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Performance of Fundamental Indices in African capital markets

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DECLARATION

I, Riaan van Jaarsveldt, declare that this research article is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Riaan van Jaarsveldt

Signed at ……

On the …….. day of …… 20…..

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ABSTRACT

This research study aims to establish whether fundamental indices outperform cap-weighted indices in African emerging markets using data from 2003 to 2017. The risk-return characteristics of indices are compared using mean-variance analysis techniques to account for variations in risk. The sources of any excess returns are further investigated by analysing single factor fundamental indices. The results indicate that fundamental indices outperformed cap-weighted indices in African emerging markets, even after accounting for risk. The outperformance was not always significant. The fundamental factors contributing most to the outperformance are cash flow and revenue.

Keywords: Fundamental Indexation; Cap-weighted Indices; Indexation; Value Bias; Value Investing; Price Noise; JSE; Egyptian Exchange; Nigerian Stock Exchange; Nairobi Securities Exchange; Stock Exchange of Mauritius.

1 INTRODUCTION AND MOTIVATION

1.1 Overview

Investors pursuing returns above the risk-free rate can choose between two prominent investment strategies to realise their goal: active portfolio management or passive portfolio management. An active approach aims to outperform a benchmark, whereas a passive approach aims to simply track a benchmark. Active portfolio management relies on a human element, such as a portfolio manager, who performs analytical research using company accounting fundamentals. Passive portfolio management, however, uses market capitalisation to construct cap-weighted indices that require limited human intervention.

Until recently, market cap-weighted indices have remained unchallenged as a passive portfolio construction technique and are regarded as the norm. In the African equity market the EGX30, NSE20, SEM10, NGSE30 and TOP40 are some examples of market cap-weighted indices. The rationale behind weighing constituents according to market capitalisation stems from Sharpe (1964) and their Capital Asset Pricing Model (CAPM). It is assumed that holding a portfolio of risky assets in proportion to their market capitalisation will be mean-variance efficient.

In recent years, active and passive strategies have combined to form a new strategy that promises to deliver excess risk-adjusted returns while maintaining many of the benefits of passive investing. This new strategy, designed by Arnott, Hsu, and Moore (2005), is known as Fundamental Indexation. It uses company

accounting fundamentals, such as revenue, sales, dividends, book value, cash flow and employment to construct indices that are shown to deliver superior risk-adjusted returns in the United States (U.S.).

Fundamental indices are said to outperform traditional cap-weighted indices as long as inaccurate market prices revert to underlying fundamental values. The observed market price of a share is the underlying fundamental value plus a zero-mean noise. Index composition tilts introduced by fundamental measures are found to improve mean-variance efficiency, this results in better returns for comparable levels of risk (Riepe & Werner, 1998).

1.2 Background

The research conducted in this research article is based on work done by Arnott et al. (2005). In their article "Fundamental Indexation" they investigated the use of fundamental measures to select and weigh index constituents as opposed to the traditional market capitalisation technique. They found that fundamental measures produce indices that are more mean-variance efficient than traditional cap-weighted indices while maintaining many of the advantages of cap-weighted indices.

The rationale for selecting and weighing index constituents using market capitalisation originated from the Capital Asset Pricing Model (CAPM). The CAPM suggests that the market portfolio, a portfolio consisting of all risky assets holding constituents weighted by market capitalisation, is mean-variance efficient (Estrada, 2006). It is therefore impossible for an investor to earn greater returns without extraordinary skill or information (Macharia, 2017).

The CAPM originated from the modern portfolio theory as proposed by Markowitz (1952). Markowitz (1952) introduced the concept of portfolio selection to construct an optimal portfolio and argued that through diversification it is possible to reduce risk and maximise the return of a portfolio. This is achieved by selecting constituents that exhibit low covariance with each other. The rationale behind this theory is that assets that exhibit low covariance will move in opposite directions and reduce the volatility/risk of the portfolio.

Cap-weighted indices derive both constituents and weightings using market capitalisation relative to the total market capitalisation of all constituents (Mar, Bird, Casavecchia, & Yeung, 2009). They provide investors with an investment strategy that is characterised by low costs, low turnover, diversification and transparency (J. C. Hsu, 2006). Cap-weighted indices, however, assign greater weight to overvalued shares and less weight to undervalued shares, in doing so creating a performance drag.

Fundamental indices derive both constituents and weightings from company fundamentals i.e. accounting valuation measures such as revenue, book value, sales, dividends, cash-flow and employment (Arnott et al., 2005). The main advantage of fundamental indices is that they do not suffer from the performance drag introduced by cap-weighted indices. Without this performance drag, fundamental indices achieved higher risk-adjusted returns. Fundamental indices, however, require periodic rebalancing leading to higher turnover, transaction costs, and taxes. They could also have unintended exposure to known size and risk factors.

Arnott et al. (2005) and J. C. Hsu and Campollo (2010) performed studies on U.S. shares and found that fundamental indexation delivered annual outperformance of approximately 1.97%. Similar studies have been performed in other developed markets with annual outperformance ranging from 1.76% to 3.59%.

1.3 Research Gap

The literature and empirical evidence supporting fundamental indexation focus heavily on developed markets. Due to the scarcity of research on this topic in African emerging markets, I initiated a review of empirical findings specific to South Africa (SA), Egypt, Nigeria, Kenya and Mauritius equity markets. The following findings were observed.

Estrada (2006) and Walkshäusl and Lobe (2010) performed broad studies that include some emerging markets. Walkshäusl and Lobe (2010) included SA and Egypt in their study and found annual outperformance of 1.81% and 5.75% respectively. Ferreira (2009) tested fundamental indices on the SA equity market and found annual outperformance of 5.5% between 1995 to 2006. Munyw'oki (2016) investigated fundamental indexation using the SA equity market as a proxy and found no evidence of outperformance between 2007 and 2016. The lack of outperformance was attributed to the similarity of constituents between the TOP40 and RAFI40. Macharia (2017) studied the Kenyan equity market over a three-year period and found minor outperformance. No empirical evidence with reference to fundamental indexation could be found for the Mauritius or Nigeria equity markets.

Given that company fundamentals such as revenue, sales, dividends, book value, cash flow and employment are widely available for listed companies it should be possible to construct fundamental indices in most African emerging markets. The sparseness and incongruences stemming from research surrounding fundamental indexation in emerging markets present a unique opportunity to explore their returns and the factors that contribute most to these returns across multiple African emerging markets over prolonged periods of time.

The findings of such a study can be used to test claims such as those made by Jun and Malkiel (2008) who posit that fundamental indices show even greater excess returns in emerging markets where financial markets are considered to be less efficient. It will also provide support for or against authors such as Broby and Lochhead (2013) who recommends that equal or fundamental weighted indices should be used in African equity markets as they provide optimal risk/reward exposure.

1.4 Problem Statement

1. The main purpose of this research is to establish whether fundamental indices outperform cap-weighted indices in the SA, Egyptian, Nigerian, Kenyan and Mauritian equity markets over a 10-year period.

2. The first sub-problem is whether fundamental indices outperform cap-weighted indices on a risk-adjusted basis in the SA, Egyptian, Nigerian, Kenyan and Mauritian equity markets over a 10-year period.

3. The second sub-problem is to identify the fundamental factors that contribute most to the excess returns exhibited by the composite fundamental index in each market.

1.5 Scope of Work

The study stretches across five African emerging markets being SA, Egypt, Nigeria, Kenya and Mauritius. Within each country, the company accounting and share price information from 2003 to 2017 will be collected for all listed companies.

In total, the study will analyse 1,307 companies, the distribution of companies can be seen in Table 1.1 below.

Table 1.1: Companies under review per country

Country	***Companies***
SA	509
Egypt	325
Nigeria	260
Kenya	76
Mauritius	137
Total	**1307**

The study creates one composite fundamental index and five single factor fundamental indices in each of the five countries for 10-year resulting in a total of 300 indices being constructed.

The study also covers five listed cap-weighted indices to track relative performance.

1.6 Assumptions and Delimitations of the Study

This study uses data over a 15-year time span and measures performance over a 10-year time span. This data should provide a sufficient representation of varying market conditions including numerous economic cycles. The time period under review includes the 2008 financial crisis, it is assumed that there is sufficient data pre and post-financial crisis to not skew results.

It is assumed that the data collected from Bloomberg Terminal and Investing.com accurately represent company accounting fundamentals, market characteristics and asset prices.

The price information used to measure performance and, in some cases, rebalance indices will be the end of day prices on the last trading day of each month. Foreign market price information of cross-listed companies will not be considered.

The effect of transaction costs and other fees are not included in this study. Dividends are excluded for performance purposes and are used only as a weighting mechanism; performance is thus limited to capital gains.

Indices are constructed using only ordinary shares of listed companies with no bonds, preference shares or alternative exchanges being considered. The study will include both primary and secondary listings of companies listed on each exchange.

The skewed sector exposure resulting from this subsection of shares under consideration could result in an imbalance, which this study will not investigate.

In the SA equity market, only companies listed on the JSE's Main Board will be considered, companies listed on other boards or exchanges such as the AltX, ZAR X, 4AX and A2X will not be considered. In the Egyptian market, only companies listed on the Egyptian Exchange will be considered, companies listed on the Nile Stock Exchange will not be considered.

It is assumed that the market has sufficient liquidity to accommodate both buy and sell transactions immediately in whole or a fraction of the units.

This study uses only book value, dividends, revenue and cash flow to constructing composite fundamental indices. This deviates slightly from the model used by Arnott et al. (2005). Income and sales were intentionally excluded because of their similarity to revenue.

1.7 Orientation of the Study

The research article will start with a review of the literature pertaining to fundamental indexation and finance theory, it will then move into empirical findings. The data and methodology section will describe the methods that will be used to construct indices and analyse the data. The presentation of results will focus on visual representation and interpretation of findings. The results will then be discussed to link the findings back to the research problem and hypotheses. Finally, the research will be concluded by the researcher interpreting how the findings can be applied by both individual and institutional investors.

2 LITERATURE REVIEW

Below I define fundamental and cap-weighted indices and proceed to provide their respective advantages and disadvantages. Thereafter, I consider theoretical contributions to the field of finance, such as market efficiency, risk and expected growth, market anomalies, Fama and French three-factor model and modern portfolio theory. Finally, I review the empirical findings surrounding the performance, risks, rebalancing and costs of fundamental indexation.

2.1 Cap-weighted Indices

Cap-weighted indices are financial indices that derive both constituents and weightings using market capitalisation relative to total market capitalisation of all constituents (Mar et al., 2009). Constituent market capitalisation is determined by multiplying the latest share price by common shares outstanding. Constituent weighting can be calculated as:

$$W_{i,t} = \frac{Market\ Cap_{i,t}}{\sum_{i=1}^{n} Market\ Cap_{i,t}}$$

where $W_{i,t}$ is the weighting of constituent i at time t.

2.1.1 Example

The FTSE/JSE TOP40 and EGX30 are both examples of cap-weighted indices on the JSE and Egyptian Exchange respectively. The FTSE/JSE TOP40 and EGX30 are both constructed using ordinary shares of the 40 and 30 largest companies respectively as measured by market capitalisation subject to free float and liquidity criteria.

2.1.2 Advantages

Arnott et al. (2005), Estrada (2006) and Balatti, Brooks, and Kappou (2017) all highlight the ability of cap-weighted indices to automatically rebalance as constituent prices fluctuate. This feature supports a passive investment strategy requiring little to no trading and therefore reduces trading costs and management fees. Adjustments are limited to constituents entering or exiting indices as market capitalisations change. Arnott et al. (2005) and J. C. Hsu (2006) explained that weighing indices using market capitalisation assigns a greater weighting to large companies and, through doing so, improves liquidity and lowers transaction costs.

Both Estrada (2006) and Balatti et al. (2017) suggested that cap-weighted indices reflect the performance of the average investor, making them sound investment benchmarks. Cap-weighted indices are market-clearing portfolios that accurately represent the investment opportunity set because they strike a balance between supply and demand and by doing so encompass the whole market. These same characteristics also lead to cap-weighted indices being termed mean-variance efficient as they supposedly provide the best risk-adjusted returns.

2.1.3 Disadvantages

Balatti et al. (2017) observed that market prices are volatile and sometimes differ substantially from fair value. Because constituent weighting and purchase price are both related to price, pricing errors are embedded twice within the index. Arnott et al. (2005), Treynor (2005), J. C. Hsu (2006) and J. Hsu, Kalesnik, and Li (2012) all argued that suboptimal performance will arise from cap-weighted

indices due to under-priced shares having smaller capitalisation and thus lower weighting while over-priced shares have larger capitalisation and thus higher weighting.

2.1.4 Conclusion of Cap-weighted Indices

Cap-weighted indices follow a truly passive investment strategy that allows an investor the opportunity to earn the same return as the average investor. The over-reliance on volatile and inaccurate market prices to both acquire and weigh constituents introduces a performance drag that leads to suboptimal performance. Cap-weighted indices can therefore not be mean-variance efficient as they do not provide the best risk-adjusted returns.

2.2 Fundamental Indices

Fundamental indices are financial indices that derive both constituents and weightings from company fundamentals i.e. accounting valuation measures such as revenue, book value, sales, dividends, cash-flow and employment (Arnott et al., 2005). Constituent weighting can be calculated as:

$$W_{i,t} = \frac{Fundamental\ Measure_{i,t}}{\sum_{i=1}^{n} Fundamental\ Measure_{i,t}}$$

where $W_{i,t}$ is the weighting of constituent i at time t.

2.2.1 Example

The FTSE/JSE RAFI 40 is an example of a fundamental index on the JSE and is constructed using ordinary shares from the 40 largest companies as measured by sales, cash flow, book value and dividends (Exchange, 2014).

2.2.2 Advantages

Arnott et al. (2005) and J. C. Hsu (2006) successfully argued that cap-weighted indices assign greater weight to overvalued shares and less weight to undervalued shares, in doing so creating a performance drag. The main advantage of fundamental indexation is that it does not suffer from this performance drag. Without this performance drag, J. C. Hsu and Campollo (2010) and Arnott et al. (2005) found that fundamental indices achieved higher risk-adjusted returns.

Fundamental indices retain some of the advantages of cap-weighted indices such as broad market participation through exposure to large capitalisation shares, high concentration in liquid shares and a high correlation to the overall market (Arnott et al., 2005).

2.2.3 Disadvantages

Estrada (2006) described fundamental indexation as an active strategy masquerading as a passive index. Fundamental indexation deviates from a passive strategy towards an active strategy requiring periodic rebalancing resulting in higher turnover, transaction costs, and taxes. The frequency with which indices are rebalanced will determine the extent of turnover and the

associated costs. If rebalancing does not occur frequently the portfolio will become susceptible to some of the disadvantages of cap-weighted indices.

Unlike cap-weighted indices fundamental indices are not market-clearing portfolios, they do not reflect the returns of an average investor and they do not represent the investible opportunity set**.** Therefore, fundamental indices cannot be used as proper benchmarks (Estrada, 2006).

Estrada (2006) and Levy (2014) argued that using simplistic measures of value such as company accounting fundamentals could lead to unintended exposure to size and risk factors. Levy (2014) further stated that the increased popularity of fundamental indexation could lead to overcrowding within a subsection of the market.

2.2.4 Conclusion of Fundamental Indices

Whether or not fundamental indices can be used as a benchmark is of little concern to the average investor. Rather, they are concerned with better risk-adjusted returns. The potential exposure to size and risk factors should therefore not deter investors if they are adequately compensated for the additional risk.

2.3 Theoretical Considerations

2.3.1 Market Efficiency

Fama (1970) defined an efficient market as one in which the price of an asset always fully reflects all the available information. They distinguished between

three forms of market efficiency, which differ based on the type of information reflected in the price. The three form are:

- Weak-form efficient
    - All the past price information is reflected in the price.
- Semi-strong form efficient
    - All public information is reflected in the price.
- Strong-form efficient
    - All information of every kind is reflected in the price.

Bruce and Levy (1989) highlighted that the market efficiency argument centres around the fact that share prices must follow a random walk pattern. A random walk pattern suggests that changes in share prices are random and as such they are unpredictable.

Affleck-Graves and Money (1975) and Hadassin (1975) all found the JSE to be weak-form efficient. Jefferis and Smith (2005) applied a time-varying GARCH model to the JSE and also found that it was weak-form efficient. Kruger, Toerien, and MacDonald (2012) found the JSE to be efficient with brief periods of inefficiency.

Jefferis and Smith (2005) and Abdmoulah (2010) both applied a time-varying GARCH model to the Egyptian Exchange and found that it was weak-form efficient. Jefferis and Smith (2005) found that the Egyptian Exchange became weak-form efficient towards 2001. Abdmoulah (2010) concluded that the Egyptian Exchange deviated significantly from an efficient market and rejected the random walk pattern for this market.

Adelegan (2004) tested the Nigerian stock market using the random walk hypothesis and found that the market could be weak-form efficient. Onoh (2016)

also tested market efficiency in the Nigerian stock market using a regression analysis and found the market to be weak-form efficient. Finally, Ayodele, Oshadare, and Ajala (2017) used input and output indices to empirically test the efficiency of the Nigerian stock market and found it to be semi-strong form inefficient.

Vitali and Mollah (2010) investigated market efficiency in SA, Egypt, Nigeria, Kenya and Mauritius using the random walk hypothesis and found that only SA could be regarded as weak-form efficient. Smith (2008) tested for weak-form efficiency in SA, Egypt, Nigeria, Kenya and Mauritius using a GARCH-type model and found the SA market to be weak-form efficient. Nigeria, Egypt and Mauritius were found to become weak-form efficient in the later part of the period while Kenya failed the efficiency test.

The mixed results found in the literature surrounding market efficiency can be attributed to thin trading in African markets. Thin trading influences the results of the random walk model, the GARCH model better fits empirical data of stock returns as it accommodates for thin trading and produces more consistent results.

These findings lean toward emerging markets being weak-form efficient. The weak-form efficiency of these markets will influence the returns of cap-weighted indices as market prices do not accurately reflect all the available information. Fundamental indices do not rely on market prices to select and weigh constituents and will, therefore, be less affected by inaccurate prices.

2.3.2 Efficient Market Hypothesis

Basu and Forbes (2014) indicated that modern finance supports the efficient market hypothesis. The price of a share is believed to be the best-unbiased estimate of fair value given all the available information. In addition to this, the Capital Asset Pricing Model (CAPM), as explained by Sharpe (1964), further suggests that the market portfolio, a portfolio consisting of all risky assets holding constituents weighted by market capitalisation, is mean-variance efficient (Estrada, 2006).

If a constituent's market price is an accurate representation of all available information and market portfolios are mean-variance efficient then it is impossible to achieve higher risk-adjusted returns without extraordinary skill or information. It follows that the average investor cannot achieve better risk-adjusted returns than just holding a market portfolio. J. C. Hsu (2006) however, reject the mean-variance efficiency of cap-weighted indices.

The SA, Egyptian, Nigerian, Kenyan and Mauritian markets are all weak-form efficient and therefore the current market price only contains past price information. Publicly available information such as company accounting fundamentals are not incorporated into the current market price and therefore cap-weighted indices cannot be mean-variance efficient in these markets.

2.3.3 Noisy Market Hypothesis

In stark contrast to the efficient market hypotheses, Perold (2007) and Estrada (2006) described the noisy market hypothesis as proposed by Siegel (2006) as follows:

Markets are subject to noise and shocks that cause prices to deviate from fair value. Shocks can be caused by speculators, momentum traders, institutions, insiders and other market participants who trade for reasons other than value. If we suppose that markets are inefficient and thus there are random price errors then some shares will be overvalued and others undervalued. Overvalued shares will have overstated market capitalisation resulting in lower future returns. Undervalued shares will have understated market capitalisation resulting in higher future returns.

Applying capitalisation weighting to an index with mispriced shares will result in overvalued shares receiving higher weightings and undervalued shares receiving lower weightings. This will result in suboptimal returns due to the performance drag introduced by market capitalisation weighting. J. C. Hsu (2006) claimed the underperformance to be equal to the variance of the price noise.

Perold (2007) however, disagrees with the suggestion that cap-weighted indices introduce a performance drag. The hypothesis used to support the notion of a performance drag uses fair value to determine pricing errors based on a probability distribution, fair value is however unknown. If market prices are used to calculate expected return instead of fair value no performance drag is found.

2.3.4 Risk and Expected Growth

Kaplan (2008) maintains that risk and future growth prospects cannot be directly observed in the market, therefore they should be accounted for either through proxies or they should be ignored. Market price reflects investor's assessment of risk and future growth prospects and can thus be used as a proxy. Cap-weighted

indices account for risk and expected growth using market prices, these prices can and most often do contain errors. Fundamental indices, on the other hand, ignore risk and expected growth altogether. Arnott et al. (2005) acknowledged that this could lead to young faster-growing companies being excluded or being underrepresented within fundamental indices.

2.3.5 Market Anomalies

Market anomalies are defined as consistent deviations from market equilibrium not explained by risk-return factors (Ferreira, 2009). Variables such as book-market ratios, market capitalisation, price-earnings ratios and leverage are found to produce returns that cannot be explained by the CAPM beta (Rensburg & Robertson, 2003).

2.3.6 Size Anomaly

The size anomalies refer to the notion that smaller companies, as measured by total market capitalisation, deliver excess returns in comparison to larger companies over the long term. Banz (1981) was among the first to observe the size anomaly, the observation underscored an empirical contradiction to the CAPM.

Reinganum (1982) found that size anomalies exist and that it could not be explained by excess risk. Rensburg and Robertson (2003) and Strugnell, Gilbert, and Kruger (2011) found the same size anomalies on the JSE with the size premium concentrated in smaller shares.

The literature surrounding the size anomaly attributes the excess returns to numerous factors such as seasonality, the influence of transaction costs, thin trading, inefficient market proxies, information asymmetry and the use of size as a proxy for risk (Strugnell et al., 2011). Strugnell et al. (2011) found tentative evidence that suggests that the size premium is reducing over time, this could be attributed to greater awareness of this anomaly.

Fundamental indices have greater exposure to smaller companies relative to cap-weighted indices. They, therefore, have meaningful exposure to the size premium and should result in excess returns.

2.3.7 Value Anomaly

The value anomaly refers to the notion that a company's share price is undervalued relative to some fundamental benchmark such as earnings, book value or dividends. Value companies trade below their fair value and therefore exhibit high dividend yield, low price-earnings ratios and high book-market ratios (Kwag & Lee, 2006).

The literature commonly attributes excess returns to either additional risk or mispricing. Chan and Lakonishok (2004), Piotroski (2000), Bartov and Kim (2004) and Kwag and Lee (2006) all found that value investing on average outperform growth investing after accounting for risk, thereby attributing the excess returns to mispricing. Chan and Lakonishok (2004) ascribed mispricing to behavioural considerations and the agency cost of delegating investment management. Bartov and Kim (2004) found mispricing to be more noticeable among smaller firms held by smaller unsophisticated investors and firms less closely followed by

market participants. Piotroski (2000) attributed mispricing to the lack of coverage and recommendations leading to markets not fully incorporating historical information such as those found in financial statements.

Strugnell et al. (2011) and Rensburg and Robertson (2003) found the value effect, as measured by the price-earnings ratio, to be present on the JSE. The value effect was found to be significant and pervasive, this could be attributed to some level of market inefficiency or misspecification of equilibrium price models such as the CAPM. The value effect was found to apply to all shares in the investment universe with returns being an inverse function of the PE ratio.

Non-price weighted indices, such as fundamental indices, will have meaningful exposure to the value premium and effectively capture any excess returns as they rebalance against long-horizon mean revision (J. Hsu, 2014).

2.3.8 Momentum Anomaly

Asness, Frazzini, Israel, and Moskowitz (2014) defined momentum as the phenomenon where shares that performed well relative to their peers continue to outperform and vice versa. George and Hwang (2004) observed that share prices do not follow a random walk pattern and that returns are therefore predictable.

Griffin, Ji, and Martin (2003), Asness et al. (2014) and Grundy and Martin (2001) all found that the excess returns generated by momentum are economically large and statistically significant. In emerging markets, the excess returns generated by momentum were found to be small but still positive. Excess returns generated by momentum were found in both expansion and contraction phases of the business cycle.

Asness et al. (2014) explained that excess returns could be attributed to either additional risk or behavioural factors. Behavioural factors relate to information diffusion and the subsequent underreaction or overreaction of traders. Griffin et al. (2003) and Grundy and Martin (2001) attributed the excess returns to behavioural factors as they found that the Fama and French three-factor risk model could not explain the excess returns.

Griffin et al. (2003) and Perold (2007) found that momentum exhibits long-term mean-reversion and that momentum therefore only attributed to excess returns over short periods. George and Hwang (2004) found that excess returns generated by momentum reversed over a one to five-year time span and become negative over long horizons.

Asness et al. (2014) found that momentum works best when used in combination with value as it incorporates both undervalued shares and future growth expectations. Perold (2007) claimed that rebalancing strategies, such as fundamental indexation, will be inferior when combined with momentum as they sell shares after they increase in value only to find that they continue to increase in value. Fundamental indices will, however, also reduce exposure to momentum shares as their prices increase and therefore reduce the negative effects of long-term mean-revision.

2.3.9 Fama and French Three-Factor Risk Model

Fama and French (1992) combined the above-mentioned anomalies to form the three-factor risk model, effectively showing market efficiency by expanding risk factors.

Balatti et al. (2017), Jun and Malkiel (2008) stated that due to fundamental indices making use of accounting fundamentals they tend to overweight value shares and underweight growth shares. This will lead to an index that consists of smaller-capitalisation shares relative to cap-weighted indices, smaller-capitalisation shares are shown to earn excess risk-adjusted returns when measuring risk using the CAPM beta.

Fundamental indexation is exposed to value, size and momentum factors, performance is therefore driven to some extent by higher weighting towards these known risk factors. According to Fama and French (1993), smaller companies are inherently riskier and the price-book ratio is itself a measure of risk that is not taken into account when using the CAPM beta.

Fama and French (1992) identified a strong association between returns and style variables such as size, price-earnings ratio, gearing and book-market ratio. Since then other style variables such as dividends, momentum, cash-flow and the January effect have been identified.

2.3.10 *Modern Portfolio Theory*

The construction of portfolios in an attempt to reduce risk originated from Markowitz (1952) who introduced the modern portfolio theory. This theory subsequently served as the foundation for the CAPM. Markowitz (1952) introduced the concept of portfolio selection to construct an optimal portfolio and argued that through diversification it is possible to reduce risk and maximise the return of a portfolio. This is achieved by selecting constituents that exhibit low covariance with each other. The rationale behind this theory is that assets that

exhibit low covariance will move in opposite directions and therefore reduce the volatility of the portfolio.

Hicks (1989) identified that it is possible to reduce risk by investing money in a range of different risky assets as appose to a single risky asset. Markowitz (1952) however differed from Hicks (1989) because the correlation of the underlying assets should be considered. If all risky assets are perfectly correlated the total risk of the portfolio will increase. Only when assets are not perfectly correlated can risk be reduced through portfolio construction.

Instead of simply investing in a large number of companies it is possible to construct an optimal portfolio that reduces risk while maintaining returns through improved portfolio construction.

2.3.11 Conclusion of the Theoretical Considerations

The markets under investigation in this study are emerging markets and are found to be weak-form efficient. Therefore, the efficient market hypothesis does not hold as asset prices do not accurately reflect all the available information, they only reflect previous price information. Consequently, the noisy market hypothesis suggests that cap-weighted indices will introduce a performance drag and provides theoretical support for the outperformance of fundamental indices in this study.

Fundamental indices are found to ignore risk and expected growth prospects by not considering price when constructing indices. However, share prices in these markets are not an accurate reflection of all the available information and could,

therefore, lead to a performance drag if weighted according to market capitalisation.

Fundamental indexation is found to introduces meaningful exposure to the value premium. Fundamental weighting rebalances constituents against long-term mean revision while providing better diversification. This allows the value premium to be captured more effectively as constituent weighting is increased when valuation ratios are high and reduced when valuation ratios are low. It also allows the excess monthly and annual returns produced by momentum to be effectively captured before being eliminated by long-term mean-reversion. The excess returns can therefore not be entirely attributed to risk introduced by value, size and momentum tilts as suggested by Fama and French (1993), but rather to dynamic shifts in weight as fundamentals change.

2.4 Empirical Findings

The theoretical considerations discussed above find support for fundamental indexation but it does not answer a very fundamental question, whether fundamental indexation really suite investors' needs? The empirical evidence below provides additional support for fundamental indexation.

2.4.1 Performance

Arnott et al. (2005) and J. C. Hsu and Campollo (2010) performed studies on U.S. shares and found that fundamental indexation delivered annual outperformance of approximately 1.97% compared to the cap-weighted S&P 500 over 43-years. Along the same lines, Basu and Forbes (2014) performed a study in Australia

and found annual outperformance of 3.50% when comparing fundamental indices to the cap-weighted S&P/ASX 200 over 25-years. Balatti et al. (2017) and J. C. Hsu and Campollo (2010) found that a UK based fundamental index outperformed the cap-weighted FTSE 100 by between 2.39% and 3.59% annually over 25-years. Hemminki and Puttonen (2008) found that a European market based fundamental index outperformed the DJ Euro Stoxx 50 by 1.76% annually over 11-years.

Walkshäusl and Lobe (2010) and J. C. Hsu and Campollo (2010) performed broad studies that stretched internationally covering developed and emerging markets and established that fundamental indices outperform cap-weighted indices in most settings.

2.4.2 Risk, Value and Size Factors

By using a broader definition of risk that includes both value and size factors the Fama and French (1993) three-factor risk model can be used to identify possible sources of excess returns in fundamental indices.

Houwer and Plantinga (2009), Walkshäusl and Lobe (2010) and Balatti et al. (2017) all found that the excess return generated by fundamental indices could not be exclusively attributed to value, size, momentum or other risk factors. The excess returns were attributed to dynamic shifts in weight and sectors within the portfolio resulting in economically and significant positive Fama and French three-factor alphas.

Blitz and Swinkels (2008), Jun and Malkiel (2008), Mar et al. (2009) and J. Hsu et al. (2012) all however found that the excess return generated by fundamental indices are largely explained by their bias towards value shares.

2.4.3 Fees and Rebalancing

Arnott et al. (2005) opted to rebalance fundamental indices annually as monthly, quarterly, and semi-annual rebalancing produced insignificant return advantages. They found constituents to be large and liquid resulting in relatively low levels of rebalancing. Consequently, costs were found to be nearly as low as that of a cap-weighted strategy.

Blitz, Van Der Grient, and Van Vliet (2010) stated that the subjective choice of when to rebalance an index can have a significant impact on performance. They found outperformance of over 10% by simply changing rebalancing dates. In addition to these findings, they also observed that when fundamental indices diverge due to rebalancing decisions the gap in performance is likely to persist.

2.4.4 Conclusion of the Empirical findings

The empirical findings lean toward fundamental indexation being a superior selection and weighting strategy. Fundamental indexation produces excess returns in both developed and emerging markets with costs comparable to cap-weighted indices. In some instances value, size, momentum and other risk factors are found to be the source of excess returns. The excess returns can, therefore, be partly attributed to additional risk and to the exploitation of known market anomalies.

3 DATA AND METHODOLOGY

3.1 Basic Paradigm

In this paper, I use the positivism paradigm to fill a knowledge gap through hypothesis testing and statistical analysis. The quantitative nature of financial instruments lends itself to both descriptive and experimental quantitative methods, I use these methodologies to analyse fundamental indices. Quantitative data analysis produces objective and accurate results that are comparable with similar studies performed in other contexts, such as those performed by Arnott et al. (2005).

3.2 Research Methodology

3.2.1 Design for Data Collection

Data collection commences by downloading company financial statements, company beta information and historical price information from Bloomberg Terminal. The data is initially stored in Microsoft Excel, once all the data has been collected the data is normalised and imported into a Microsoft SQL Server database. The data is then checked for reliability to ensure that there are no outliers and any missing price information is collected from Investing.com. These financial statements are the source of the fundamental measures used in this study such as book value, cash flow, sales, dividends, employees. Share prices are obtained for each company per month to track relative monthly performance and calculated market capitalisation. The historical risk-free rate is obtained by using the historical 10-year government bond yield for each country.

The study also collects data on five listed cap-weighted indices used as benchmarks to track relative performance, these indices are listed in Table 3.1 below.

Table 3.1: Benchmark indices under review per country

Country	***Index Name***
SA	TOP40 Index
Egypt	EGX30 Index
Nigeria	NGSE30 Index
Kenya	NSE20 Index
Mauritius	SEM10 Index

For each of these indices, I collect monthly price and beta information and track their performance over 10-years. These indices were selected because of data availability and they represent an average index fund on their respective exchanges.

3.2.2 Population and Sample

The study focuses on five African emerging markets namely SA, Egypt, Nigeria, Kenya and Mauritius. The investment universe will consist of only common shares of listed companies that traded between 1 January 2003 and 31 December 2017 on the JSE, Egyptian Exchange, Nigerian Stock Exchange, Nairobi Securities Exchange and Stock Exchange of Mauritius. No bonds, preference shares or alternative exchanges were considered. Both active and inactive shares are considered to prevent survival bias from influencing the results.

Data is collected from 2003 to 2017, although the study only covers performance over a 10-year time span I collect data for 15-years as some measures are based on five-year trailing averages.

In total, the study collects and analyses data stretching across 1,307 companies, the distribution of companies can be seen in Table 3.2 below.

Table 3.2: Companies under review per country

Country	***Companies***
SA	509
Egypt	325
Nigeria	260
Kenya	76
Mauritius	137
Total	**1307**

This study will not use sampling because it considers the whole population in each country to achieve consistent and reliable results.

3.2.3 Research Design

This study uses the model proposed by Arnott et al. (2005) to calculate composite fundamental indices and single factor fundamental indices.

Constituents are selected and portfolio weights calculated yearly on the 1st of January using data available on the last trading day of the previous year. Rebalancing of the portfolio also occurs on the last trading day of each year using

end-of-day prices. Arnott et al. (2005) found annual rebalancing to be most effective when taking into account index turnover and the associated costs.

Composite fundamental indices are constructed yearly by ranking companies in descending order using each individual fundamental measure. This study uses the following fundamental measures in the construction of composite fundamental indices:

- trailing one-year book value
- trailing five-year average cash flow
- trailing five-year average revenue
- trailing five-year average dividends

The top n constituents for each measure are selected and their weightings computed using the corresponding measure relative to the top n constituents. If a constituent is not selected in the top n constituents for an individual measure, it will be assigned a zero weighting for that measure when computing the average composite weighting. Dividends were treated differently because companies can elect not to pay dividends, in this case, the average weight of the remaining measurements are used. Constituent weightings for each measure are combined, in equal proportions, to form an average composite weighting. The top n constituents are selected and weighted based on the average composite weighting. This process is repeated using data from the JSE, Egyptian Exchange, Nigerian Stock Exchange, Nairobi Securities Exchange and Stock Exchange of Mauritius.

Two fundamental measures were excluded from the construction of composite fundamental indices. Trailing one-year employment was excluded because the information was not always available. Trailing five-year average gross sales was also removed because of its similarity to trailing five-year average revenue.

Five additional single factor fundamental indices will be constructed yearly using:

- trailing one-year book value
- trailing five-year average cash flow
- trailing five-year average revenue
- trailing five-year average dividends
- trailing one-year employment

For each fundamental factor, constituents are sorted in descending order, the top n constituents are selected and their weightings computed relative to the top n constituents.

This process is repeated using data from the JSE, Egyptian Exchange, Nigerian Stock Exchange, Nairobi Securities Exchange and Stock Exchange of Mauritius. The number of constituents selected per exchange can be found in table 3.3 below.

Table 3.3: Constituents selected per exchange

Exchange	*Constituents*
Johannesburg Stock Exchange	40
Egyptian Exchange	30
Nigerian Stock Exchange	30
Nairobi Securities Exchange	20
Stock Exchange of Mauritius	10

The fundamental measures used to construct fundamental indices were selected because they conform to those used by Arnott et al. (2005). They are accounting metrics extracted from income statements, statements of cash flow and balance sheets that do not rely on price as a measure of company size.

Once all indices are constructed and rebalanced for each of the 10-years I introduce constituent share price to track relative monthly performance.

3.2.4 Data Analysis and Hypothesis Testing

Data analysis is performed using quantitative and visual analysis techniques, thereafter results are interpreted and deliberated. I measure and graph annual return, annual excess return and the performance of 1,000 units invested at the beginning of 2008.

Descriptive statistics are generated to determine the average return, geometric return, minimum return, maximum return, standard deviation, kurtosis and skewness of each index. The average returns, standard deviation and beta will

be used to calculate the Jensen's alpha, Sharpe Ratio and Treynor Ratio for each index.

The Standard Deviation, a measure used to quantify the variability of returns and measure total risk, will be calculated as follows:

$$StdDev = \sqrt{\frac{\sum_{y=1}^{n}(Ry - \mu)^{2}}{n}}$$

Where Ry is the return of the index in year y, μ is the mean return of the index and n is the number of years under review.

The Beta, a measure of the volatility of the portfolio against that of the market, will be calculated as follows:

$$Bp = \sum_{i=1}^{n} W_{i,t} * B_{i,t}$$

where $W_{i,t}$ is the weighting of constituent i at time t and $B_{i,t}$ is the beta of constituent i at time t.

The Jensen's alpha, a measure of performance above or below the expected return as calculated by the CAPM, will be calculated as follows:

$$Jensen's\ Alpha = Rx - (Rf + B * (Rm - Rf))$$

Where Rx is the average index return, Rf is the appropriate risk-free rate, B is the CAPM beta and Rm is the market return.

The Sharpe Ratio, a measure of excess performance after adjusting for total risk, will be calculated as follows:

$$Sharpe\ Ratio = \frac{Rx - Rf}{StdDev(Rx)}$$

where Rx is the average index return, Rf is the appropriate risk-free rate and StdDev(Rx) is the standard deviation of index return.

The Treynor Ratio, a measure of excess return for each unit of risk, will be calculated as follows:

$$Treynor\ Ratio = Rx - Rf$$

where Rx is the average index return and Rf is the appropriate risk-free rate.

The results from the data analysis will be used to test the following hypotheses:

- Hypothesis H1: Fundamental indices outperform cap-weighted indices in African emerging markets.
- Hypothesis H2: Fundamental indices exhibit greater excess returns in African emerging markets. Excess returns are defined as average outperform of more than 2% annually.
- Hypothesis H3: Fundamental indices outperform cap-weighted indices in African emerging markets when accounting for risk.

The monthly performance of single factor fundamental indices will be used in each market to perform correlation testing with composite fundamental indices in an attempt to identify which fundamental measures contribute most to excess returns.

3.3 Potential Weaknesses

The effect of transaction costs and other fees are not included in this study. It has however been shown that rebalancing indices annually only slightly increases transactions costs and therefore does not influence the results significantly (Arnott et al., 2005). Dividends are excluded for performance purposes and are used only as a weighting mechanism; performance is thus limited to capital gains.

The study only reviews the performance of indices between 2003 and 2017, not since their inception date. The data used to construct indices and track their relative performance are sourced from secondary data sources. The data has not been verified through comparison with other data sources, therefore some measures used to construct and measure indices might be missing from time to time. Although every effort is made to find correct and accurate data the results might be influenced by these anomalies.

3.4 Validity and Reliability

The degree to which the results of this study can be generalised is assessed by looking at four dimensions of generalisation being population, context, treatment and time.

The results from this research article can be generalised to the immediate population, being other indices on the same exchanges and other African emerging markets, due to similarities in market characteristics. The study considers five African emerging markets thereby improving the reliability and validity of the findings. Both Walkshäusl and Lobe (2010) and Estrada (2006)

provide support for this conclusion as they found that fundamental indices outperform cap-weighted indices in both developed and emerging markets.

The treatment of research characteristics moderately influences results. Arnott et al. (2005) established that monthly, quarterly and semi-annual rebalancing of fundamental indices have little influence on returns. Blitz et al. (2010) however, maintain that the subjective choice of when to rebalance can have a dramatic influence on performance. To address this issue I rebalance indices periodically on the 1st of January to conform with Arnott et al. (2005) and other researchers.

Arnott et al. (2005) affirm that fundamental indices exhibit robust performance across time, business cycles and market phases. The only exception found was during market bubbles when fundamental indices tend to underperform cap-weighted indices. The period under consideration in this study is 10-years and should be sufficient to account for these anomalies.

3.5 Ethical Assurances

The data gathered in this report relates to listed companies and is readily available in the public domain from a variety of sources, therefore I foresee no ethical concerns.

4 PRESENTATION OF THE RESULTS

The results contained in this section are derived from the research methodology as described above and will be structured according to each problem/sub-problem the research article attempts to address. Within each section, each exchange will be considered in isolation to identify the behaviour of fundamental indices within that market.

4.1 Return and Performance

Return and performance analyses are performed to test the main problem statement being:

The main purpose of this research is to establish whether fundamental indices outperform cap-weighted indices in the SA, Egyptian, Nigerian, Kenyan and Mauritian equity markets over a 10-year period.

The results are divided into three sections to gain a better understanding of the performance characteristics of each index. The first section looks at the total return performance by measuring the growth in value of 1,000 units invested in each index at the beginning of 2008. The second section compares the annual return of each index to gain a better understanding of when the performance came about. Finally, the excess annual returns of fundamental indices are compared using the cap-weighted index as a reference point to better measure over or under-performance.

4.1.1 *JSE*

The return performance results for the fundamental indices and cap-weighted TOP40 index benchmark are graphed in figure 4.1 below.

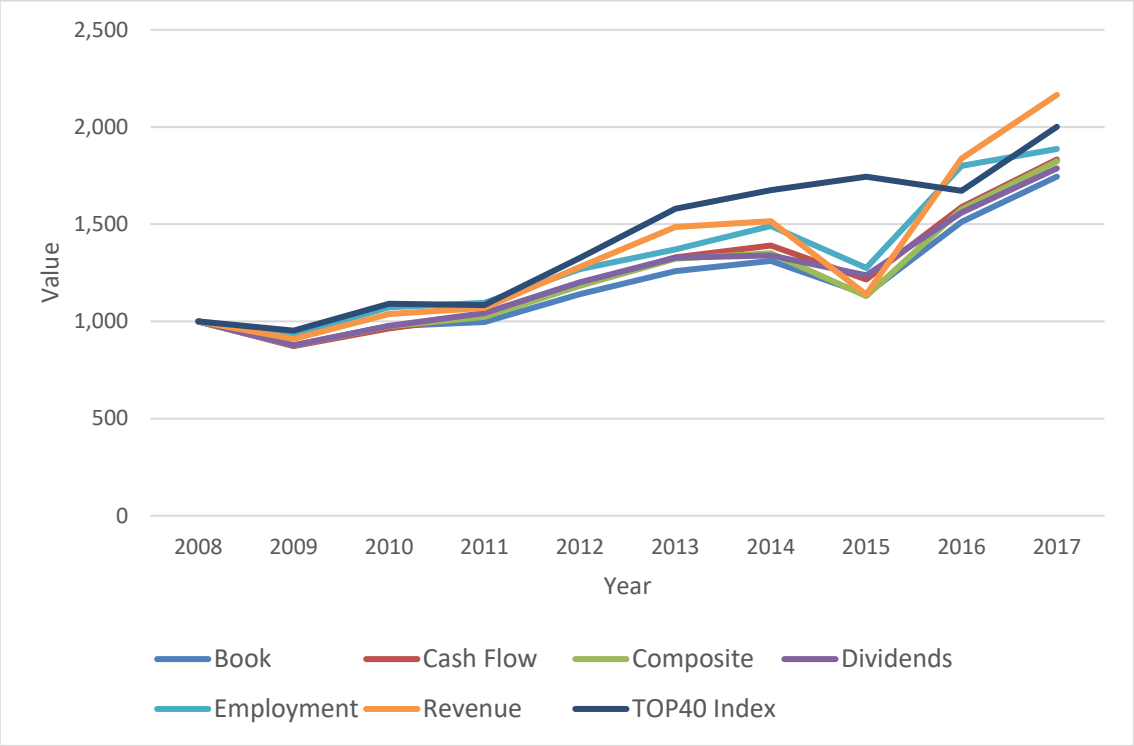


Figure 4.1: SA return comparison between fundamental indices and cap-weighted benchmark

It is observed from the return comparison graph in figure 4.1 above that the Revenue fundamental index outperformed the cap-weighted TOP40 index at the end of 2017. The cap-weighted TOP40 index however outperformed all other fundamental indices including the Composite index. The Revenue index ended the period with a value of R 2,165.32. The Composite index ended the period with only R 1,823.47 compared to the TOP40 index with R 2,001.24.

The Revenue index has a total return of 116.53%. The Composite index managed to deliver a total return of 82.35% compared to the TOP40 index which has a total return of 100.12%.

The annual return results for the fundamental indices and cap-weighted TOP40 index benchmark are graphed in figure 4.2 below.

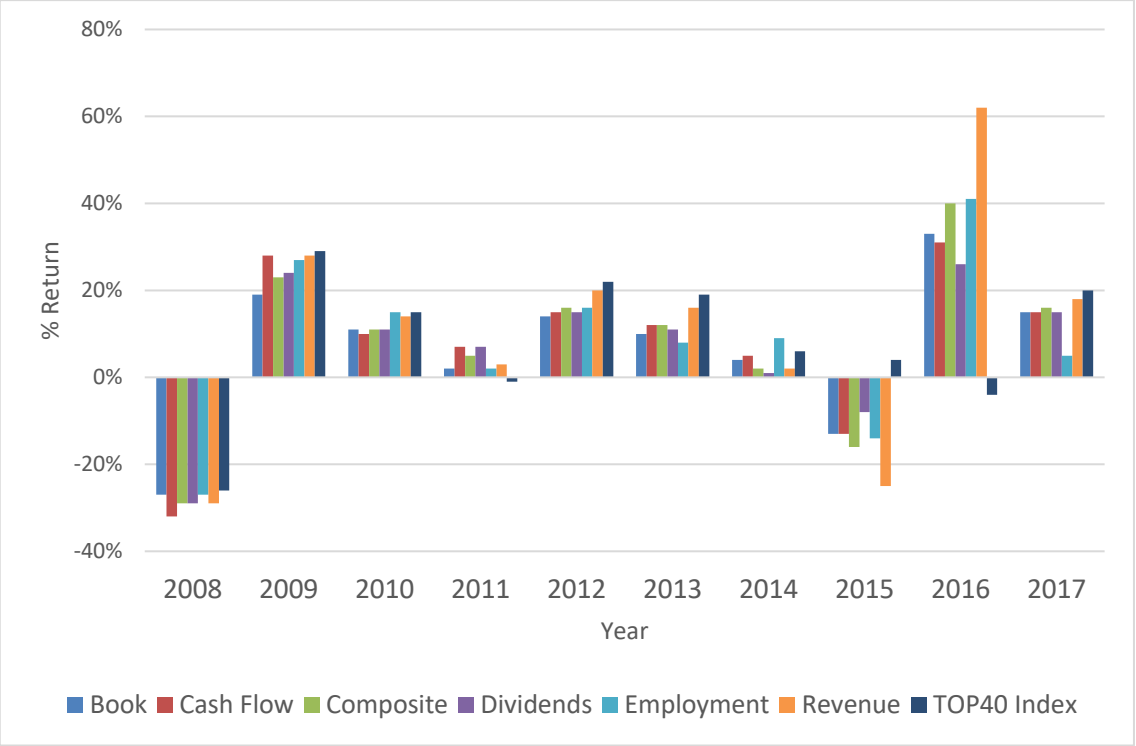


Figure 4.2: SA annual return comparison between fundamental indices and cap-weighted benchmark

From figure 4.2 above it is observed that the cap-weighted TOP40 index minimised losses during the 2008 downturn and subsequently outperformed in 2009. The Composite index underperformed the TOP40 index each year except in 2016 when it outperformed by 44%.

The performance surrounding 2015 and 2016 requires some explanation. In 2015 all fundamental indices show negative performance while the cap-weighted

benchmark showed positive performance. In 2016 the cap-weighted benchmark showed negative performance while all fundamental indices showed positive performance. This can be attributed to the fundamental indices being heavily weighted towards the basic materials sector, the Revenue index had a 56.67% weighting towards the basic materials sector. A combination of oversupply and weak demand for natural resources resulted in a loss of 25.41% for the basic material constituents of the Revenue index. The losses were erased in the subsequent year with the Revenue index attributing 55.51% of its performance to constituents in the basic materials sector.

The annual excess returns for the fundamental indices are graphed in figure 4.3 below using the cap-weighted TOP40 index benchmark as a reference point.

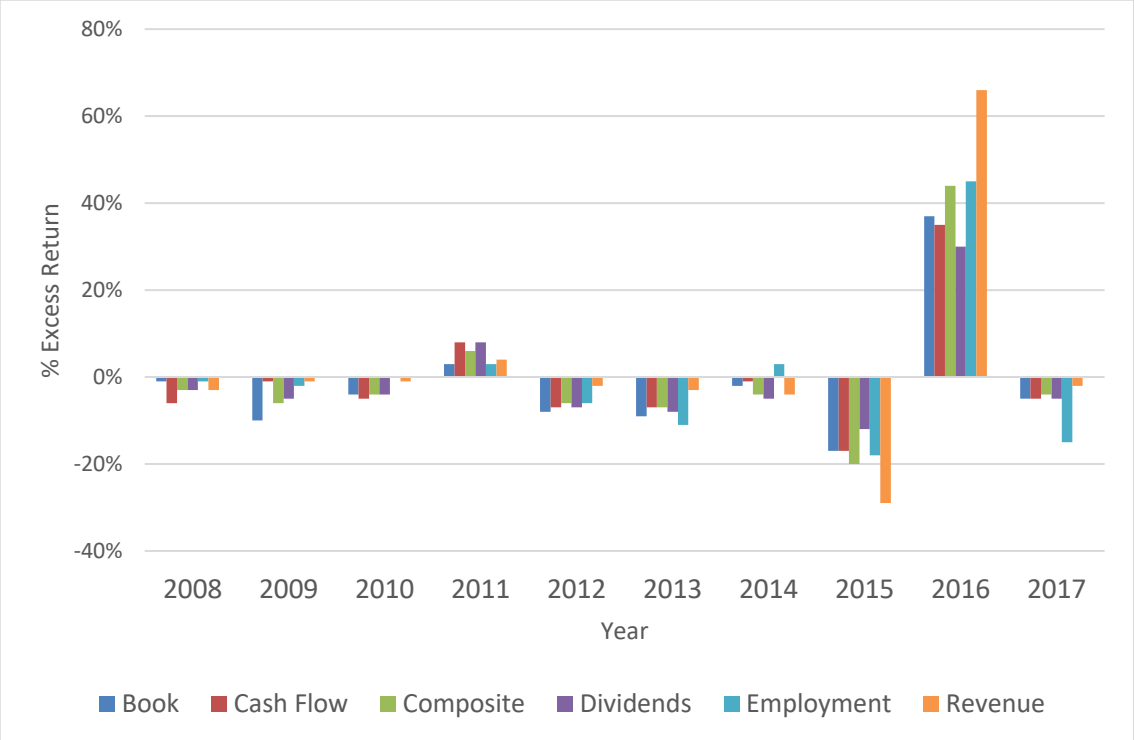


Figure 4.3: SA excess return per year relative to the cap-weighted benchmark

From figure 4.3 above it is observed that the cap-weighted TOP40 benchmark outperformed all fundamental indices in 6 out of the 10 years. All fundamental indices outperformed the cap-weighted TOP40 index only twice over the 10 years. The majority of the outperformance exhibited by fundamental indices were concentrated in 2016, the outperformance more than compensated for the underperformance exhibited in 2015.

4.1.2 *Egyptian Exchange*

The return performance results for the fundamental indices and cap-weighted EGX30 index benchmark are graphed in figure 4.4 below.

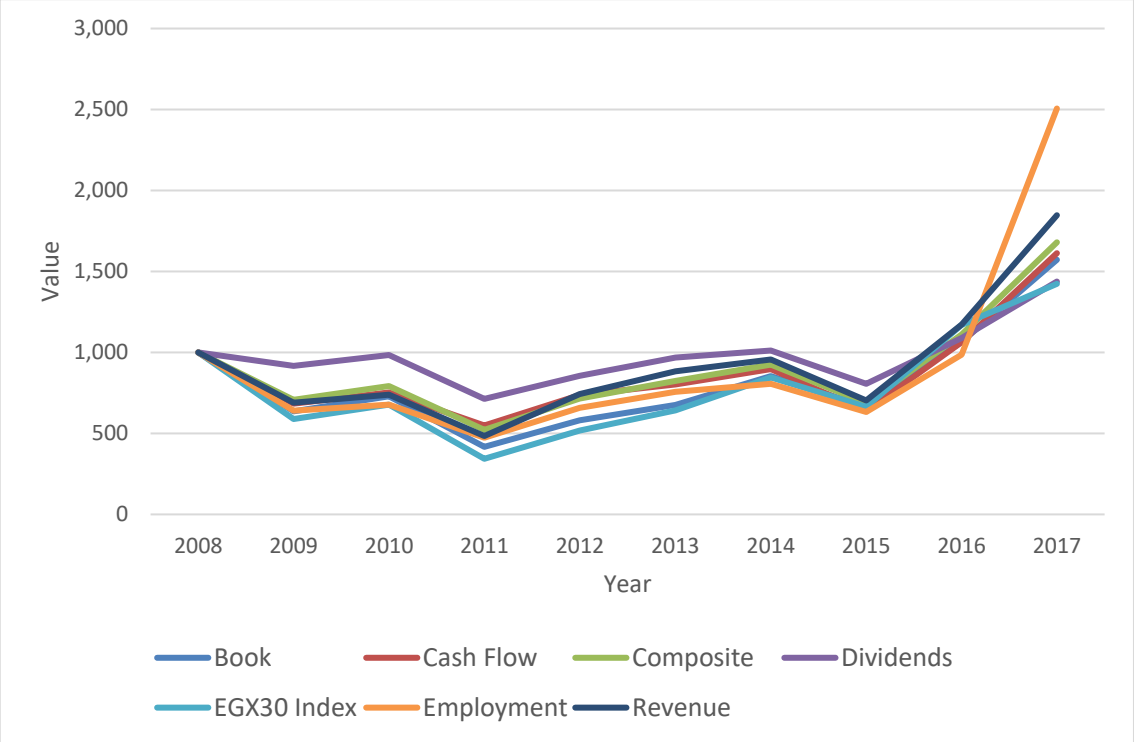


Figure 4.4: Egypt return comparison between fundamental indices and cap-weighted benchmark

It is observed from the return comparison graph in figure 4.4 above that all the fundamental indices outperformed the cap-weighted EGX30 index at the end of

2017. The Employment index performed the best and ended the period with a value of e£ 2,506.14. The Composite index ended the period with a value of e£ 1,680.00 compared to e£ 1,423.65 for the EGX30 index.

The Revenue index also performed relatively well with an ending value of e£ 1,847.25. The Employment index has a total return of 150.61%, the Revenue index has a total return of 84.73% and the EGX30 index has a total return of 42.37%.

The annual return results for the fundamental indices and cap-weighted EGX30 index benchmark are graphed in figure 4.5 below.

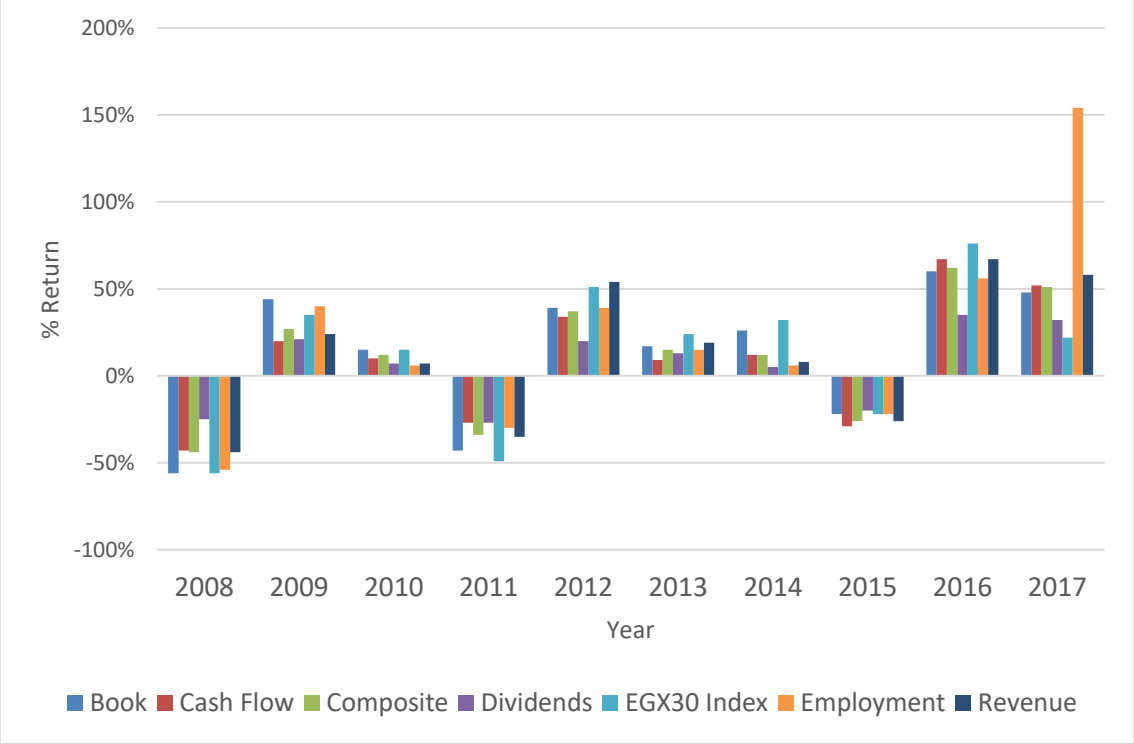


Figure 4.5: Egypt annual return comparison between fundamental indices and cap-weighted benchmark

From figure 4.5 above it is observed that during the 2008 downturn the EGX30 index and Book index suffered the largest losses. The Book index subsequently outperformed in 2009 while the EGX30 index delivered a modest return. The

Revenue index outperformed all indices in 2012. The Employment index only outperformed all other indices in 2017.

The annual excess returns for the fundamental indices are graphed in figure 4.6 below using the cap-weighted EGX30 index benchmark as a reference point.

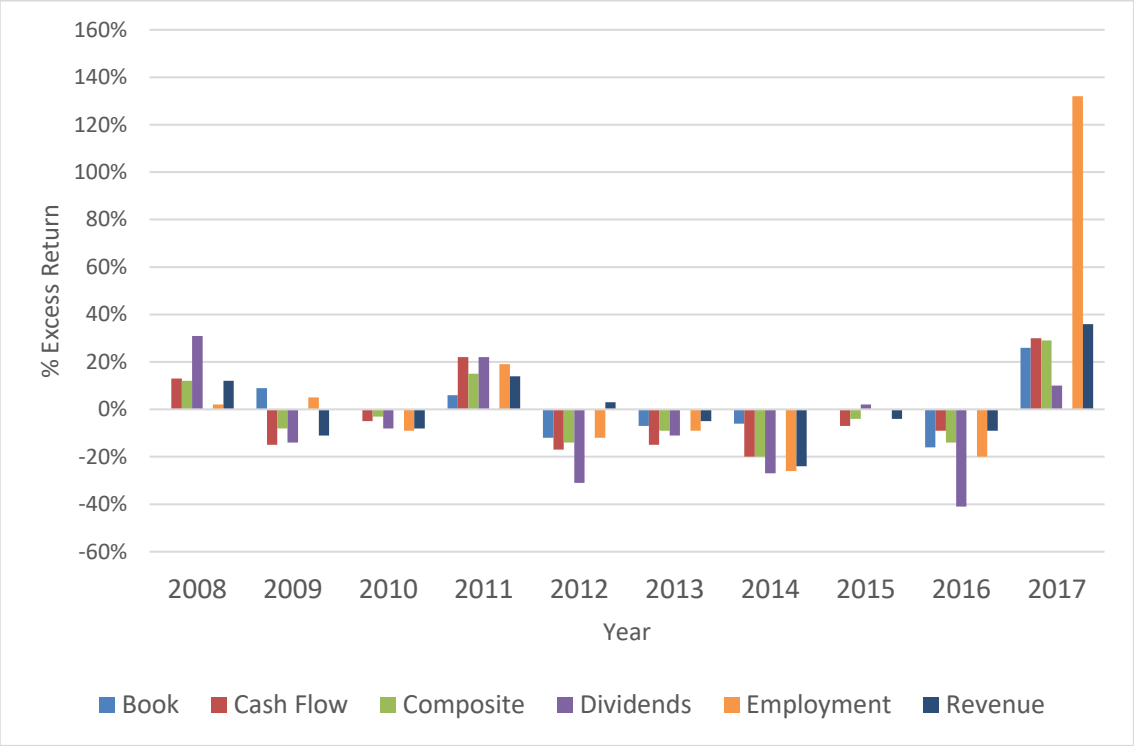


Figure 4.6: Egypt excess return per year relative to the cap-weighted benchmark

From figure 4.6 above it is observed that the cap-weighted EGX30 benchmark outperformed all fundamental indices in 4 out of the 10 years. All fundamental indices outperformed the cap-weighted EGX30 index only three times over the 10 years. The Employment index outperformed all indices in 2017, the outperformance amounted to 132% compared to the EGX30 index. The majority of the outperformance is concentrated in 2017, the outperformance more than compensated for the underperformance exhibited in 2016.

4.1.3 *Nigerian Stock Exchange*

The return performance results for the fundamental indices and cap-weighted NGSE30 index benchmark are graphed in figure 4.7 below.

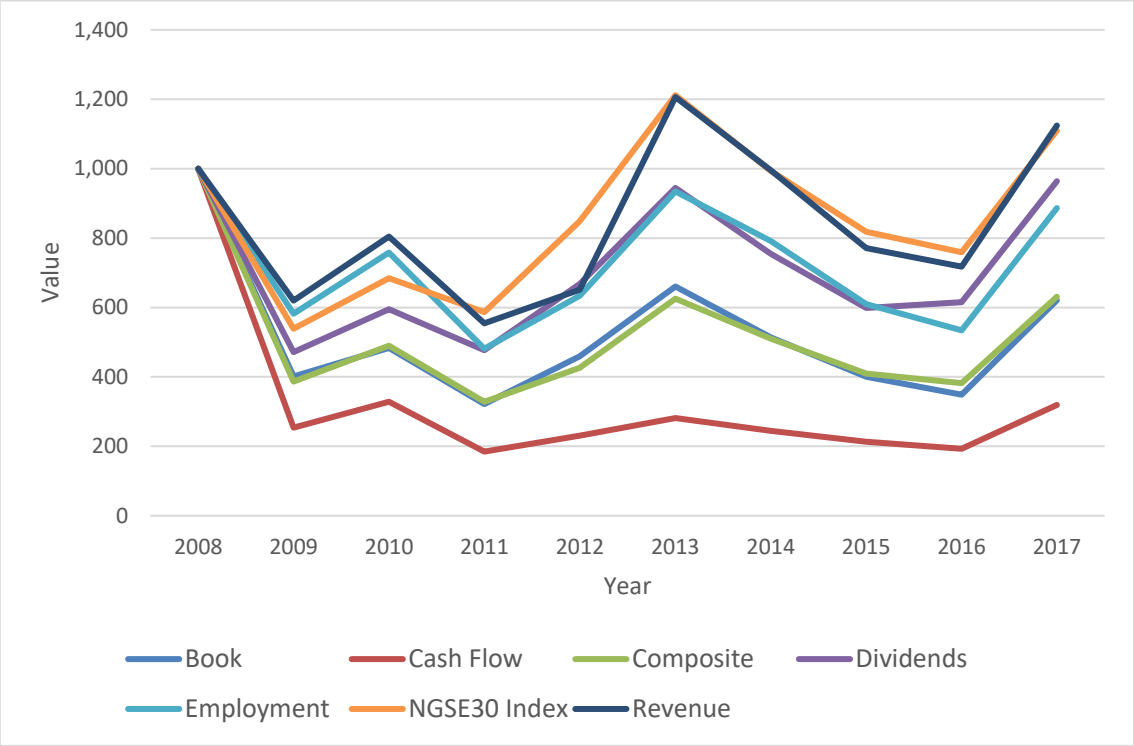


Figure 4.7: Nigeria return comparison between fundamental indices and cap-weighted benchmark

It is observed from the return comparison graph in figure 4.7 above that the Revenue fundamental index outperformed the cap-weighted NGSE30 index at the end of 2017. The cap-weighted NGSE30 index however outperformed all other fundamental indices including the Composite index. The Revenue index ended the period with a value of ₦ 1,124.62. The Composite index ended the period with only ₦ 630.92 compared to the NGSE30 index with ₦ 1,109.73.

The Revenue index has a total return of 12.46%. The Composite index managed to deliver a total return of -36.91% compared to the NGSE30 index which has a total return of 10.97%.

The annual return results for the fundamental indices and cap-weighted NGSE30 index benchmark are graphed in figure 4.8 below.

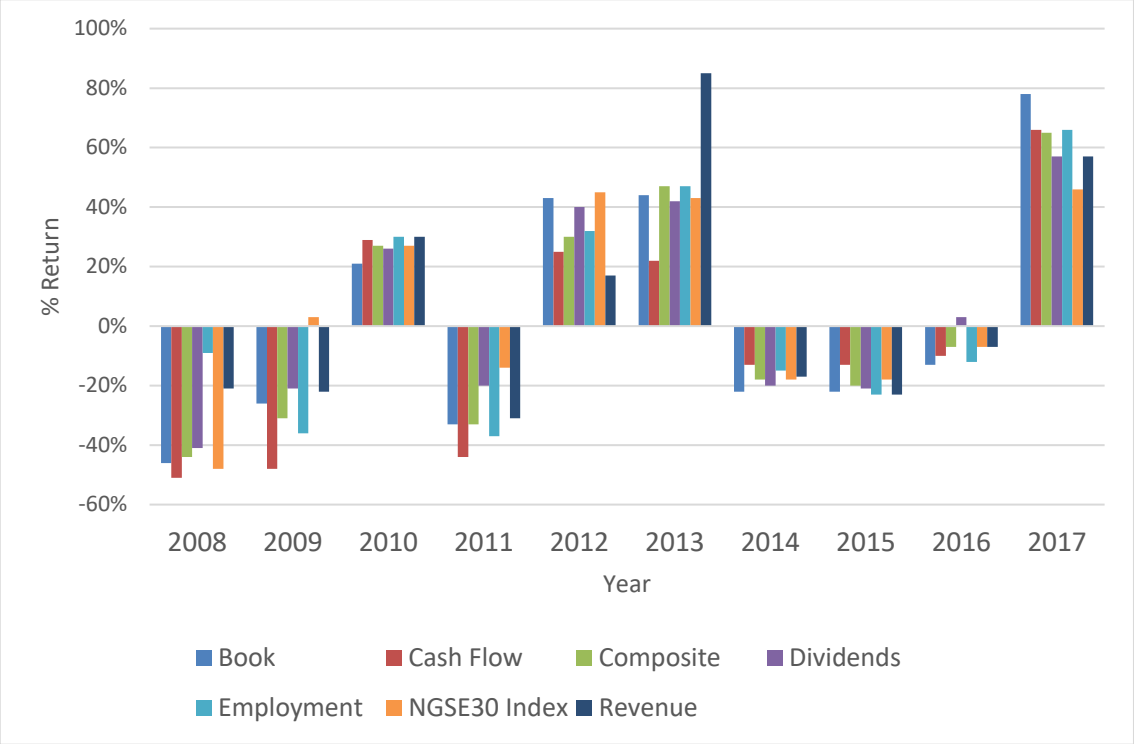


Figure 4.8: Nigeria annual return comparison between fundamental indices and cap-weighted benchmark

From figure 4.8 above it is observed that the cap-weighted NGSE30 index performed relatively poorly during the 2008 downturn but subsequently outperformed in 2009. The performance surrounding 2009 requires some explanation. In 2009 the cap-weighted benchmark showed positive performance while all fundamental indices showed negative performance. This can be attributed to the fundamental indices being heavily weighted towards the financial sector, the Cash Flow index had a 92.9% weighting towards the financial sector. Reckless lending initiated Nigeria's banking crisis resulted in a weighted loss of 48.81% for the financial constituents of the Cash Flow index.

The annual excess returns for the fundamental indices are graphed in figure 4.9 below using the cap-weighted NGSE30 index benchmark as a reference point.

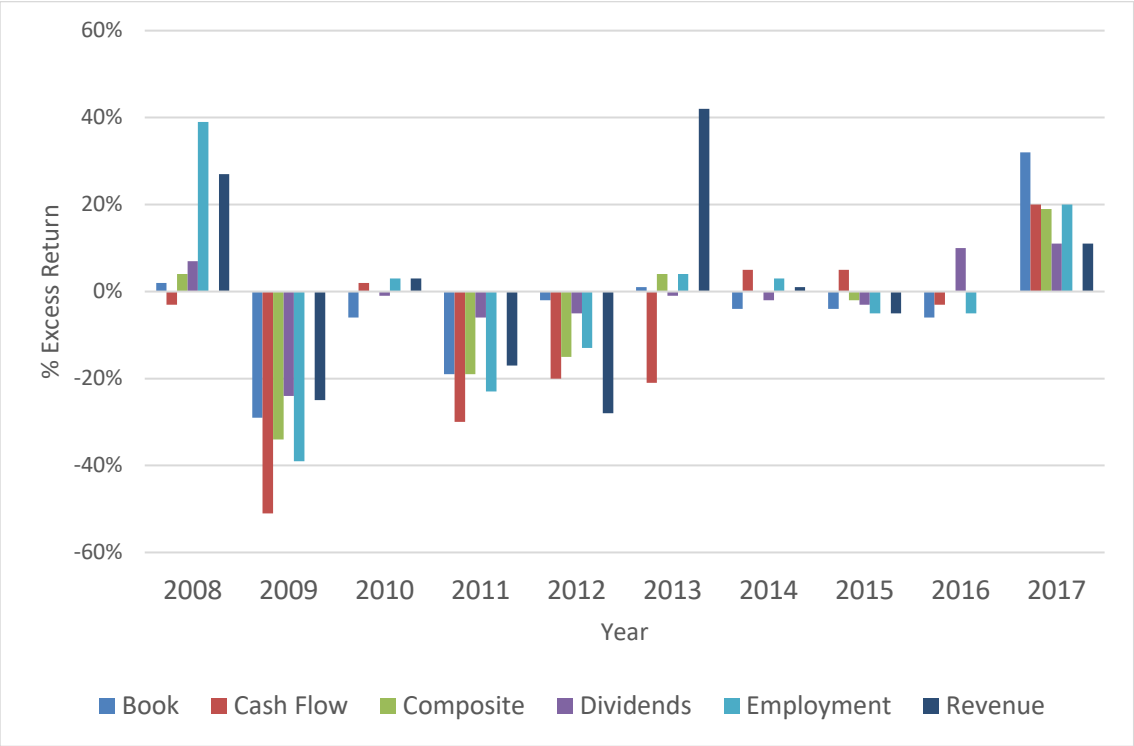


Figure 4.9: Nigeria excess return per year relative to the cap-weighted benchmark

From figure 4.9 above it is observed that the cap-weighted NGSE30 benchmark outperformed all fundamental indices in 3 out of the 10 years. All fundamental indices outperformed the cap-weighted NGSE30 index only once over the 10 years. The Revenue index outperformed all other indices in 2013 with the closest index being the Composite index. The majority of the fundamental index outperformance is concentrated in 2017. The Composite index, however, underperformed the NGSE30 index in 2009, 2011, 2012 and 2015.

4.1.4 *Nairobi Securities Exchange*

The return performance results for the fundamental indices and cap-weighted NSE20 index benchmark are graphed in figure 4.10 below.

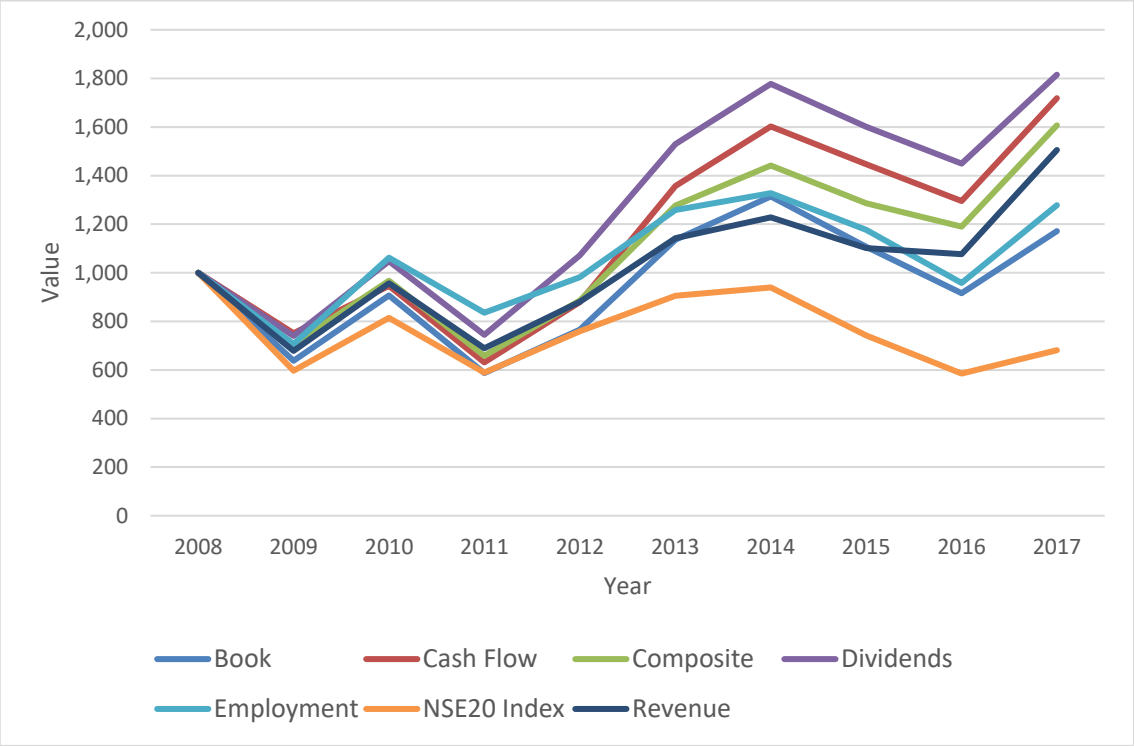


Figure 4.10: Kenya return comparison between fundamental indices and cap-weighted benchmark

It is observed from the return comparison graph in figure 4.10 above that the all fundamental indices outperformed the cap-weighted NSE20 index at the end of 2017. The Dividend index performed the best and ended the period with a value of 1,815.23 shilling. The Composite index ended the period with 1,606.87 shilling compared to 681.74 shilling for the NSE20 index.

The Cash Flow index also performed relatively well with an ending value of 1,718.69 shilling. The Dividend index has a total return of 81.52%, the Composite index has a total return of 60.69% and the EGX30 index has a total return of -31.83%.

The results of the annual return for the fundamental indices and cap-weighted NSE20 index benchmark are graphed in figure 4.11 below.

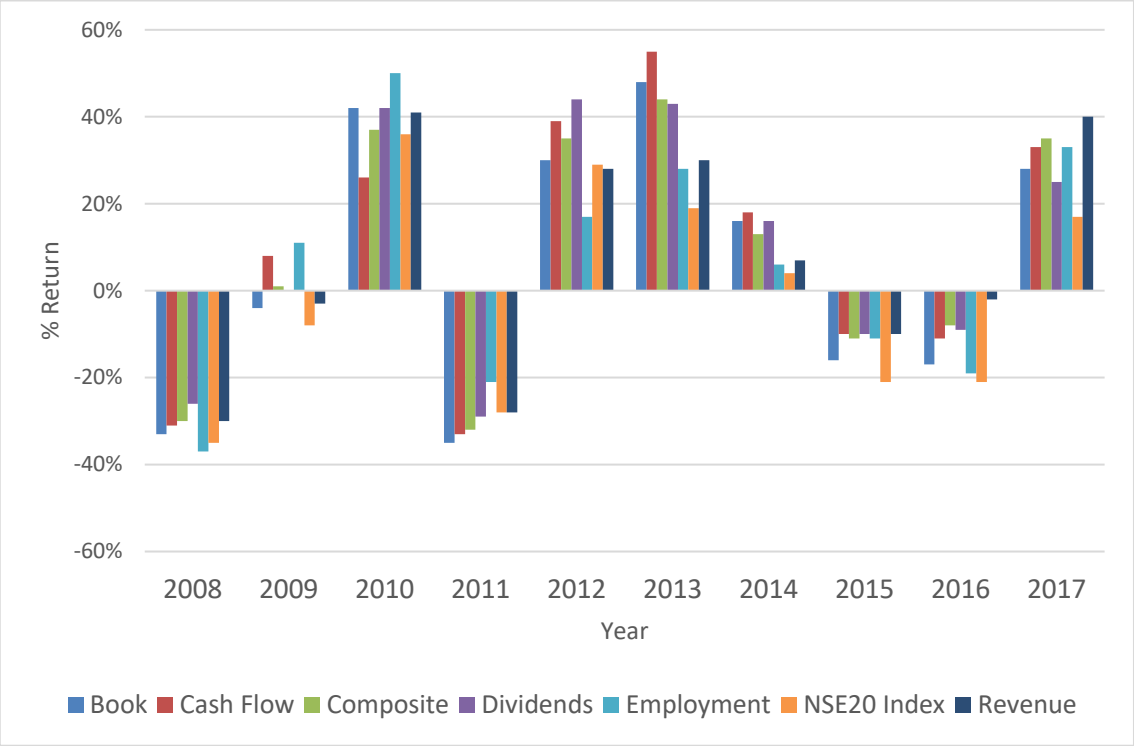


Figure 4.11: Kenya annual return comparison between fundamental indices and cap-weighted benchmark

From figure 4.11 above it is observed that during the 2008 downturn the Composite index and NSE20 index suffered losses of 30% and 35% respectively. The Composite index subsequently achieved a positive return in 2009 with 1% while the NSE20 index delivered a negative return of 8%. The NSE20 index underperformed all other indices in 2009, 2013, 2014, 2015, 2016 and 2017.

The annual excess returns for the fundamental indices are graphed in figure 4.12 below using the cap-weighted NSE20 index benchmark as a reference point.

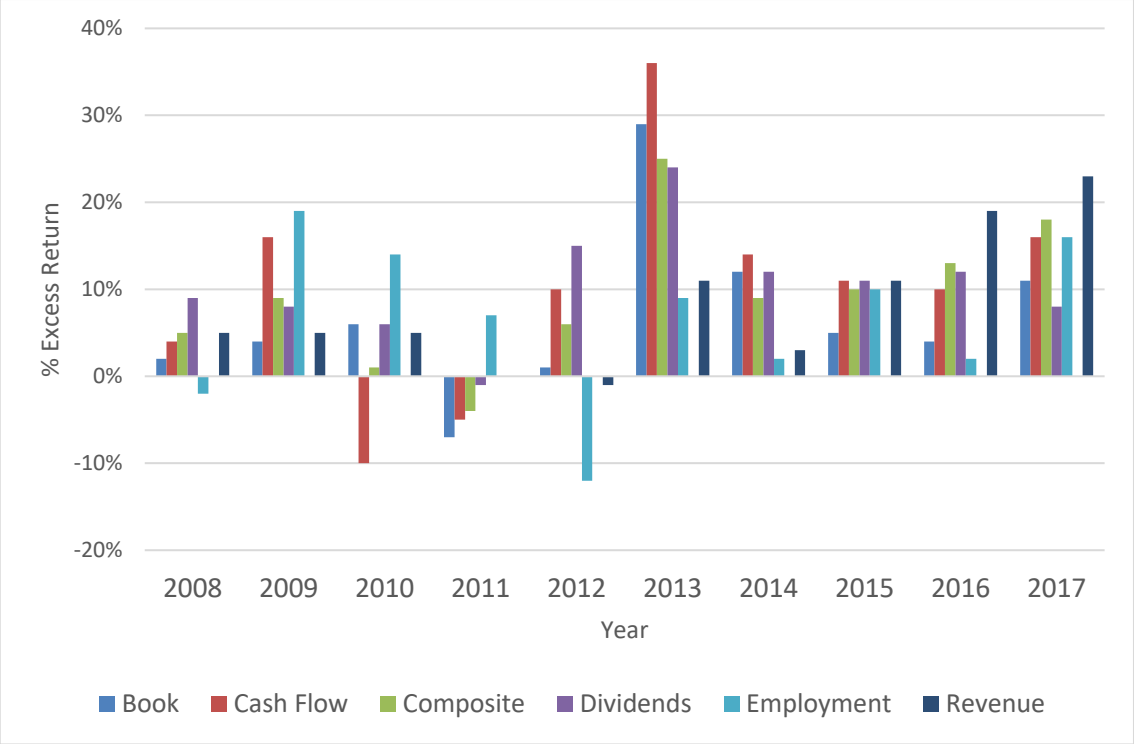


Figure 4.12: Kenya excess return per year relative to the cap-weighted benchmark

From figure 4.12 above it is observed that the cap-weighted NSE20 benchmark never outperformed all fundamental indices. All fundamental indices outperformed the cap-weighted NSE20 index in 6 out of the 10 years. The outperformance mostly occurred from 2013 onwards. The Composite index only underperformed the NSE20 once during the 10-year period, in 2011.

4.1.5 *Stock Exchange of Mauritius*

The return performance results for the fundamental indices and cap-weighted SEM10 index benchmark are graphed in figure 4.13 below.

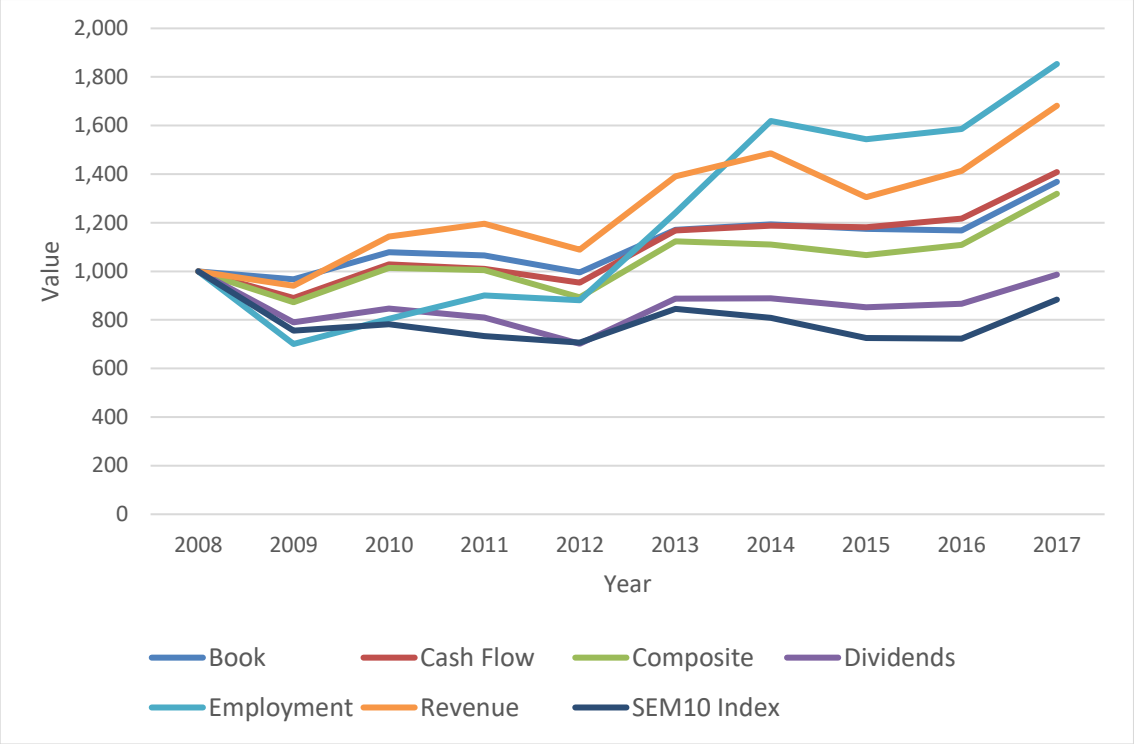


Figure 4.13: Mauritius return comparison between fundamental indices and cap-weighted benchmark

It is observed from the return comparison graph in figure 4.13 above that the all fundamental indices outperformed the cap-weighted SEM10 index at the end of 2017. The Employment index performed the best and ended the period with a value of Rs 1,853.44. The Composite index ended the period with Rs 1,319.30 compared to Rs 883.64 for the SEM10 index.

The Revenue index also performed relatively well with an ending value of Rs 1,681.66. The Employment index has a total return of 85.34%, the Revenue index has a total return of 68.17%, the Composite index has a total return of 31.93% and the SEM10 index has a total return of -11.64%.

The results of the annual return for the fundamental indices and cap-weighted SEM10 index benchmark are graphed in figure 4.14 below.

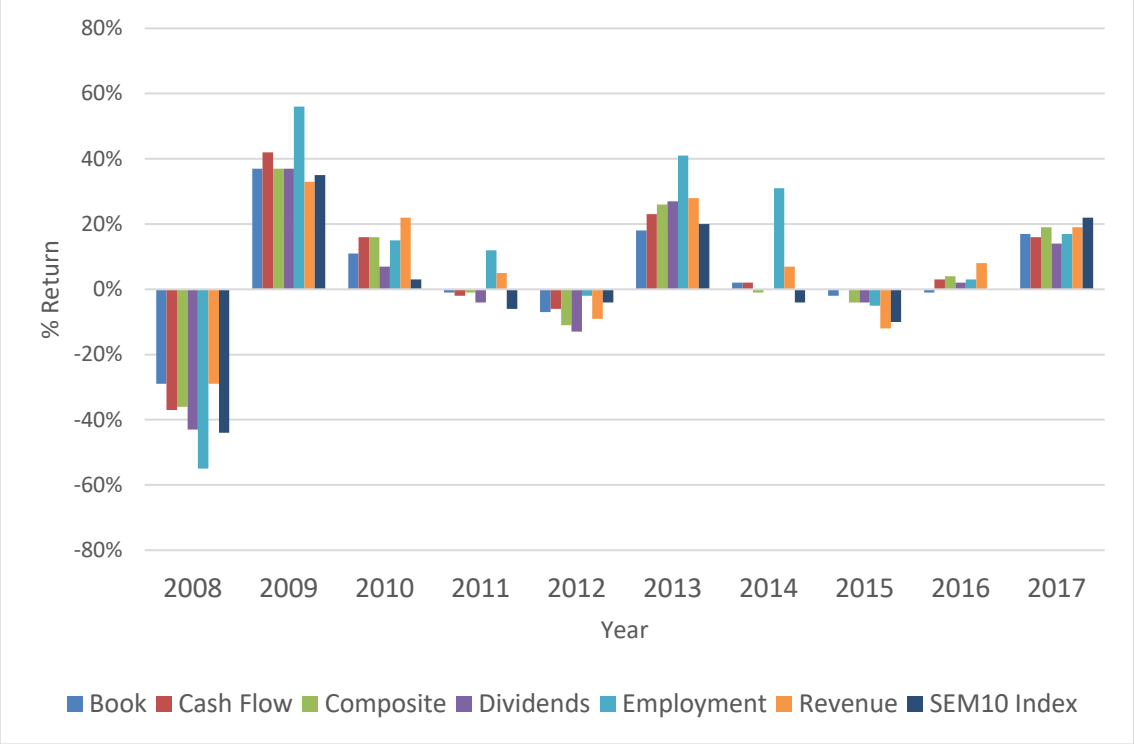


Figure 4.14: Mauritius annual return comparison between fundamental indices and cap-weighted benchmark

From figure 4.14 above it is observed that during the 2008 downturn the SEM10 index and Employment index suffered the largest losses. The Employment index subsequently outperformed in 2009 with 56% while the SEM10 index delivered a return of 33%. The Employment index outperformed all other indices in 2009, 2011, 2013 and 2014.

The annual excess returns for the fundamental indices are graphed in figure 4.15 below using the cap-weighted SEM10 index benchmark as a reference point.

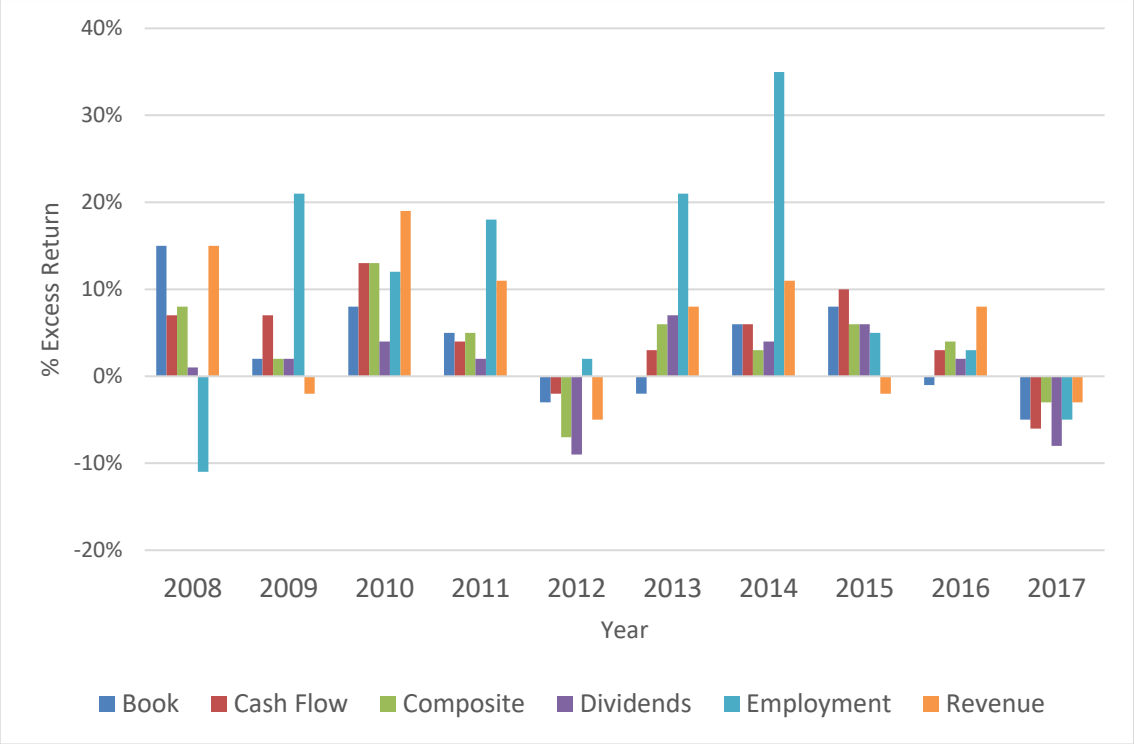


Figure 4.15: Mauritius excess return per year relative to the cap-weighted benchmark

From figure 4.15 above it is observed that the cap-weighted SEM10 benchmark outperformed all fundamental indices only once during the 10-year period, in 2017. All fundamental indices outperformed the cap-weighted SEM10 index only three times over the 10-year time span being 2010, 2011 and 2014. The Employment index outperformed all other indices in 2009, 2011, 2012 2013, and 2014. The Composite index outperformed the EGX30 index benchmark 8 out of the 10 years, the only two years of underperformance occurred in 2012 and 2017.

4.2 Risk

Risk analyses are performed to test the first sub-problem statement being:

The first sub-problem is whether fundamental indices outperform cap-weighted indices on a risk-adjusted basis in the SA, Egyptian, Nigerian, Kenyan and Mauritian emerging markets over a 10-year period.

Descriptive statistics are generated to determine the average return, geometric return, minimum return, maximum return, standard deviation, kurtosis and skewness of each index. The average returns, standard deviation and beta are used to calculate the Jensen's alpha, Sharpe ratio and Treynor ratio for each index.

The geometric return is the average of a set of products and is used to determine the performance of the investment portfolio. The standard deviation is used to quantify the amount of variability of the returns and is a measure of total risk. Portfolio beta measures the volatility of the portfolio against that of the market as a whole and is a measure of systematic risk only. Jensen's alpha is used to determine the excess return of the portfolio over the expected return as calculated using the CAPM and beta. The Sharpe ratio measures the average return in excess of the risk-free rate per unit of total risk using the standard deviation. The Treynor ratio measures the average return in excess of the risk-free rate per unit of systematic risk using the portfolios beta.

4.2.1 *JSE*

The risk and performance characteristics for the fundamental indices and cap-weighted TOP40 index benchmark can be seen in table 4.1 below.

Table 4.1: SA risk and performance characteristics for fundamental indices and cap-weighted benchmark

Index	*Geometric Return*	*Min*	*Max*	*SD*	*Beta*	*Jensen Alpha*	*Sharpe Ratio*	*Treynor Ratio*
TOP40 Index	7.20%	-26%	29%	16%	0.64	-0.047	0.007	0.002
Composite	6.29%	-29%	40%	19%	0.84	-0.067	-0.014	-0.003
Dividend	6.04%	-29%	26%	16%	0.83	-0.073	-0.060	-0.012
Revenue	8.07%	-29%	62%	26%	0.79	-0.034	0.101	0.033
Book	5.49%	-27%	33%	17%	0.85	-0.080	-0.088	-0.017
Employment	6.58%	-27%	41%	19%	0.91	-0.070	-0.004	-0.001
Cash Flow	6.15%	-32%	31%	19%	0.85	-0.070	-0.026	-0.006

Looking at the results in table 4.1 above the geometric return for the fundamental Revenue index is the highest with the second highest being the cap-weighted TOP40 index. The Composite index delivered a geometric return of 6.29% annually. The Revenue index, therefore, outperformed the TOP40 index by 0.87% annually. The TOP40 index outperformed the Composite index by 0.91% annually. The TOP40 index has the lowest standard deviation followed by the Dividend index. The Revenue index has the highest standard deviation. The TOP40 index also has the lowest beta followed by the Revenue index. Not one of the indices manage to return a positive Jensen's alpha, the Revenue index exhibited the highest Jensen's alpha. The Revenue index also exhibited the highest Sharpe and Treynor ratios. The TOP40 index outperformed the Composite index in all three of the return per unit of risk measures.

4.2.2 *Egyptian Exchange*

The risk and performance characteristics for the fundamental indices and cap-weighted EGX30 index benchmark can be seen in table 4.2 below.

Table 4.2: Egypt risk and performance characteristics for fundamental indices and cap-weighted benchmark

Index	*Geometric Return*	*Min*	*Max*	*SD*	*Beta*	*Jensen Alpha*	*Sharpe Ratio*	*Treynor Ratio*
EGX30 Index	3.73%	-56%	76%	43%	1.13	-0.124	0.042	0.016
Composite	5.32%	-44%	62%	36%	0.71	-0.088	0.006	0.003
Dividend	3.71%	**-27%**	35%	**23%**	**0.60**	-0.124	-0.214	-0.082
Revenue	6.44%	-44%	67%	39%	0.79	-0.077	0.056	0.028
Book	4.63%	-56%	60%	40%	0.80	-0.083	0.045	0.022
Employment	**9.61%**	-54%	**154%**	58%	0.75	**0.006**	**0.173**	**0.133**
Cash Flow	4.94%	-43%	67%	36%	0.64	-0.086	-0.014	-0.008

Looking at the results in table 4.2 above the geometric return for the fundamental Employment index is the highest at 9.61% with the second highest being the Revenue index at 6.44%. The Composite index has a geometric return of 5.32% while the EGX30 index has a geometric return of only 3.73%. The Composite index, therefore, outperformed the EGX30 index by 1.59% annually. The Dividend index has the lowest standard deviation followed by the Cash Flow index. The Employment index has the highest standard deviation. The EGX30 index has the highest beta followed by the Book index. The Dividend index has the lowest beta. Only one of the indices manage to return a positive Jensen's alpha, the Employment index exhibited the highest Jensen's alpha. The

Employment index also exhibited the highest Sharpe and Treynor ratios. The EGX30 index outperformed the Composite index in two of the return per unit of risk measures being the Sharpe and Treynor ratios.

4.2.3 *Nigerian Stock Exchange*

The risk and performance characteristics for the fundamental indices and cap-weighted NGSE30 index benchmark can be seen in table 4.3 below.

Table 4.3: Nigeria risk and performance characteristics for fundamental indices and cap-weighted benchmark

Index	***Geometric Return***	***Min***	***Max***	***SD***	***Beta***	***Jensen Alpha***	***Sharpe Ratio***	***Treynor Ratio***
NGSE30 Index	1.03**%**	-48%	46%	**33%**	**0.53**	**-0.127**	-0.206	-0.127
Composite	-4.48%	-44%	65%	38%	1.25	-0.252	-0.292	-0.088
Dividend	-0.46%	-41%	57%	34%	1.12	-0.209	-0.238	-0.073
Revenue	**1.11%**	**-31%**	**85%**	39%	1.10	-0.184	**-0.148**	**-0.053**
Book	-4.54%	-46%	78%	41%	1.16	-0.235	-0.248	-0.088
Employment	-1.22%	-37%	66%	36%	1.12	-0.211	-0.228	-0.074
Cash Flow	-10.84%	-51%	66%	39%	1.52	-0.336	-0.422	-0.108

Looking at the results in table 4.3 above the geometric return for the fundamental Revenue index is the highest at 1.11% with the second highest being the cap-weighted NGSE30 index at 1.03%. The Revenue index, therefore, outperformed the NGSE30 index by 0.08% annually. The Composite index delivered a geometric return of -4.48% annually. The NGSE30 index, therefore, outperformed the Composite index by 5.51% annually. The NGSE30 index has

the lowest standard deviation followed by the Dividend index. The Book index has the highest standard deviation and the NGSE30 has the lowest standard deviation. The NGSE30 index also has the lowest beta at 0.53 followed by the Revenue index at 1.10. Not one of the indices manage to return a positive alpha, the NGSE30 index exhibited the highest Jensen's alpha. The Revenue index exhibited the highest Sharpe and Treynor ratios. The NGSE30 index outperformed the Composite index in two of the return per unit of risk measures being the Jensen's alpha and Sharpe ratio.

4.2.4 *Nairobi Securities Exchange*

The risk and performance characteristics for the fundamental indices and cap-weighted NSE20 index benchmark can be seen in table 4.4 below.

Table 4.4: Kenya risk and performance characteristics for fundamental indices and cap-weighted benchmark

Index	*Geometric Return*	*Min*	*Max*	*SD*	*Beta*	*Jensen Alpha*	*Sharpe Ratio*	*Treynor Ratio*
NSE20 Index	-3.75%	-35%	36%	**25%**	**0.44**	-0.175	-0.515	-0.298
Composite	4.81**%**	-32%	44%	29%	1.00	-0.141	-0.134	-0.038
Dividend	**6.20%**	**-29%**	44%	28%	0.96	**-0.124**	**-0.092**	**-0.027**
Revenue	4.25%	-30%	41%	26%	0.88	-0.139	-0.186	-0.056
Book	1.69%	-35%	48%	31%	1.09	-0.175	-0.205	-0.058
Employment	2.35%	-37%	50%	27%	1.03	-0.170	-0.237	-0.064
Cash Flow	5.47%	-33%	**55%**	30%	1.04	-0.135	-0.094	-0.027

Looking at the results in table 4.4 above the geometric return for the fundamental Dividend index is the highest at 6.20% with the second highest being the Cash Flow index at 5.47%. The Composite index has a geometric return of 4.81% while the NSE20 index has a geometric return of -3.75%. The NSE20 index has the lowest standard deviation followed by the Revenue index. The Book index has the highest standard deviation. The NSE20 index has the lowest beta followed by the Revenue index. The Book index has the highest beta. Not one of the indices manage to return a positive alpha, the Dividend index exhibited the highest Jensen's alpha. The Dividend index also exhibited the highest Sharpe and Treynor ratios. The Composite index outperformed the NSE20 index in all three of the return per unit of risk measures.

4.2.5 *Stock Exchange of Mauritius*

The risk and performance characteristics for the fundamental indices and cap-weighted SEM10 index benchmark can be seen in table 4.5 below.

Table 4.5: Mauritius risk and performance characteristics for fundamental indices and cap-weighted benchmark

Index	*Geometric Return*	*Min*	*Max*	*SD*	*Beta*	*Jensen Alpha*	*Sharpe Ratio*	*Treynor Ratio*
SEM10 Index	-1.17%	-44%	35%	22%	1.00	-0.104	-0.162	-0.035
Composite	2.88%	-36%	37%	21%	0.82	-0.055	0.009	0.002
Dividend	-0.11%	-43%	37%	22%	0.78	-0.078	-0.110	-0.031
Revenue	5.48%	-29%	33%	19%	0.98	-0.043	0.128	0.025
Book	3.11%	**-29%**	37%	**18%**	**0.60**	-0.043	-0.012	-0.004
Employment	**6.48%**	-55%	**56%**	30%	1.02	**-0.005**	**0.218**	**0.065**
Cash Flow	3.66%	-37%	42%	21%	0.95	-0.056	0.048	0.010

Looking at the results in table 4.5 above the geometric return for the fundamental Employment index is the highest at 6.48% with the second highest being the Revenue index at 5.48%. The Composite index has a geometric return of 2.88% while the SEM10 index has a geometric return of -1.17%. The Book index has the lowest standard deviation followed by the Revenue index. The Employment index has the highest standard deviation. The Book index has the lowest standard deviation. The Employment index has the highest beta followed by the SEM10 index. The Book index has the lowest beta. Not one of the indices manage to return a positive alpha, the Employment index exhibited the highest Jensen's alpha. The Employment index also exhibited the highest Sharpe and Treynor ratios. The Composite index outperformed the SEM10 index in all three of the return per unit of risk measures.

4.3 Correlation

Correlation analyses are performed, correlation matrices are tabled and the results are interpreted to test the second sub-problem statement being:

The second sub-problem is to identify the fundamental factors that contribute most to the excess returns exhibited by the composite fundamental index in each market.

Single factor fundamental indices are used in each market to perform correlation testing against the composite fundamental index in an attempt to identify which fundamental measures contribute most to excess returns.

4.3.1 *JSE*

The correlation coefficients between fundamental indices can be seen in table 4.6 below.

Table 4.6: SA index correlation matrix

	Composite	***Book***	***Dividends***	***Employment***	***Revenue***	***CashFlow***
Composite	1					
Book	**0.98**	1				
Dividends	0.96	0.94	1			
Employment	0.92	0.92	0.86	1		
Revenue	0.96	0.91	0.86	0.89	1	
CashFlow	0.98	0.97	0.97	0.91	0.91	1

Looking at the correlation matrix in table 4.6 above the returns of the Book index show a strong positive correlated to the Composite index. The Cash Flow index

has the second highest correlation with the Composite index followed by the Dividend and Revenue indices. Finally, the Employment index exhibits the weakest correlation to the Composite index.

4.3.2 *Egyptian Exchange*

The correlation coefficients between fundamental indices can be seen in table 4.7 below.

Table 4.7: Egypt index correlation matrix

	Composite	***Book***	***Dividends***	***Employment***	***Revenue***	***CashFlow***
Composite	1					
Book	0.97	1				
Dividends	0.94	0.90	1			
Employment	0.87	0.86	0.87	1		
Revenue	**0.99**	0.95	0.92	0.87	1	
CashFlow	0.98	0.93	0.89	0.84	0.96	1

Looking at the correlation matrix in table 4.7 above the returns of the Revenue index show a strong positive correlated to the Composite index. The Cash Flow index has the second highest correlation with the Composite index followed by the Book and Dividend indices. Finally, the Employment index exhibits the weakest correlation to the Composite index.

4.3.3 *Nigerian Stock Exchange*

The correlation coefficients between fundamental indices can be seen in table 4.8 below.

Table 4.8: Nigeria index correlation matrix

	Composite	*Book*	*Dividends*	*Employment*	*Revenue*	*CashFlow*
Composite	1					
Book	**0.98**	1				
Dividends	0.98	0.97	1			
Employment	0.91	0.90	0.88	1		
Revenue	0.94	0.90	0.91	0.92	1	
CashFlow	0.96	0.94	0.92	0.85	0.84	1

Looking at the correlation matrix in table 4.8 above the returns of the Book index show a strong positive correlated to the Composite index. The Dividend index has the second highest correlation with the Composite index followed by the Cash Flow and Revenue indices. Finally, the Employment index exhibits the weakest correlation to the Composite index.

4.3.4 *Nairobi Securities Exchange*

The correlation coefficients between fundamental indices can be seen in table 4.9 below.

Table 4.9: Kenya index correlation matrix

	Composite	*Book*	*Dividends*	*Employment*	*Revenue*	*CashFlow*
Composite	1					
Book	0.98	1				
Dividends	0.98	0.97	1			
Employment	0.89	0.88	0.86	1		
Revenue	0.95	0.90	0.89	0.85	1	
CashFlow	**0.99**	0.97	0.97	0.89	0.90	1

Looking at the correlation matrix in table 4.9 above the returns of the Cash Flow index shows a strong positive correlated to the Composite index. The Book index has the second highest correlation with the Composite index followed by the Dividend and Revenue indices. Finally, the Employment index exhibits the weakest correlation to the Composite index.

4.3.5 *Stock Exchange of Mauritius*

The correlation coefficients between fundamental indices can be seen in table 4.10 below.

Table 4.10: Mauritius index correlation matrix

	Composite	*Book*	*Dividends*	*Employment*	*Revenue*	*CashFlow*
Composite	1					
Book	0.93	1				
Dividends	0.93	0.80	1			
Employment	0.69	0.68	0.63	1		
Revenue	0.93	0.85	0.83	0.79	1	
CashFlow	**0.97**	0.94	0.84	0.68	0.89	1

Looking at the correlation matrix in table 4.10 above the returns of the Cash Flow index has a strong positive correlated to the Composite index. The Revenue index has the second highest correlation with the Composite index followed by the Dividend and Book indices. Finally, the Employment index exhibits the weakest correlation to the Composite index.

4.4 Summary of the Results

On the JSE, the Revenue index outperformed all indices with a geometric return of 8.07%, it outperformed the cap-weighted TOP40 index benchmark by 1.78% annually. The TOP40 index outperformed the Composite index by 0.91% annually. The fundamental Revenue index has the highest Jensen's alpha, Sharpe ratio and Treynor ratio. The TOP40 index outperformed the Composite index in all three of the return per unit of risk measures. Finally, Book Value exhibited the strongest correlation with the Composite index.

On the Egyptian Exchange, the Employment index outperformed all indices with a geometric return of 9.61%, it outperformed the cap-weighted EGX30 index

benchmark by 5.88% annually. The Composite index outperformed the EGX30 cap-weighted index by 1.59% annually. The fundamental Employment index has the highest Jensen's alpha, Sharpe ratio and Treynor ratio. The EGX30 index outperformed the Composite index in two of the three return per unit of risk measures being the Sharpe and Treynor ratios. Revenue exhibited the strongest correlation with the Composite index.

On the Nigerian Stock Exchange, the Revenue index outperformed all indices with a geometric return of 1.11%, it outperformed the cap-weighted NGSE30 index benchmark by 0.08% annually. The NGSE30 index outperformed the Composite index by 5.51% annually. The fundamental Revenue index has the highest Sharpe and Treynor ratios. The NGSE30 index has the highest Jensen's alpha. Book Value exhibited the strongest correlation with the Composite index.

On the Nairobi Securities Exchange, the Dividend index outperformed all indices with a geometric return of 6.20%, it outperformed the cap-weighted NSE20 index benchmark by 9.95% annually. The Composite index outperformed the NSE20 cap-weighted index by 8.56% annually. The fundamental Dividend index has the highest Jensen's alpha, Sharpe ratio and Treynor ratio. The Composite index outperformed the NSE20 index in all three of the return per unit of risk measures. Finally, Cash Flow exhibited the strongest correlation with the Composite index.

On the Stock Exchange of Mauritius, the Employment index outperformed all indices with a geometric return of 6.48%, it outperformed the cap-weighted SEM10 index benchmark by 7.65% annually. The Composite index outperformed the SEM10 cap-weighted index by 4.05% annually. The fundamental Employment index has the highest Jensen's alpha, Sharpe ratio and Treynor

ratio. The Composite index outperformed the Employment index in all three of the return per unit of risk measures. Finally, Cash Flow exhibited the strongest correlation with the Composite index.

5 DISCUSSION OF THE RESULTS

Below I discuss the results of this study and position the results in relation to the literature. The discussions are grouped according to each hypothesis and specify how the results provide support for or against each hypothesis.

5.1 Discussions surrounding Hypothesis H1

The first hypothesis being discussed is Hypothesis H1, the hypothesis is as follows:

Fundamental indices outperform cap-weighted indices in African emerging markets.

Here we consider returns only, the risk undertaken to reach the returns are not considered. From the results, it is observed that in each market a fundamental index outperformed the cap-weighted benchmark.

On the JSE the fundamental Revenue index outperformed the cap-weighted TOP40. On the Egyptian Exchange, the fundamental Employment index outperformed the cap-weighted EGX30. On the Nigerian Stock Exchange, the fundamental Revenue index outperformed the cap-weighted NGSE30. On the Nairobi Securities Exchange, the fundamental Dividend index outperformed the cap-weighted NSE30. Finally, on the Stock Exchange of Mauritius, the fundamental Employment index outperformed the cap-weighted SEM10.

These findings provide support for Hypothesis H1 and align with the empirical findings produced by Arnott et al. (2005). These findings also align with those of Walkshäusl and Lobe (2010) and J. C. Hsu and Campollo (2010) who performed

broad studies that stretched internationally covering developed and emerging markets and established that fundamental indices outperform cap-weighted indices in most settings.

J. Hsu (2014) discussed the sources of excess returns of fundamental indices and showed that non-price weighted indices have meaningful exposure to the value premium and effectively capture any excess returns as they rebalance against long-horizon mean revision.

This is consistent with Balatti et al. (2017), Jun and Malkiel (2008) who stated that fundamental indices overweight value shares and underweight growth shares. This will lead to an index that consists of smaller-capitalisation shares relative to cap-weighted indices, smaller-capitalisation shares are shown to earn excess returns.

This is also consistent with Rensburg and Robertson (2003), Strugnell et al. (2011) and Hoffman (2012) who found that smaller companies deliver excess returns in comparison to larger companies over the long term.

Considering the results and empirical evidence supporting the findings it can be concluded that fundamental indices outperformed cap-weighted indices in African emerging markets when disregarding risk. The outperformance can be attributed to dynamic shifts in weight and sector as well as exposure to size and value factors.

5.2 Discussions surrounding Hypothesis H2

The second hypothesis being discussed is Hypothesis H2, the hypothesis is as follows:

Fundamental indices exhibit greater excess returns in African emerging markets. Excess returns are defined as average outperform of more than 2% annually.

Here we consider excess returns only, we do not consider the risk undertaken to reach the excess returns. From the results, it is observed that not all markets exhibited excess returns greater than 2%.

On the JSE, the fundamental Revenue index outperformed the cap-weighted TOP40 by only 1.78% annually. On the Nigerian Stock Exchange, the fundamental Revenue index outperformed the cap-weighted NGSE30 by only 0.08% annually. Therefore, fundamental indices on the JSE and Nigerian Stock Exchange did not exhibit excess returns greater than 2%.

On the Egyptian Exchange, the fundamental Employment index outperformed the cap-weighted EGX30 by 5.88% annually. On the Nairobi Securities Exchange, the fundamental Dividend index outperformed the cap-weighted NSE30 by 9.95% annually. On the Stock Exchange of Mauritius, the fundamental Employment index outperformed the cap-weighted SEM10 by 7.65% annually. Therefore, some fundamental indices on the Egyptian Exchange, Nairobi Securities Exchange and Stock Exchange of Mauritius did exhibit excess returns greater than 2%.

These findings provide mixed support for Hypothesis H2 and mixed support for Jun and Malkiel (2008) who claims that fundamental indices show even greater excess returns in emerging markets where financial markets are considered to be less efficient.

The discovery of excess returns on the JSE of 1.78% annually aligns with some studies performed in other developed markets. Arnott et al. (2005) and J. C. Hsu and Campollo (2010) performed studies on U.S. shares and found that fundamental indexation delivered annual outperformance of approximately 1.97% annually. Hemminki and Puttonen (2008) found that a European market based fundamental index outperformed the DJ Euro Stoxx 50 by 1.76% annually.

The large annual excess returns exhibited by the Egyptian Exchange (5.88%), Nairobi Securities Exchange (9.95%) and Stock Exchange of Mauritius (7.65%) do not align with studies performed in developed markets. The outperformance in developed markets is much smaller. Basu and Forbes (2014) performed a study in Australia and found annual outperformance of 3.50% annually. Balatti et al. (2017) and J. C. Hsu and Campollo (2010) found that a UK based fundamental index outperformed the cap-weighted FTSE 100 by between 2.39% and 3.59% annually over 25-years.

The excess returns observed on the JSE and Egyptian Exchange align closely with Walkshäusl and Lobe (2010) who found outperformance of 1.81% and 5.75% respectively.

Considering the results and empirical evidence it would appear that not all fundamental indices exhibit greater excess returns in African emerging markets.

Three of the markets, however, do exhibit higher excess returns than those observed in developed markets.

5.3 Discussions surrounding Hypothesis H3

The third hypothesis being discussed is Hypothesis H3, the hypothesis is as follows:

Fundamental indices outperform cap-weighted indices in African emerging markets when accounting for risk.

Here we consider the performance and risk undertaken to reach the performance. A combination of the Jensen's alpha, Sharpe ratio and Treynor ratio are used to measure return per unit of risk. From the results, it is observed that in each of the markets a fundamental index outperformed the cap-weighted benchmark on a risk-adjusted basis.

On the JSE the fundamental Revenue index outperformed the cap-weighted TOP40 in all three of the return per unit of risk measures. On the Egyptian Exchange, the fundamental Employment index outperformed the cap-weighted EGX30 in all three of the return per unit of risk measures. On the Nairobi Securities Exchange, the fundamental Dividend index outperformed the cap-weighted NSE30 in all three of the return per unit of risk measures. On the Stock Exchange of Mauritius, the fundamental Employment index outperformed the cap-weighted SEM10 in all three of the return per unit of risk measures.

On the Nigerian Stock Exchange, the fundamental Revenue index outperformed the cap-weighted NGSE30 in two of the three return per unit of risk measures

being the Sharpe and Treynor ratios. The cap-weighted NGSE30 has the highest Jensen's alpha.

These results provide support for Hypothesis H2 and for authors such as Broby and Lochhead (2013) who recommends that equal or fundamental indices should be used in African equity markets as they provide optimal risk/reward exposure.

These results align with the empirical findings produced by Arnott et al. (2005) and Estrada (2006) who stated that fundamental indices have higher Sharpe ratios compared to cap-weighted indices.

This is consistent with findings from Arnott et al. (2005), J. C. Hsu (2006), J. C. Hsu and Campollo (2010) and Arnott et al. (2005) who found that fundamental indices achieved higher risk-adjusted returns.

This is also consistent with Houwer and Plantinga (2009), Walkshäusl and Lobe (2010) and Balatti et al. (2017) who found that the excess return generated by fundamental indices could not be exclusively attributed to value, size or other risk factors. The additional excess returns were attributed to dynamic shifts in weight and sectors within indices.

Finally, Riepe and Werner (1998) also found that index composition tilts introduced by fundamental measures improve mean-variance efficiency, this results in better returns for comparable levels of risk.

Considering the results and empirical evidence supporting the findings it can be concluded that fundamental indices outperformed cap-weighted indices in African emerging markets when accounting for risk. The higher risk-adjusted returns are consistent with other studies performed in developed markets.

5.4 Discussions surrounding factors contributing to returns

The monthly performance of fundamental indices are used in each market to perform correlations in an attempt to identify which fundamental measures contribute most to excess returns. When looking at the correlations it is also useful to consider the performance of these single-factor fundamental indices and how their performance together with their correlation influenced the performance of the composite fundamental index. The Employment index is not considered in this discussion because it was not used in the construction of the composite fundamental indices.

From the performance results, it is observed that two composite fundamental indices underperformed their cap-weighted benchmarks.

On the JSE the Composite index underperformed the cap-weighted TOP40 index. The Composite index has the lowest correlation with the Revenue index, however, the Revenue index delivered the highest returns. The Composite index has the highest correlation with the Book index, however, the Book index delivered the lowest returns.

On the Nigeria Stock Exchange, the Composite index underperformed the cap-weighted NGSE30 index. The Composite index has the lowest correlation with the Revenue index, however, the Revenue index delivered the highest returns. The Composite index has the highest correlation with the Book index, however, the Book index delivered the second lowest returns.

From the performance results, it is also observed that three composite fundamental indices outperformed their cap-weighted benchmark.

On the Egyptian Exchange, the Composite index outperformed the cap-weighted EGX30 index. The Composite index has the lowest correlation with the Dividend index, the Dividend index delivered the lowest returns. The Composite index has the highest correlation with the Revenue index, the Revenue index delivered the highest returns.

On the Nairobi Securities Exchange, the Composite index outperformed the cap-weighted NSE20 index. The Composite index has the lowest correlation with the Revenue index, the Revenue index delivered only moderate returns. The Composite index has the highest correlation with the Cash Flow index, the Cash Flow index delivered the second highest returns.

On the Stock Exchange of Mauritius, the Composite index outperformed the cap-weighted SEM10 index. The Composite index has the lowest correlation with the Book index, the Book index delivered only moderate return over the period. The Composite index has the highest correlation with the Cash Flow index, the Cash Flow index delivered the second highest returns.

These findings suggest that book value is an inferior measure of company value. A high correlation to book value coincides with lower returns while a low correlation to book value coincides with higher returns. The findings further suggest that cash flow is a superior measure of company value. A high correlation to cash flow coincided with higher returns. Finally, the findings suggest that revenue could be a superior measure of company value. A high correlation to revenue coincided with high returns. A low correlation to revenue coincided with low returns in most instances.

Ferreira (2009) indicated that the scope of his research on Fundamental Indexation could be expanded by creating more data points and by analysing the correlations between fundamental indices and other variable. Ferreira (2009) also indicated that his research provided scope for further research to perform in-depth correlations between the Book Value index and Composite index. This study does exactly that by using monthly data to analysing the correlations between single factor fundamental indices and their composite fundamental counterparts.

These findings provide support against proponents such as Perold (2007) and Blitz and Swinkels (2008) who state that fundamental indexation is simply value investing. Ferreira (2009) explained that value shares commonly refers to shares with low price-to-book values. The findings of this study indicate that book value is an inferior measure of company value and that the returns of composite fundamental indices are driven by factors such as cash flow and revenue. A portfolio based on book value would, therefore, have underperformed the composite fundamental index from 2008 to 2017.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research study aimed to establish whether fundamental indices outperformed cap-weighted indices in the SA, Egyptian, Nigerian, Kenyan and Mauritian emerging markets using data from 2003 to 2017. The risk-return characteristics of indices are compared using mean-variance analysis techniques to account for variations in risk. The sources of any excess returns were further investigated by constructing and comparing single factor fundamental indices.

The results from this study indicate that fundamental indices outperformed cap-weighted indices in African emerging market. Although a fundamental index outperformed the cap-weighted benchmark in each of the markets not all fundamental indices delivered superior returns. On the JSE and Nigeria Stock Exchange fundamental indices performed relatively poorly. On the Egyptian Exchange, Nairobi Securities Exchange and Stock Exchange of Mauritius fundamental indices performed exceptionally well.

When accounting for risk fundamental indices outperformed cap-weighted indices in African emerging market. Fundamental indices delivered the best return per unit of risk as measured by the Jensen's alpha, Sharpe ratio and Treynor ratio. The only exception was on the Nigerian Stock Exchange where the cap-weighted index achieved the highest Jensen's alpha.

The fundamental factors that contributed most to the excess returns seem to have been cash flow and revenue. A high correlation to these factors resulted in excess returns. Book value was found to be an inferior measure of company value.

These findings are significant for individuals and institutions who invest in African equity markets. Both individual and institutional investors could benefit from the higher returns generated by the fundamental metrics effect through investments in fundamental indices. Institutional investors can use the findings pertaining to the factors that contribute most to excess returns to create indices and portfolios with increased weightings towards these factors. Finally, investors in the SA, Egyptian, Nigerian, Kenyan and Mauritian markets may appreciate the fact that fundamental metrics may positively influence their portfolio performance.

6.2 Recommendations

This study seeks to determine whether fundamental indices outperform cap-weighted indices in African capital markets. The study only focused on SA, Egypt, Nigeria, Kenya and Mauritius. Further research could be done on other African capital markets, such as Morocco and Cote D'Ivoire, to establish whether fundamental indices exhibit similar results in these markets.

This study seeks to determine whether fundamental indices outperform cap-weighted indices in African capital markets after accounting for risk. Three return per unit of risk measures were used being the Jensen's alpha, Sharpe ratio and Treynor ratio. This research can be extended by using the Fama and French Three-Factor Model to measure size and value risk factors in these markets.

This study identified possible return drivers, such as cash flow and revenue. Further research could be done where these return drivers are awarded a higher weighting in the construction of composite fundamental indices.

7 REFERENCES

Abdmoulah, W. (2010). Testing the evolving efficiency of Arab stock markets. *International Review of Financial Analysis, 19*(1), 25-34.

Adelegan, O. J. (2004). How efficient is the Nigerian stock market? Further evidence. *African Review of Money Finance and Banking*, 145-165.

Affleck-Graves, J., & Money, A. (1975). A Note on the Random Walk Model and South African Share Prices. *South African Journal of Economics, 43*(3), 232-236.

Arnott, R. D., Hsu, J., & Moore, P. (2005). Fundamental indexation. *Financial Analysts Journal, 61*(2), 83-99.

Asness, C. S., Frazzini, A., Israel, R., & Moskowitz, T. J. (2014). Fact, fiction and momentum investing.

Ayodele, A. J., Oshadare, S. A., & Ajala, O. A. (2017). Semi-Strong Form of Efficiency of Nigerian Stock Market: An Empirical Test in the Context of Input and Output Index. *International Journal of Financial Research, 9*(1), 115.

Balatti, M., Brooks, C., & Kappou, K. (2017). Fundamental indexation revisited: New evidence on alpha. *International Review of Financial Analysis, 51*, 1-15.

Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of financial economics, 9*(1), 3-18.

Bartov, E., & Kim, M. (2004). Risk, mispricing, and value investing. *Review of Quantitative Finance and Accounting, 23*(4), 353-376.

Basu, A. K., & Forbes, B. (2014). Does fundamental indexation lead to better risk-adjusted returns? New evidence from Australian Securities Exchange. *Accounting & Finance, 54*(3), 699-728.

Blitz, D., & Swinkels, L. (2008). Fundamental indexation: An active value strategy in disguise. *Journal of Asset Management, 9*(4), 264-269.

Blitz, D., Van Der Grient, B., & Van Vliet, P. (2010). Fundamental indexation: Rebalancing assumptions and performance.

Broby, D., & Lochhead, M. (2013). What is the appropriate index construction methodology for African equity investment?

Bruce, I., & Levy, K. N. (1989). The complexity of the stock market.

Chan, L. K., & Lakonishok, J. (2004). Value and growth investing: Review and update. *Financial Analysts Journal, 60*(1), 71-86.

Estrada, J. (2006). Fundamental indexation and international diversification.

Exchange, J. S. (2014). FTSE/JSE RAFI 40 Index. Retrieved from Johannesburg Stock Exchange website: https://www.jse.co.za/services/market-data/indices/ftse-jse-africa-index-series/rafi

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance, 25*(2), 383-417.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *The journal of Finance, 47*(2), 427-465.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics, 33*(1), 3-56.

Ferreira, R. (2009). *The application of fundamental indexing to the South African equity market for historical data dating back to 1996.* Stellenbosch: University of Stellenbosch,

George, T. J., & Hwang, C. Y. (2004). The 52-week high and momentum investing. *The journal of Finance, 59*(5), 2145-2176.

Griffin, J. M., Ji, X., & Martin, J. S. (2003). Momentum investing and business cycle risk: Evidence from pole to pole. *The journal of Finance, 58*(6), 2515-2547.

Grundy, B. D., & Martin, J. S. M. (2001). Understanding the nature of the risks and the source of the rewards to momentum investing. *The Review of Financial Studies, 14*(1), 29-78.

Hadassin, I. (1975). An investigation into the behaviour of earnings and share prices of listed South African companies.

Hemminki, J., & Puttonen, V. (2008). Fundamental indexation in Europe. *Journal of Asset Management, 8*(6), 401-405.

Hicks, J. R. (1989). A suggestion for simplifying the theory of money. In *General Equilibrium Models of Monetary Economies* (pp. 7-23): Elsevier.

Hoffman, A. (2012). Stock return anomalies: evidence from the Johannesburg Stock Exchange. *Investment Analysts Journal, 2012*(75), 21-41.

Houwer, R., & Plantinga, A. (2009). Fundamental indexing: An analysis of the returns, risks and costs of applying the strategy.

Hsu, J. (2014). Value investing: Smart beta vs. style indices.

Hsu, J., Kalesnik, V., & Li, F. (2012). An investor's guide to smart beta strategies. *AAII Journal*, 11-16.

Hsu, J. C. (2006). Cap-weighted portfolios are sub-optimal portfolios.

Hsu, J. C., & Campollo, C. (2010). An examination of fundamental indexation.

Jefferis, K., & Smith, G. (2005). The changing efficiency of African stock markets. *South African Journal of Economics, 73*(1), 54-67.

Jun, D., & Malkiel, B. G. (2008). New paradigms in stock market indexing. *European Financial Management, 14*(1), 118-126.

Kaplan, P. D. (2008). Why fundamental indexation might—or might not—work. *Financial Analysts Journal, 64*(1), 32-39.

Kruger, R., Toerien, F., & MacDonald, I. (2012). Nonlinear serial dependence in share returns on the Johannesburg Stock Exchange. *African Finance Journal, 14*(2), 64-84.

Kwag, S.-W., & Lee, S. W. (2006). Value investing and the business cycle. *Journal of Financial Planning, 19*(1), 64.

Levy, K. (2014). Smart beta versus smart alpha.

Macharia, S. W. (2017). Portfolio diversification fundamental indexing versus cap weighted indexing: a case of Kenya.

Mar, J., Bird, R., Casavecchia, L., & Yeung, D. (2009). Fundamental indexation: an Australian investigation. *Australian Journal of Management, 34*(1), 1-20.

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

Munyw'oki, J. K. (2016). *Relative performance of fundamental indices on the South African equities market.* (M.B.A), University of the Witwatersrand, Johannesburg. (HG 4529.5)

Onoh, J. O. (2016). Semi-Strong Market Efficiency Studies of the Nigerian Capital Market Using Dividend Announcements.

Perold, A. F. (2007). Fundamentally flawed indexing. *Financial Analysts Journal, 63*(6), 31-37.

Piotroski, J. D. (2000). Value investing: The use of historical financial statement information to separate winners from losers. *Journal of Accounting Research*, 1-41.

Reinganum, M. R. (1982). A direct test of Roll's conjecture on the firm size effect. *The journal of Finance, 37*(1), 27-35.

Rensburg, P. v., & Robertson, M. (2003). Size, price-to-earnings and beta on the JSE Securities Exchange. *Investment Analysts Journal, 32*(58), 7-16.

Riepe, M. W., & Werner, M. D. (1998). Are enhanced index mutual funds worthy of their name? *The Journal of Investing, 7*(2), 6-15.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of Finance, 19*(3), 425-442.

Siegel, J. J. (2006). The 'noisy market'hypothesis. *Wall Street Journal, 14*, A14.

Smith, G. (2008). Liquidity and the informational efficiency of African stock markets. *South African Journal of Economics, 76*(2), 161-175.

Strugnell, D., Gilbert, E., & Kruger, R. (2011). Beta, size and value effects on the JSE, 1994–2007. *Investment Analysts Journal, 40*(74), 1-17.

Treynor, J. (2005). Why market-valuation-indifferent indexing works. *Financial Analysts Journal, 61*(5), 65-69.

Vitali, F., & Mollah, S. (2010). Stock market efficiency in Africa: Evidence from random walk hypothesis. *South Western Finance*.

Walkshäusl, C., & Lobe, S. (2010). Fundamental indexing around the world. *Review of Financial Economics, 19*(3), 117-127.