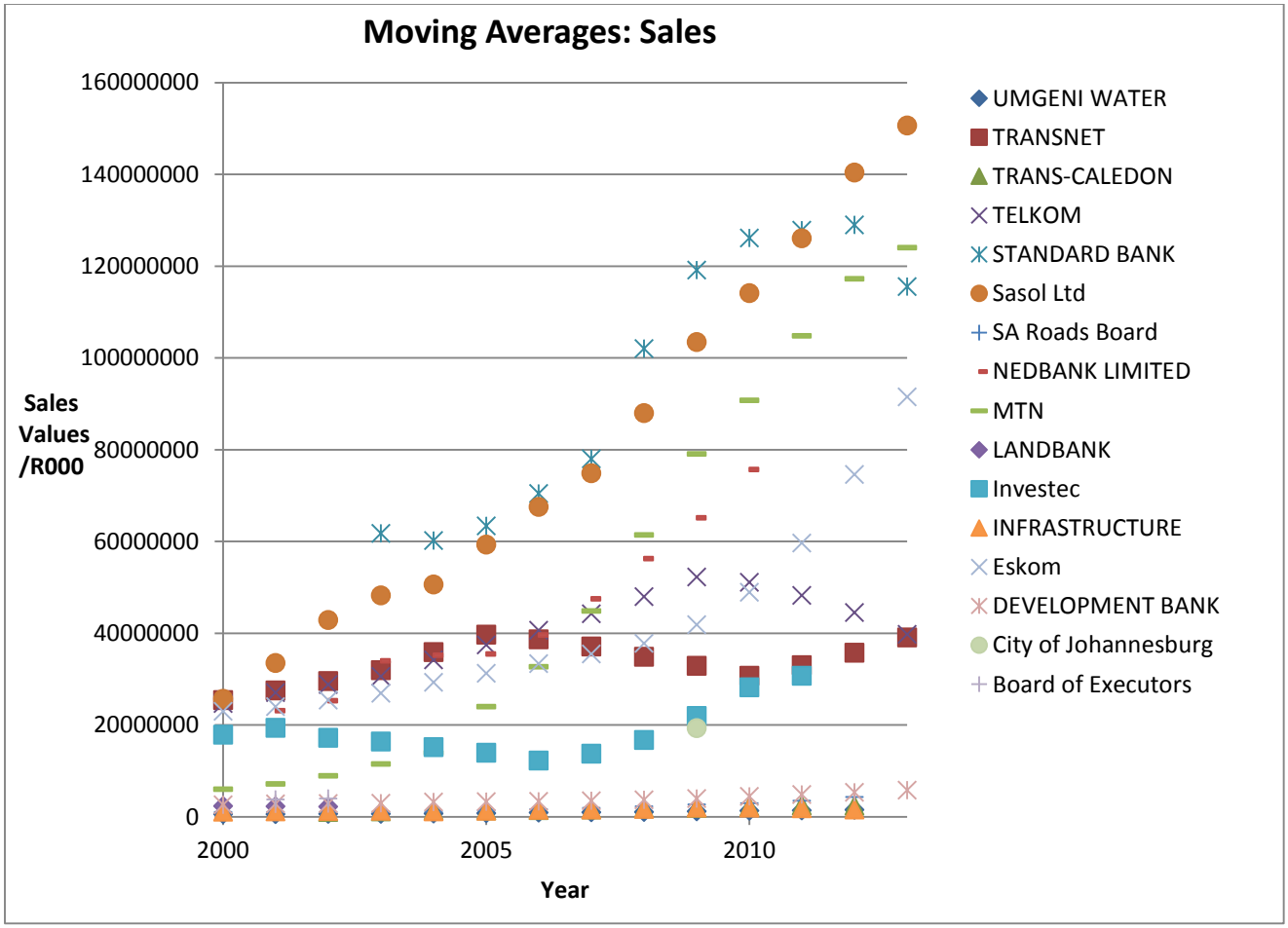
BOND CODE	NAME	BOND CODE	NAME
2006		***2008***	
MTN01	MTN	MTN01	MTN
NED2	NEDBANK LIMITED	NED2	NEDBANK LIMITED
SBS1	STANDARD BANK OF SA LTD	ABS7	ABSA BANK LIMITED
AB02	ABSA BANK LIMITED	FRX15	FIRSTRAND BANK LIMITED
SBK7	STANDARD BANK OF SA LTD	SBS1	STANDARD BANK OF SA LTD
OML01	OLD MUTUAL LIFE ASSURANCE	AB02	ABSA BANK LIMITED
FRB05	FIRSTRAND BANK LIMITED	SBK7	STANDARD BANK OF SA LTD
AB06	ABSA BANK LIMITED	OML01	OLD MUTUAL LIFE
DC03	DAIMLERCHRYSLER SA (PTY) LTD	ABS5	ABSA BANK LIMITED
LGL1	THE LIBERTY GROUP LIMITED	FRB05	FIRSTRAND BANK LIMITED
SBK5	STANDARD BANK OF SA LTD	IV04	Investec bank Ltd
NED1	NEDBANK LIMITED	ADB03S	AFRICAN DEVELOPMENT BANK
SBK3	STANDARD BANK OF SA LTD	AB06	ABSA BANK LIMITED
AG01	ANGLO GOLD ASHANTI LIMITED	DC03	DAIMLERCHRYSLER SA (PTY) LTD
SFL2	Sasol Ltd	LGL1	THE LIBERTY GROUP LIMITED
NED6	NEDBANK LIMITED		
2007		***2009***	
MTN01	MOBILE TELEPHONE NETWORKS HOLDINGS	MTN01	MOBILE TELEPHONE NETWORKS HOLDINGS
NED2	NEDBANK LIMITED	NED2	NEDBANK LIMITED
ABS7	ABSA BANK LIMITED	ABS7	ABSA BANK LIMITED
SBS1	STANDARD BANK OF SA LTD	FRX15	FIRSTRAND BANK LIMITED
AB02	ABSA BANK LIMITED	SBS1	STANDARD BANK OF SA LTD
SBK7	STANDARD BANK OF SA LTD	NBK2A	NEDBANK LIMITED
OML01	OLD MUTUAL LIFE ASSURANCE	AB02	ABSA BANK LIMITED
ABS5	ABSA BANK LIMITED	SBK7	STANDARD BANK OF SA LTD
FRB05	FIRSTRAND BANK LIMITED	OML01	OLD MUTUAL LIFE ASSURANCE
IV04	Investec bank Ltd	SBS9	STANDARD BANK OF SA LTD
AB06	ABSA BANK LIMITED	ABS5	ABSA BANK LIMITED
DC03	DAIMLERCHRYSLER SA (PTY) LTD	FRB05	FIRSTRAND BANK LIMITED
LGL1	THE LIBERTY GROUP LIMITED	IV04	Investec bank Ltd
SBK5	STANDARD BANK OF SA LTD	ADB03S	AFRICAN DEVELOPMENT BANK
NED1	NEDBANK LIMITED	AB06	ABSA BANK LIMITED
SBK3	STANDARD BANK OF SA LTD		

BOND CODE	NAME	BOND CODE	NAME
2010		***2012***	
NED2	NEDBANK LIMITED	FRX31	FIRSTRAND BANK LIMITED
ABS7	ABSA BANK LIMITED	ABS7	ABSA BANK LIMITED
FRX15	FIRSTRAND BANK LIMITED	FRX15	FIRSTRAND BANK LIMITED
FRX14	FIRSTRAND BANK LIMITED	FRX14	FIRSTRAND BANK LIMITED
NBK2A	NEDBANK LIMITED	NBK2A	NEDBANK LIMITED
AB02	ABSA BANK LIMITED	AB02	ABSA BANK LIMITED
SBK7	STANDARD BANK OF SA LTD	SBK7	STANDARD BANK OF SA LTD
OML01	OLD MUTUAL LIFE ASSURANCE	OML01	OLD MUTUAL LIFE ASSURANCE
SBS9	STANDARD BANK OF SA LTD	SBS9	STANDARD BANK OF SA LTD
ABS5	ABSA BANK LIMITED	SBS25	STANDARD BANK OF SA LTD
FRB05	FIRSTRAND BANK LIMITED	ABS5	ABSA BANK LIMITED
IV04	Investec bank Ltd	FRB05	FIRSTRAND BANK LIMITED
ADB03S	AFRICAN DEVELOPMENT BANK	SBS19	STANDARD BANK OF SA LTD
AB06	ABSA BANK LIMITED	IV04	Investec bank Ltd
		ADB03S	AFRICAN DEVELOPMENT BANK
		AB06	ABSA BANK LIMITED
2011		***2013***	
FRX31	FIRSTRAND BANK LIMITED	FRX31	FIRSTRAND BANK LIMITED
NED2	NEDBANK LIMITED	ABS7	ABSA BANK LIMITED
ABS7	ABSA BANK LIMITED	FRX15	FIRSTRAND BANK LIMITED
FRX15	FIRSTRAND BANK LIMITED	FRX14	FIRSTRAND BANK LIMITED
FRX14	FIRSTRAND BANK LIMITED	NBK2A	NEDBANK LIMITED
NBK2A	NEDBANK LIMITED	AB02	ABSA BANK LIMITED
AB02	ABSA BANK LIMITED	SBK7	STANDARD BANK OF SA LTD
SBK7	STANDARD BANK OF SA LTD	OML01	OLD MUTUAL LIFE ASSURANCE COMPANY (SOUTH AFRICA) LIMITED
OML01	OLD MUTUAL LIFE ASSURANCE	SBS9	STANDARD BANK OF SA LTD
SBS9	STANDARD BANK OF SA LTD	SBS25	STANDARD BANK OF SA LTD
ABS5	ABSA BANK LIMITED	ABS5	ABSA BANK LIMITED
FRB05	FIRSTRAND BANK LIMITED	FRB05	FIRSTRAND BANK LIMITED
SBS19	STANDARD BANK OF SA LTD	SBS19	STANDARD BANK OF SA LTD
IV04	Investec bank Ltd	IV04	Investec bank Ltd
ADB03S	AFRICAN DEVELOPMENT BANK	ADB03S	AFRICAN DEVELOPMENT BANK

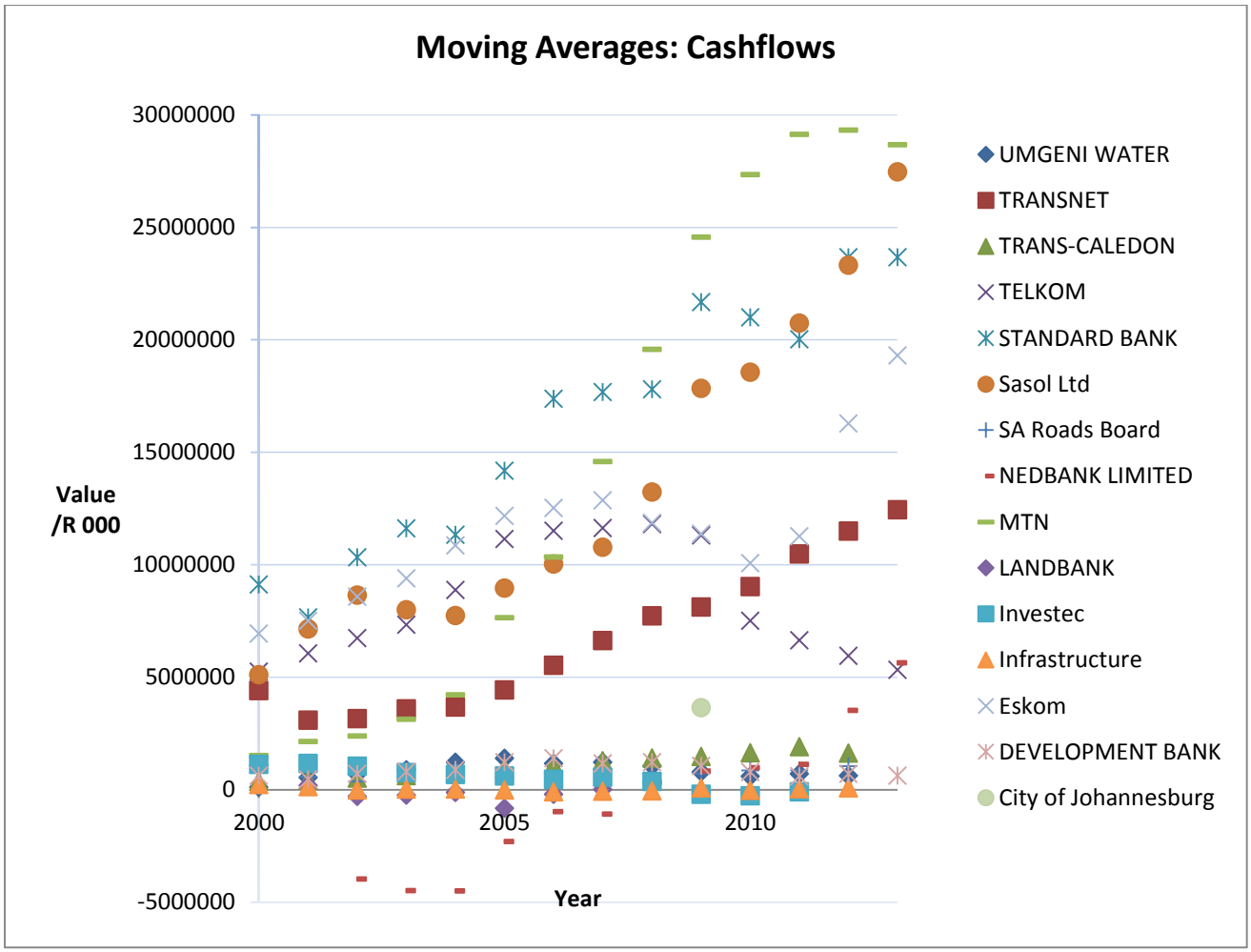
Appendix B

Index metrics scatter plots

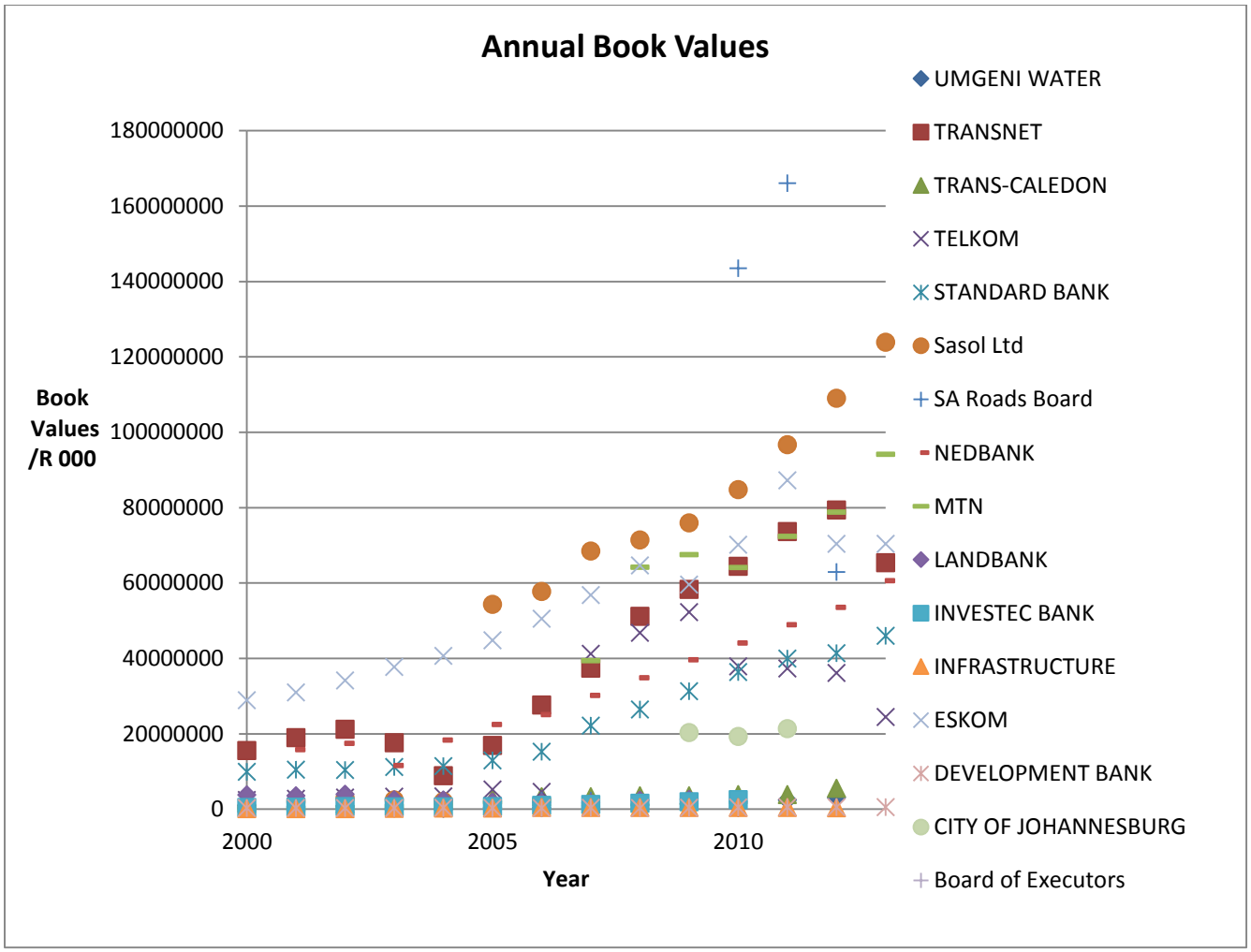
Appendix B1: Sales



Appendix B2: Cashflow



Appendix B3: Book Values



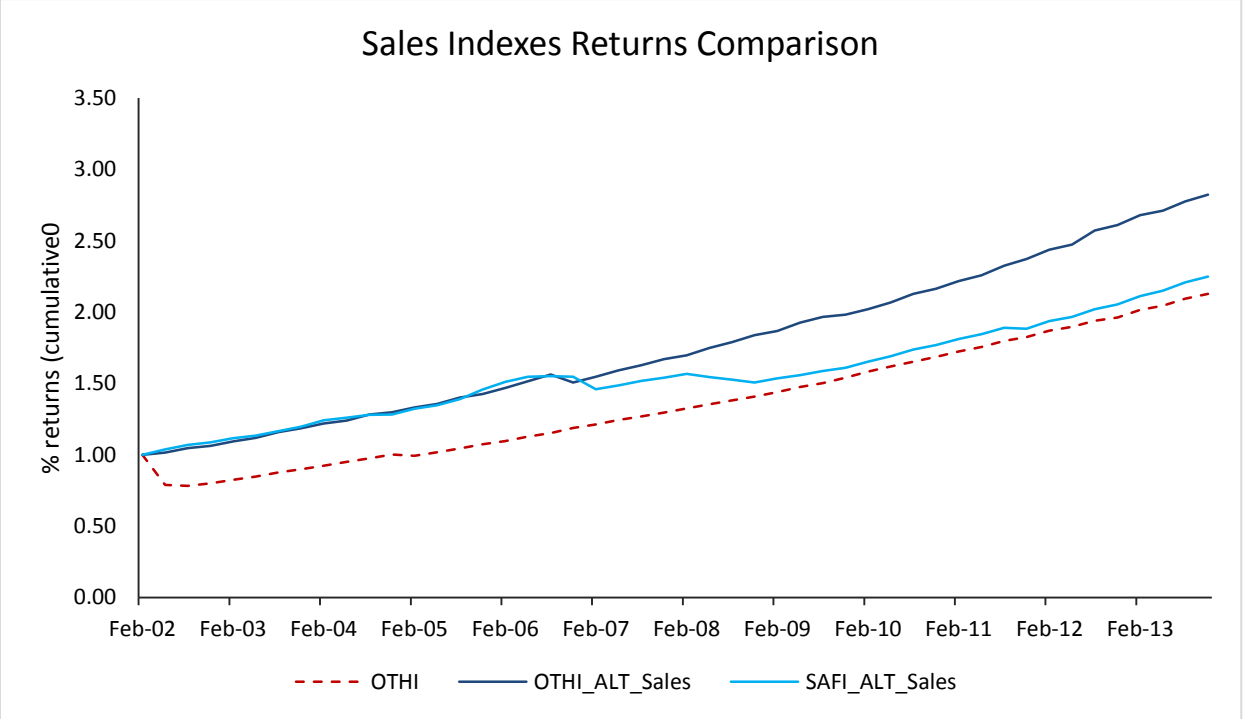
Appendix C

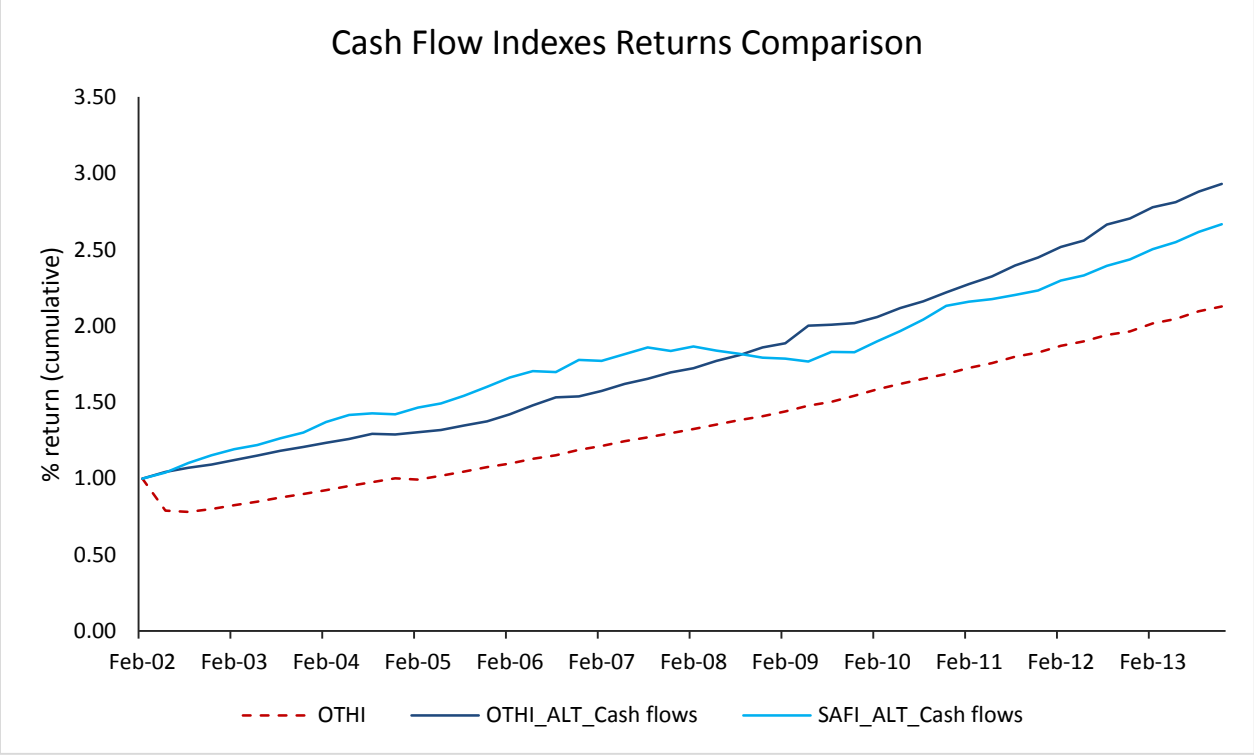
Correlation Matrix of Index Weightings

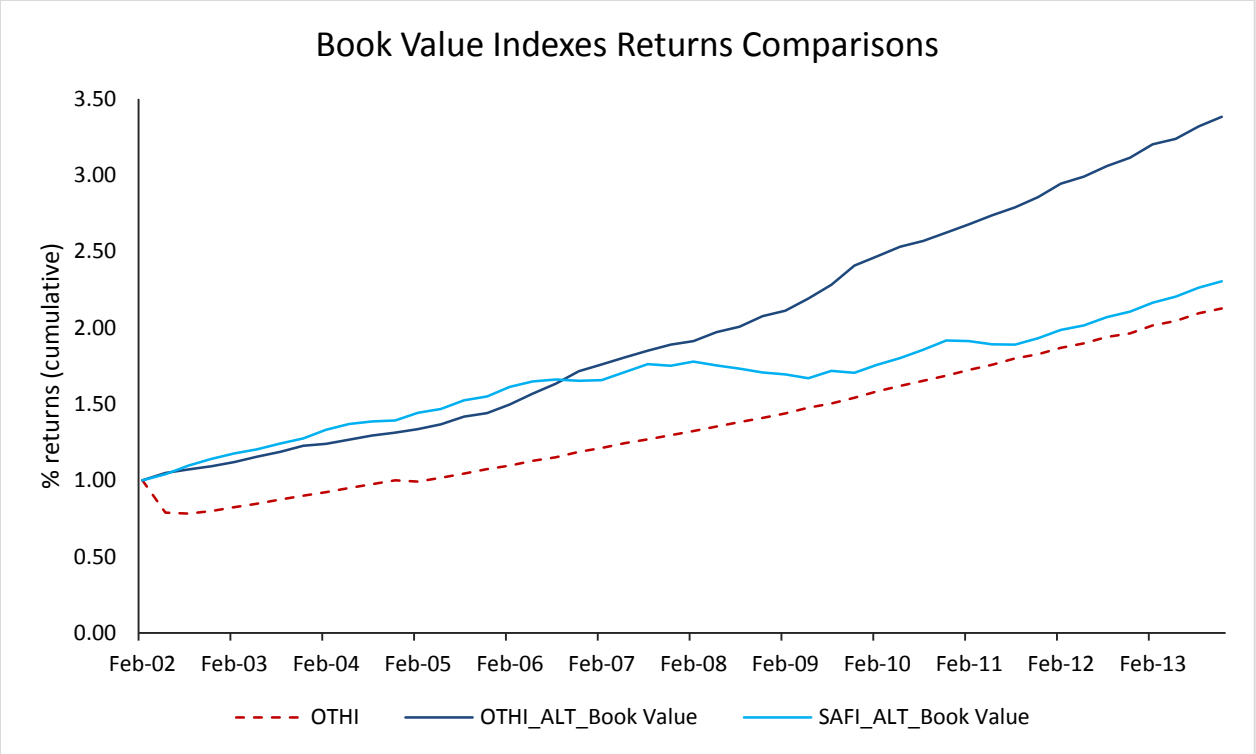
	OTHI	Sales Index	Cash Flow Index	Book Value Index	Composite Index
2000	1	0.382	0.384	0.416	0.436
2001	1	0.300	0.507	0.557	0.561
2002	1	0.341	0.624	0.393	0.537
2003	1	0.252	0.386	0.471	0.432
2004	1	0.383	0.568	0.714	0.663
2005	1	0.117	0.359	0.398	0.338
2006	1	0.028	0.203	0.561	0.304
2007	1	-0.155	-0.024	0.103	-0.042
2008	1	-0.050	0.016	0.218	0.054
2009	1	0.114	0.211	0.179	0.172
2010	1	-0.093	0.015	-0.317	-0.205
2011	1	0.126	-0.063	-0.209	-0.143
2012	1	0.125	-0.024	-0.178	-0.051
2013	1	0.125	0.058	-0.087	0.057

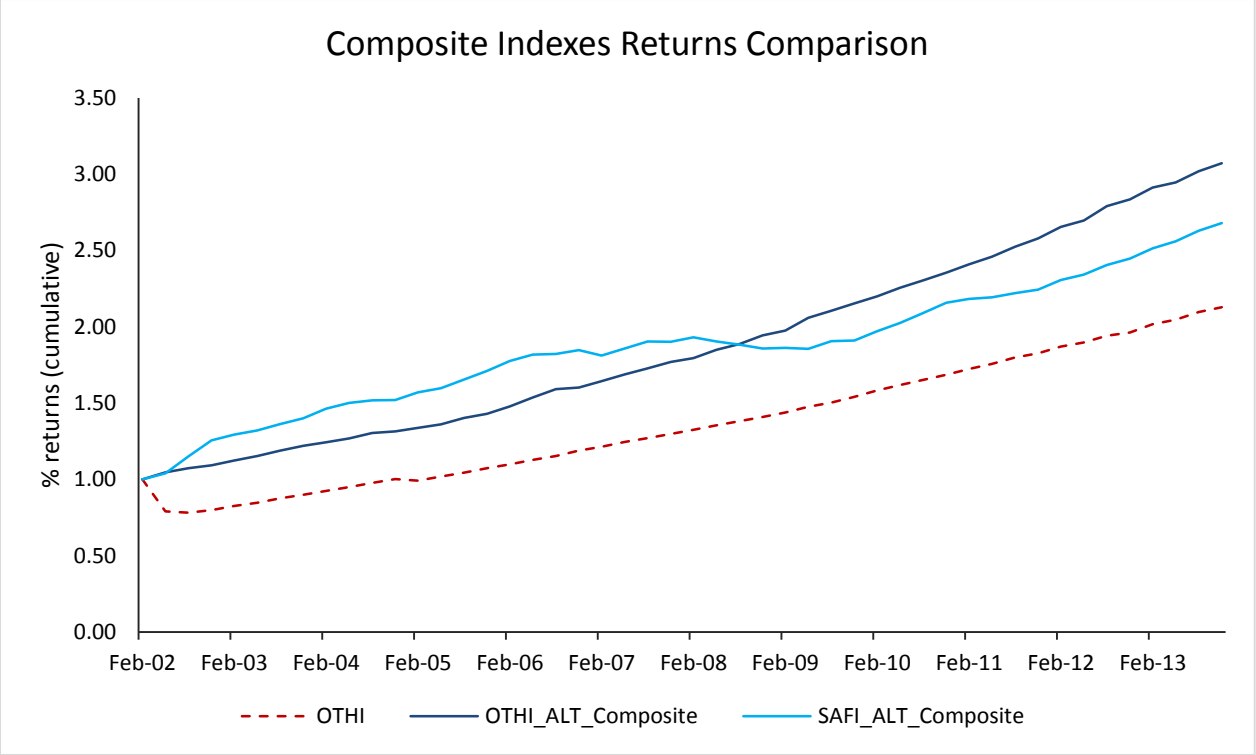
Appendix D

Indexes Returns Comparisons



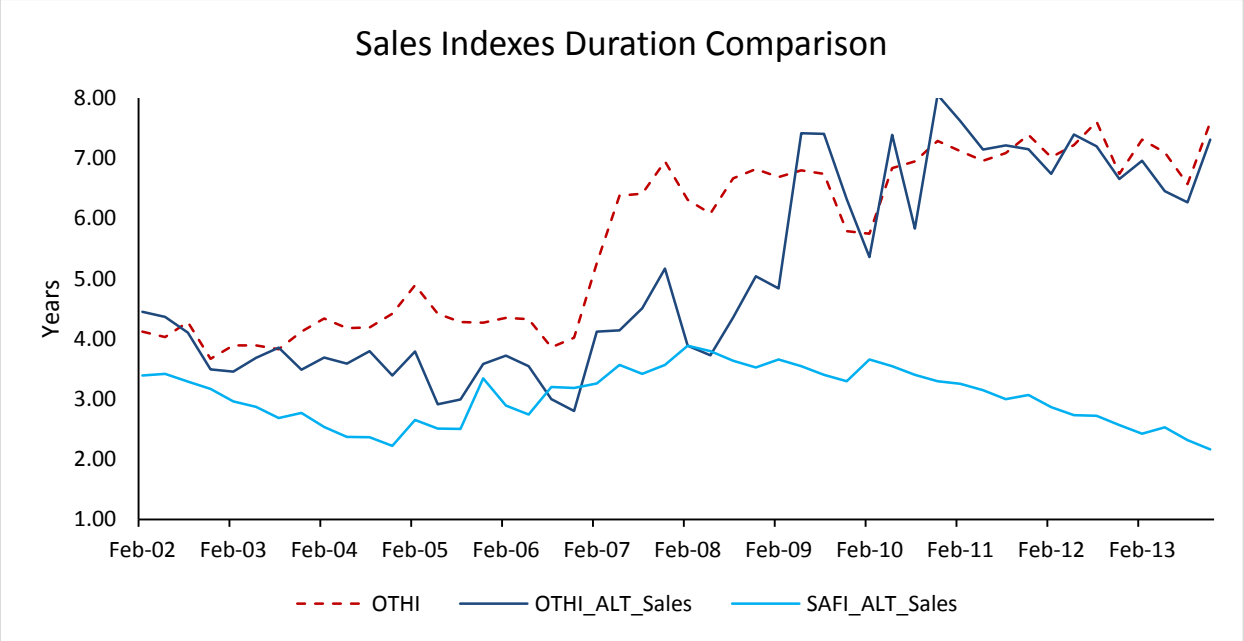


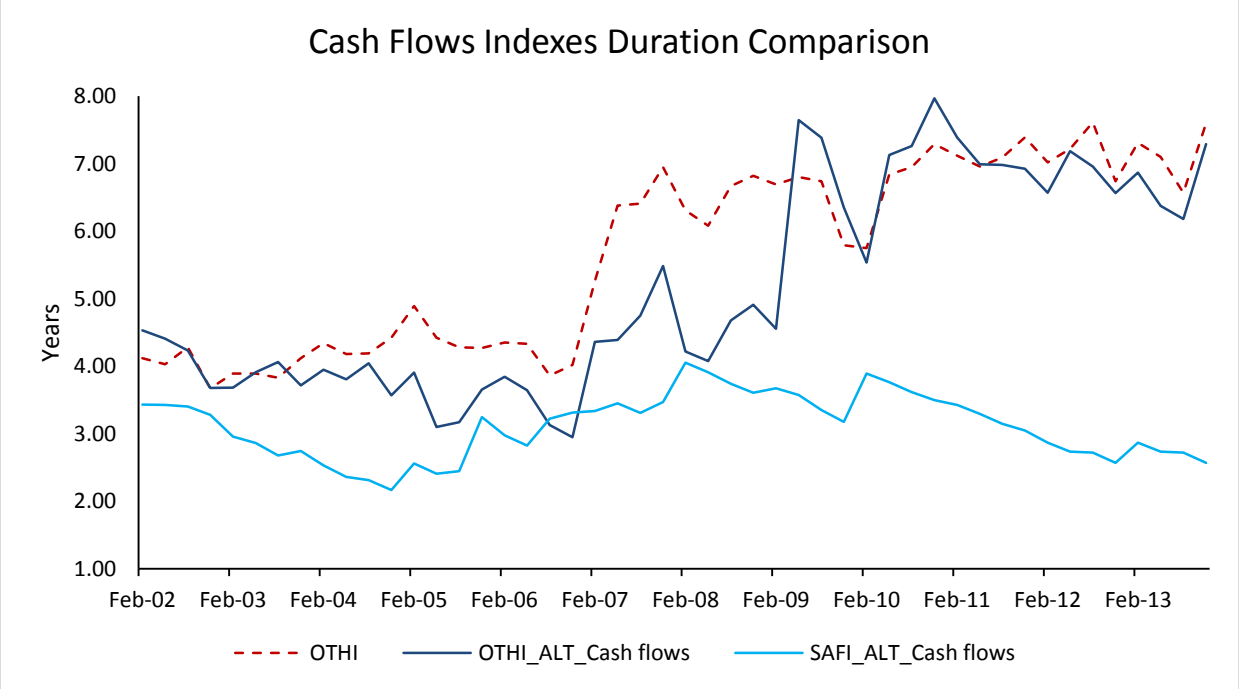

Book Value Indexes Returns Comparisons
% returns (cumulative)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Feb-02
Feb-03
Feb-04
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
OTHI
OTHI_ALT_Book Value
SAFI_ALT_Book Value

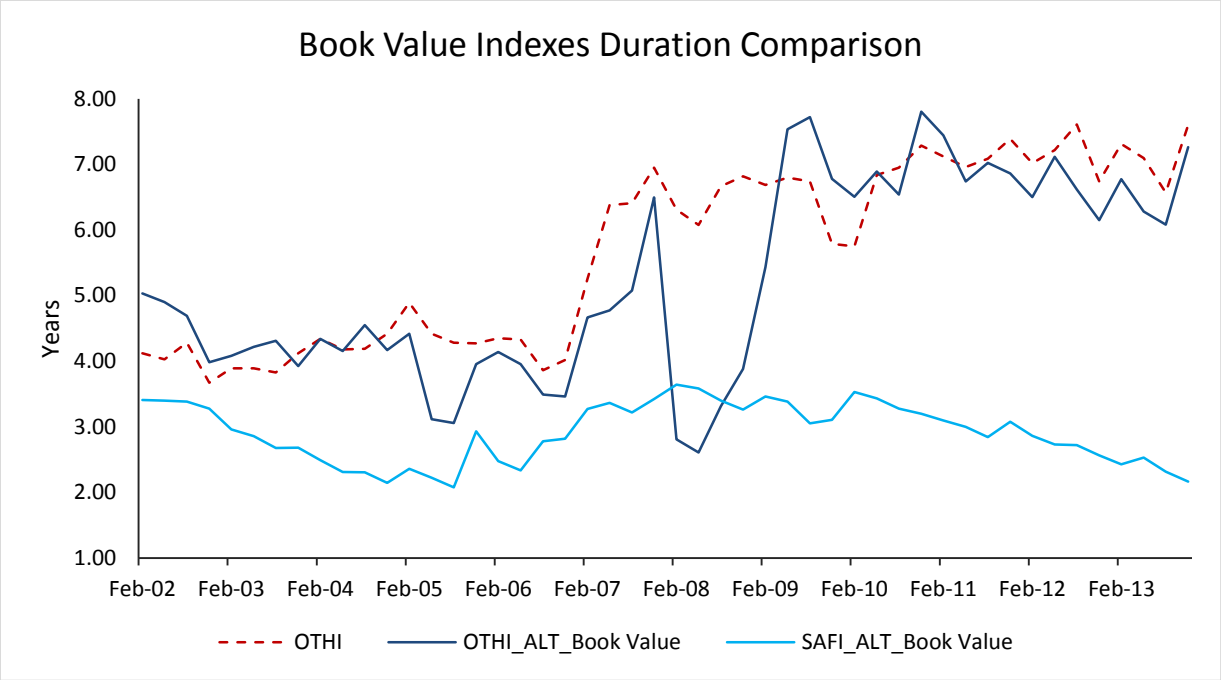

Composite Indexes Returns Comparison
% returns (cumulative)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Feb-02
Feb-03
Feb-04
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
OTHI
OTHI_ALT_Composite
SAFI_ALT_Composite

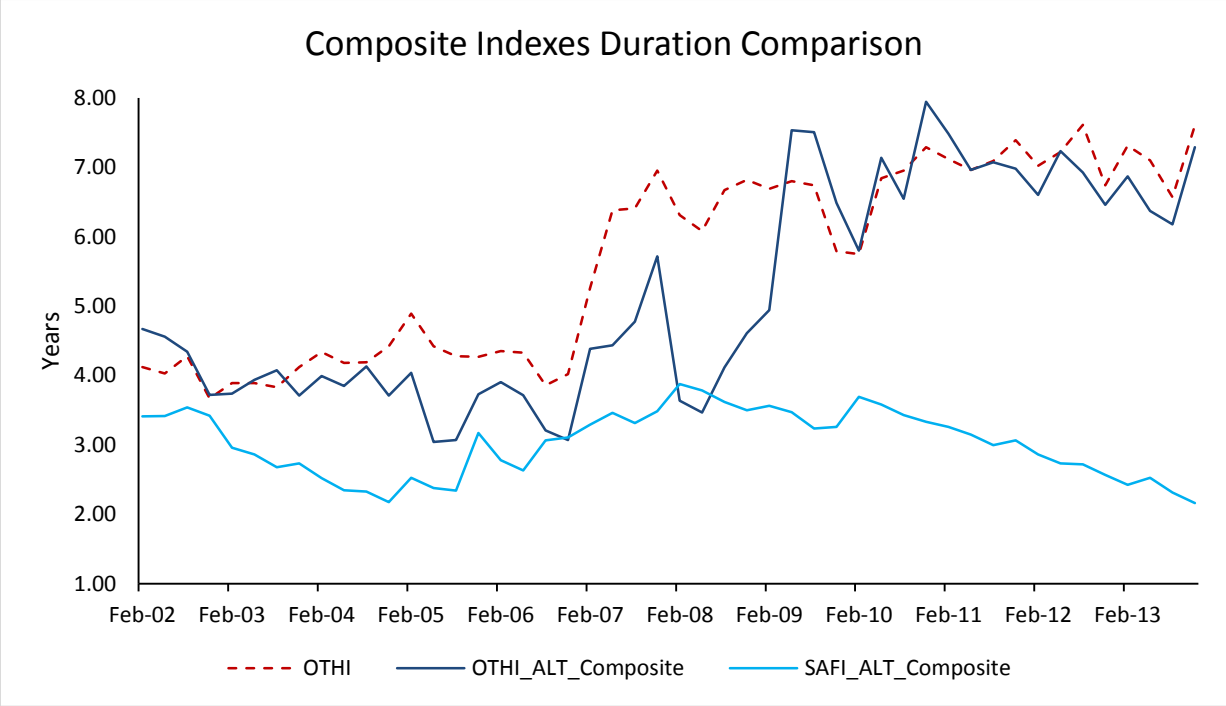
Appendix E

Indexes Duration Comparisons






Book Value Indexes Duration Comparison
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
Years
Feb-02
Feb-03
Feb-04
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
OTHI
OTHI_ALT_Book Value
SAFI_ALT_Book Value


Composite Indexes Duration Comparison
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
Years
Feb-02
Feb-03
Feb-04
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
OTHI
OTHI_ALT_Composite
SAFI_ALT_Composite

Appendix F

Regression Analysis Output

Appendix F1: OTHI_ALT_Sales Regression Output

OTHI_ALT_Sales

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.0153
R Square	0.0002
Adjusted R Square	-0.0248
Standard Error	0.0298
Observations	42.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0000	0.0000	0.0093	0.9236
Residual	40.0000	0.0355	0.0009		
Total	41.0000	0.0355			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.0172	0.0049	3.4909	0.0012	0.0072	0.0271	0.0072	0.0271
r(b) - r(f)	0.0159	0.1645	-0.0965	0.9236	- 0.3482	0.3165	- 0.3482	0.3165

Appendix F2: OTHI_ALT_CF Regression Output

OTHI_ALT_CF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1529
R Square	0.0234
Adjusted R Square	-0.0062
Standard Error	0.0311
Observations	35.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0008	0.0008	0.7897	0.3806
Residual	33.0000	0.0320	0.0010		
Total	34.000	0.0327			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	1.414%	0.0056	2.5270	0.0165	0.0028	0.0255	0.0028	0.0255
r(b) - r(f)	0.1612	0.1814	0.8886	0.3806	- 0.2078	0.5302	-0.2078	0.5302

Appendix F3: OTHI_ALT_BV Regression Output

OTHI_ALT_BV

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1436
R Square	0.02062%
Adjusted R Square	- 0.0066
Standard Error	0.0419
Observations	38.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0013	0.0013	0.7581	0.3897
Residual	36.0000	0.0632	0.0018		
Total	37.0000	0.0646			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	2.260%	0.0073	3.1065	0.0037	0.0078	0.0374	0.0078	0.0374
r(b) - r(f)	0.2113	0.2427	0.8707	0.3897	- 0.2809	0.7036	- 0.2809	0.7036

Appendix F4: OTHI_ALT_Composite Regression Output

OTHI_ALT_composite

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1426
R Square	0.0203
Adjusted R Square	-0.0069
Standard Error	0.0301
Observations	38.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0007	0.0007	0.7473	0.3931
Residual	36.0000	0.0326	0.0009		
Total	37.0000	0.0332			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.0173	0.0052	3.3453	0.0019	0.0068	0.0278	0.0068	0.0278
r(b) - r(f)	0.1497	0.1732	0.8645	0.3931	-0.2015	0.5009	-0.2015	0.5009

Appendix F5: SAFI_ALT_Sales Regression Output

SAFI_ALT_sales

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1620
R Square	0.0262
Adjusted R Square	- 0.0024
Standard Error	0.0355
Observations	36.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0012	0.0012	0.9164	0.3452
Residual	34.0000	0.0429	0.0013		
Total	35.0000	0.0441			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.527%	0.0062	1.7879	0.0827	-0.0015	0.0236	- 0.0015	0.0236
r(b) - r(f)	0.1974	0.2062	0.9573	0.3452	-0.2217	0.6165	-0.2217	0.6165

Appendix F6: SAFI_ALT_CF Regression Output

SAFI_ALT CF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1800
R Square	0.03240
Adjusted R Square	0.0001
Standard Error	0.0431
Observations	32.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0019	0.0019	1.0045	0.3242
Residual	30.0000	0.0558	0.0019		
Total	31.0000	0.0577			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.0159	0.0081	4.3803	0.0001	0.0188	0.0517	0.0188	0.0517
r(b) - r(f)	0.2556	0.2550	1.0022	0.3242	-0.2652	0.7764	-0.2652	0.7764

Appendix F7: SAFI_ALT_BV Regression Output

SAFI_ALT_BV

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1282
R Square	0.0164
Adjusted R Square	- 0.0187
Standard Error	0.0348
Observations	30.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0006	0.0006	0.4676	0.4997
Residual	28.0000	0.0340	0.0012		
Total	29.0000	0.0346			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.0111	0.0068	3.8142	0.0007	0.0120	0.0399	0.0120	0.0399
r(b) - r(f)	0.1413	0.2066	0.6838	0.4997	- 0.2820	0.5646	-0.2820	0.5646

Appendix F8: SAFI_ALT_Composite Regression Output

SAFI_ALT_composite

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1613
R Square	0.2600
Adjusted R Square	-0.0088
Standard Error	0.0403
Observations	30.0000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	0.0012	0.0012	0.7475	0.3946
Residual	28.0000	0.0454	0.0016		
Total	29.0000	0.0466			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
α	0.0108	0.0078	2.6724	0.0124	0.0049	0.0368	0.0049	0.0368
r(b) - r(f)	0.2143	0.2479	0.8646	0.3946	- 0.2934	0.7220	-0.2934	0.7220