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**PORTFOLIO DIVERSIFICATION FUNDAMENTAL INDEXING VERSUS CAP
WEIGHTED INDEXING: A CASE OF KENYA**

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

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This Research Proposal has been submitted for examination with my approval as the Supervisor.

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Abstract

Indexing is very crucial when it comes to investing. Indexes are believed to be diversified, liquid and transparent and as such, many investors invest in portfolios built on these indexes. Active managers as well seek to build portfolios that generate high returns while focusing on these indexes as their benchmarks. The Capital Asset Pricing Model (CAPM) postulates that a cap-weighted market index is an efficient equity investment and investors cannot do better than these indexes without extraordinary skill or information. This is the main model upon which many indexes are created for example FTSE 15 in Kenya. It has however been established that capitalization weighted indexes are not mean-variance efficient when the model is replaced by real-world constraints (Markowitz H. M., 2005) and thus not optimal. Arnott, Hsu and Moore (2005) found that capital weighted portfolios tend to be flawed when it comes to pricing resulting into a price drag. It is therefore not prudent to fully rely on them. Managers should rather focus on building mean variance efficient indexes than those built on capitalization weighting. According to (Arnott, Hsu and Moore, 2005), (Hsu J. c. & Carmen, 2006) and (Siegel, June 2006) (Walkshausl & Sebastian, 2010), fundamental indexes significantly outperform cap-weighted indexes due a price drag from prices being noisy. The focus of this study is to explore whether this premise is true from a Kenyan investor perspective. Fundamental indexes on book value, cash flow and revenue are constructed focusing on all listed companies in the NSE. The top 15 companies in each portfolio are evaluated against the reference index. The findings do not provide any significant evidence to dispute the findings of Arnott, Hsu and More, 2005. Fundamental indexes outpace cap-weighted indexes and thus should be considered as an alternative in indexing.

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List of abbreviations

CBK	Central Bank of Kenya
NSE	Nairobi Securities Exchange
NASI	Nairobi All Share Index
FTSE	Financial Times Stock Exchange
S&P	Standard and Poor's
NYSE	New York Securities Exchange
CW	Capital Weighted
CAPM	Capital Asset Pricing Model
RAFI	Research Affiliates Fundamental Index.
KCB	Kenya Commercial Bank
SCBK	Standard Chartered Bank of Kenya
EABL	East African Breweries Limited
BAT	British American Tobacco

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Portfolio diversification is one of the most fundamental and important tenets of modern finance (Clifford S. Asness, 2011). Diversification is the only free lunch in investing (Markowitz H. , March 1952). Diversification allows one reduce portfolio risk without reducing expected return and as such, is pursued by most active managers aiming at obtaining alpha returns.

Indexing is a powerful tool to investing (Hsu J. c. & Carmen, 2006). It is inexpensive to implement and absolutely transparent. Indexing has immense capacity, highly liquid and naturally well diversified (Campollo, 2006). Fundamental indexation refers to construction of indices in which the assets are weighted not by capitalization, but by price insensitive fundamental measures of value such as dividends, earnings, cash flow or sales. Cap-weighted indexing on the other hand is construction of indices based on market capitalization given by; outstanding number of shares multiplied by price. (Arnott, Hsu and Moore, 2005) argued that price-insensitive fundamentals should and do outperform cap-weighted indices. They use US data between 1962 and 2004 to establish the plausibility of this premise and reported that indices weighted by book value, income, revenue, sales, dividends, and employment significantly outperformed the S&P 500 and the reference cap-weighted portfolio in a variety of time periods and scenarios. The table below represents their findings.

Return Characteristics of Alternative Indexing Metrics,1962-2004

Portfolio/Index	Ending value of \$1	Geometric return	Volatility	Sharpe ratio	Excess Return vs Reference	t-statistic for Excess Return
S&P	73.98	10.53	15.1	0.315	0.18	0.76
Reference	68.95	10.35	15.2	0.301	-	-
Book	136.22	12.11	14.9	0.426	1.76	3.22
Income	165.21	12.61	14.9	0.459	2.26	3.72
Revenue	182.05	12.87	15.9	0.448	2.52	3.25
Sales	184.95	12.91	15.8	0.452	2.56	3.36
Dividends	131.37	12.01	13.6	0.458	1.66	2.02
Employment	156.83	12.48	15.9	0.423	2.13	2.98
Composite	156.54	12.47	14.7	0.455	2.12	3.26
Average(ex - composite)	159.44	12.50%	15.20%	0.444	2.15pps	3.09

CAPM Characteristics of Alternative Indexing Metrics,1962-2004

Portfolio/Index	Geometric return	Correlation with Reference	CAPM Beta vs Reference	CAPM Alpha vs Reference	t-statistic for CAPM Alpha
S&P	10.53	100%	0.99	0.23%	0.76
Reference	10.35	-	-	-	-
Book	12.11	97	0.95	1.98	3.22
Income	12.61	97	0.95	2.51	3.72
Revenue	12.87	95	0.99	2.57	3.25
Sales	12.91	95	0.99	2.63	3.36
Dividends	12.01	94	0.84	2.39	2.02
Employment	12.48	96	1	2.15	2.98
Composite	12.47	96	0.93	2.44	3.26
Average(ex-composite)	12.50%	96.00%	0.95	2.37%	3.09

The returns produced by the fundamental indexes are on average, 1.97 percentage points higher than S&P 500 and 2.15 percentage points higher than the reference portfolio. The excess returns were equally significant and had an average t-statistic of about 3.09. The return advantages computed to ending values are above twice that of the ending value for the reference portfolio. The average CAPM alpha is at 2.37% with a t-statistic of 3.41.

Proponents of fundamental indexes (Arnott, Hsu and Moore, 2005), (Hsu J. c. & Carmen, 2006) (Siegel, June 2006), (Mar, Ron , Lorenzo, & Danny, 2009; Hemminki, 2008) and (Ferreira & JD, 2011) have similarly proven that these indices outperform a cap-weighted index. Fundamental indexes outperform their respective cap benchmarks by 2% per annum in the U.S and 3.5% globally (Hsu J. c. & Carmen, 2006). Fundamental indexing eliminates the return drag inherent in cap-weighted indexes at the same time preserving the benefits of cap-weighting.

However, major indexes such as S&P are still based on market capitalization weightings inspired by the mean variance framework of (Markowitz, 1992). The Capital Asset Pricing Model (CAPM) suggests that a cap-weighted market index is an efficient equity investment providing the highest risk adjusted return and investors cannot do better than these indexes without extraordinary skill or information.

Cap-weighted indexes have a number of benefits. First, Cap-weighted indexes are highly correlated with trading liquidity thus emphasizing the more heavily traded stocks thereby reducing portfolio transaction costs. Second, Cap-weighted indexes involve a passive strategy requiring little trading. Indexing to a cap weighted index incurs far lower trading costs and fees than active management. Cap-weighted portfolios automatically rebalance as security prices fluctuate. Third, market capitalization is highly correlated with investment capacity; cap weighting tends to emphasize stocks with greater investment capacities, thus allowing the use of passive indexing on an immense scale by large pension funds and institutions (Arnott R. D., Jason, & Philip, Fundamental Indexation, 2005).

Despite all these documented gains, cap-weighted indexes tend to be flawed in a very fundamental way (Campollo, 2006). Cap-weighting overweighs overvalued stock at the expense of undervalued companies which results into a return drag. Cap-weighting gives additional weight to stocks that are currently overpriced relative to their unknown discounted future cash

flows (the true fair value) and reduces weights in stocks that are currently trading below the true fair value. Market capitalization is a volatile way to measure a company's size or its true fair value. Cap-weighting might thus lead to suboptimal portfolio return characteristics because returns are noisy. The assumption that cap-weighted equity market indexes are sufficiently representative of the CAPM market portfolio and mean variance efficient doesn't hold water. This is because it is hard to determine a market portfolio that represents all potentially risky assets.

Equal weighting is another alternative used in indexing that tries to mitigate the shortfalls of cap-weighted indexes. Equal weighted indexes weight each component the same. They offer investors a viable option to market cap weighting. They address concerns associated with cap-weighted indexes that exhibit bias towards large cap stocks and those with strong growth opportunities. Equal weighted indexes limit single stock risk, have disciplined rebalancing and tilt toward small cap and value stocks (Kittsley, 2006). They however, have a number of disadvantages. Equal weighting does not preserve the benefits of cap-weighting, it lacks the liquidity and capacity found in traditional market indexes, and its return characteristics are not representative of the aggregate equity market. It also has logical inconsistencies in that it gives equal weights to 20th largest company as to the largest company while giving no weight to the 21st largest company in a portfolio of 20 stocks.

(Perold, 2007) counters the argument that cap-weighted indexes have a performance drag. Perold postulates that market capitalization does not reveal whether a stock is overvalued or undervalued, the random mispricing of stocks does not systematically shift the portfolio toward overvalued stocks. (Perold, 2007) argues that investors who have no knowledge on fair value but understand that markets are inefficient, can condition only on the market price and try to infer the fair value. For such, investment in cap-weighted indexes entails no drag. On the other hand, investors who know something about fair value can take advantage of this knowledge and beat the market. Fundamental indexes thus do not outperform because of a return drag from overweighting overvalued stocks and underweighting undervalued stocks, the outperformance could be as a result of having superior information. The excess returns in fundamental index according to (Pereira, 2009) could be attributed to market inefficiency resulting into mispricing

or value tilt strategy of the fundamental indexes. There is still no resolution on the factors that cause outperformance of fundamental indexes.

This study seeks to explore whether fundamental indexes indeed outpace cap-weighted indexes in Kenya while preserving the benefits of cap-weighted indexes. A fundamental index is built using companies listed in the Nairobi securities exchange and compared to the FTSE NSE 15 index that is constructed using market values as a proxy for cap weighted index. The fundamental indexes are evaluated on a mean variance basis focusing on returns, Sharpe ratio and volatility. The returns are further evaluated using CAPM model to establish whether fundamental indexes generate alpha returns. Capitalization and concentration ratios are used to establish whether these indexes still preserve the benefits of cap-weighted index hence their use as alternative indexes.

1.2 Statement of the problem

Traditional cap weighted portfolios have been the main investment strategies used by investors. They are founded on a mean variance optimization framework thus deemed to be optimal and as such, a passive investor can do no better than holding a market portfolio (Robert D Arnott, 2005). However a nagging question still remains: Can a capitalization weighted portfolio provide the best available risk and return relation for an investor?

Cap-weighted indexes underperform fundamental index (Campollo, 2006). Cap weighted indices rely on company share prices in measuring company size or its true fair value. Where prices are noisy, this may increase the volatility of the index and may lead to suboptimal portfolio return characteristics. In an economy where market prices contain a pricing error that mean reverts to zero, fundamental indexation works since weights are uncorrelated with pricing errors (Hsu J. C., 2008) From a mathematical perspective, cap weightings give additional weight to stocks that are overpriced relative to their true fair value and reduce weights to stocks that are trading below their true fair value (Hsu J. , 2004) and (Treynor, 2005). Treynor also shows that pricing errors can lead to a negative alpha for any price-weighted or cap-weighted portfolio relative to a price-indifferent portfolio, such as the Fundamental indexes or equal weighting. This altogether leads to a performance drag in cap-weighted and other price weighted portfolios. This drag is present where markets are inefficient and investors are aware of fair values of stocks (Perold A. F., 2008).

The assumptions of the mean variance efficiency of cap-weighted indexes are deeply flawed. Empirical evidence suggests that cap-weighted exhibit a substantial and statistically significant drag on performance relative to the opportunity set available to investors in those markets (Arnott & Markowitz, 2008). Most markets are inefficient which counters the assumptions of mean variance efficiency of cap-weighted indexes. In such noisy environments price related indexes tend to perform sub optimally when prices mean revert thus presenting fundamental indexes as possible alternatives. This study seeks to establish whether fundamental indexes outperform cap-weighted indexes from a Kenyan investor perspective while preserving the benefits of a cap weighted index by overcoming the flaws associated with cap-weighted indexes.

1.3 Research objectives

1. To establish whether a fundamental index outperforms a cap-weighted index in the Kenyan market on a mean variance basis; using monthly stock returns from 2012-2015.
2. To establish whether a fundamental index preserves the benefits of a cap-weighted index by retaining the investment the investment and liquidity capacity of cap-weighted indexes.

1.4 Research questions

1. Does a fundamental index outperform a cap-weighted index on a mean variance basis?
2. Does a fundamental index preserve the investment and liquidity capacity benefits of a cap weighted index?

1.5 Justification

Hitherto, many index providers in the world have built indexes based on market capitalization due to the belief that they are mean variance efficient. Replete of literature have however, countered this argument based on their simplifying assumptions. This creates a gap and the need to create a bench mark index built on alternative mean variance framework that offer investors a broader and informed option when making investment decisions. Fundamental indexes are the new alternatives to cap-weighted indexes.

Every day, active fund managers seek to exploit investment strategies that will outperform the benchmark index thus generating alpha returns. However, issues still abound in their efficiency such as: Higher management fees and trading expenses increased monitoring of organizational

and personnel moves, limited capacity for assets under management and broad asset class coverage necessitating multiple managers. Fundamental weighted indexing solves these problems without giving up expected excess returns. It is passive, replicable, formulaic, and transparent and objectively constructed (Arnott & West, 2006). Fundamental indexing enables investors and fund managers create one portfolio solution to their equity allocation, at the same time obtain excess returns. Hence it can be used as an alternative to fund managers.

This study will be useful to many participants including investors, fund managers and index providers. It will give fund managers an alternative to use while evaluating their portfolios and know which companies to invest in based on their fundamentals. Investors will profit to greater level since they will be able to make better passive investments that generate alpha returns using a fundamental index.

The study also provides a basis for further research on fundamental indexing in Kenya to researchers and other bodies since there is almost no literature published on this topic. Researchers interested in the topic of fundamental indexing will find this study of importance.

CHAPTER TWO

LITERATURE REVIEW

2.1 Cap-Weighted index versus Fundamental index

Capital Asset Pricing Model (CAPM) inspired by the mean variance portfolio analysis framework of Markowitz, has been the center of factor analysis for many decades. According to CAPM, a market portfolio is mean-variance optimal implying that a passive manager can do no better than holding a market portfolio (Robert D, Jason, & Philip, 2005). Many academic papers, have however, rejected the idea that cap weighted indexes are good CAPM market proxies. An examination by (Markowitz H. M., 2005) on the assumptions that underlie the CAPM theory, similarly establishes several aspects that question the robustness of the expectation that a capitalization weighted market portfolio is mean variance optimal. The assumption ceases when real-world constraints are incorporated.

Cap-weighted indexes are flawed in a fundamental way in that, they place heavy weights on overvalued companies and lower weights on undervalued companies (Hsu J. C. & Carmen, 2006). Cap-weighted indexes underperform fundamental indexes because; they put more weight on overvalued stocks relative to their true fair value and reduces weights in stocks that are currently trading below their true fair value. This mismatch results into a return drag in cap-weighted portfolios (Robert D, Jason, & Philip, 2005). Fundamental indexing eliminates the return drag inherent in cap-weighted indexes causing underperformance in cap-weighted stocks (Hsu J. C. & Carmen, 2006) . Fundamental indexes outperform their respective cap benchmarks by 2% per annum in the U.S and 3.5% globally. Similarly, portfolios constructed on fundamental indexing outperformed the S&P by an average of 1.97% a year over 43-year span tested. This could arise from: superior market portfolio construction, price inefficiency and additional exposure to distress risk (Campollo, 2006). It follows that indexes constructed using Main Street measures of company size are significantly better than the cap- weighted Wall Street indexes. (Walkshausl & Sebastian, 2010) found out that all globally fundamentally weighted versions and 46 out of 50 country specific fundamentally weighted portfolios create higher returns than their

capitalization-weighted counterparts with similar volatility. Fundamental indexes provide economically and statistically significant positive alphas worldwide (West, 2006) similarly found out that fundamental indexing on sectors equally exhibits excess returns. They compare the sector performance of the large composite to that S&P 500 and show annualized excess returns of large Composite Sectors over S&P sectors.

According to (Arnott, Hsu and Moore, 2005) fundamental indexes flawed in certain areas. Fundamental indexes have higher turnover than cap weighted indexes primarily arising from index reconstitution. Capitalization weighting on the other hand has a number of advantages: First it is a passive strategy requiring little trading. Secondly, a cap-weighted index provides a convenient way to participate in the broad equity market. Lastly, market capitalization is highly correlated with trading liquidity, so cap weighting tends to emphasize the more heavily traded stocks thereby reducing portfolio transaction costs. They however, find that fundamental indexes still generate positive alphas even after incorporating transaction costs.

2.2 Fundamental indexing and the noisy market hypothesis

In the presence of noisy stock prices, cap-weighted indexes will offer investors risk and return characteristics that are inferior to those of fundamentally weighted indexes (Siegel, June 2006). Noisy stock prices result into cap-weighted indexes overweighting every overvalued company and underweighting every undervalued company resulting into a performance drag of two percent per annum (Arnott, Hsu and Moore, 2005).

However, (Perold A. F., 2007) refutes this argument. According to Perold, 2007, the crux of the issue is that noisy market hypothesis anchors on fair value which is inconsistent with fundamental indexing supporters who claim that; an investor can outperform market cap-weighted indexes without knowing fair value. If one does not know fair value, then even though prices may move toward fair value, the direction of that movement is random. To anchor on fair value is to contradict the ongoing assumption of the noisy market hypothesis that we do not know fair value (Perold A. F., 2007). Because market capitalization does not reveal whether a stock is overvalued or undervalued, the random mispricing of stocks does not systematically shift the portfolio toward overvalued stocks (Perold, 2007). Fundamental indexes thus do outperform cap-weighted indexes only where there is a consensus on the fair value resulting into a return

drag from overweighting overvalued stocks and underweighting undervalued stocks associated with cap-weighted indexes.

According to (Pereira, 2009) fundamental indexes are biased towards stocks with lower expected growth and/or higher risk. Whether this generates a higher risk adjusted return, depends on the extent to which the market prices stocks efficiently and, any inefficiencies correlate with the chosen fundamental metrics. If the market is efficient, then market cap-weighted indexes will provide unbiased estimates of the true value of the stocks. If not, then fundamental indexes might dampen the adverse effects of noise which manifest in excessive market volatility and ultimately under/overweighting expensive cheap shares. If value stocks are systematically mispriced, fundamental indexing might perform well along with other value oriented strategies because it is exploiting this inefficiency not because capitalization weighting, in and of itself creates a performance bias (Perold A. F., 2007).

2.3 Fundamental indexing as a value tilt strategy

According to (Malkiel & Derek, 2007), outperformance of (Research Affiliates Fundamental Index) RAFI over the traditional cap-weighted indices has not been a result of the strategy's ability to arbitrage the inefficiency of cap-weighted indexing, but a reward from loading on factor tilts namely size and value risk factors. He suggests that investors should be cautious not to dramatically shift holdings of their portfolios away from capitalization weighting. In the same spirit, (Dopfel, 2008) postulates that, fundamental weightings may produce intended or unintended side bets, such as bias to value. He argues that if a fundamental strategy aligns with familiar style and size tilts but with little additional value-added, then the investor would have more flexibility and probably lower cost by using reweighted combinations of traditional cap-weighted style and size component indexes instead. A fundamental index should optimize on mispricing effects to add value.

In quest to find out whether fundamental indexes are simply value tilt strategies, (Walkshausl & Sebastian, 2010) decompose fundamental index performance in single-factor framework, as well as by applying (Fama & Frech, 1993) three-factor model and (Carhart, 1997) four-factor model with global and country specific self constructed size, value and momentum factors. Christian and Lobe find that fundamental indexing provides economic and statistically significant positive alphas even after controlling for data snooping biases and value premium within the (Carhart,

1997) four-factor model. This counters the idea that fundamental indexing is nothing but a simple value tilt strategy. (Chen, Michael Dempsy, & Paul, 2015) however, present different results; in determining whether outperformance of fundamental indexes can be attributed to market timing, they find evidence that stocks of the DJIA (Dow Jones Industrial Average Index) and Russel 1000 formed as fundamental indexes provide superior returns to market cap-weighted indexes, primarily due to exposures to the Fama French value factor. Fundamental indexes exhibit significant positive alphas with Fama French three-factor model in country specific fundamental indexes. This is not so with the DJIA and Russel 1000 fundamental indexes. This poses room for further research on the factors that cause fundamental indexes to outpace the cap-weighted indexes whether the value and size are the main contributors of this outperformance.

2.4 Market cap versus equal weighting

Equal weighted indexes offer an alternative approach of weighting constituents by market capitalization. They weight each component the same. Equal weighted indexes also address concerns associated with cap-weighted indexes that tend to exhibit bias toward large cap stocks and those with strong growth characteristics. Equal weighted indexes limit single stock and concentration risk, have disciplined rebalancing and tilt toward small cap and value stocks. Although annual rebalancing might increase turnover, it provides an opportunity to capture mean reversion among component securities eliminating short-term anomalies in valuation and return drag. Periodic rebalance reallocates money away from recent outperformers into recent underperformers capitalizing on short-term pricing inefficiencies (Kittsley, 2006). This results in equal weighted indexes outperforming cap-weighted indexes.

A manager's ability to add value is increased as the number of securities in his universe increases. More securities in the benchmark, allow the manager greater opportunity to apply his skill, and thus add value. When a manager faces long only constraint, as with traditional cap-weighting; he will have a greater opportunity to add value when the weights of the benchmark are evenly distributed. Concentrated benchmarks act to reduce the effective opportunity of the manager thus diminishing his ability to add value (Wander, 2003). This is mostly the case with cap-weighted indexes. Equal weighted indexes are more efficient indexes to cap-weighted indexes. They offer investors the most number of stocks to invest in thus offering managers greater investment opportunity. (Wander, 2003) evaluates different benchmarks in terms of

perceived opportunity (nominal number of stocks) and effective opportunity (effective number of stocks). He reports the findings below.

Perceived opportunity versus effective opportunity			
Benchmark	Perceived opportunity	Effective opportunity	Efficiency
S&P 500	500	102	20%
Russell 1000	1000	124	12%
Russell 2000	2000	1120	56%
S&P 500(equal weighted)	500	500	100%
S&P 500/Barra growth	164	42	26%
S&P 500/Barra value	336	70	21%

Equal weighted indexes are the most efficient offering investors a broader investment opportunity.

Equal weighted indexes however do not preserve the benefits of cap-weighting such as liquidity and capacity (Arnott R. D., Jason, & Philip, Fundamental Indexation, 2005). They also have logical inconsistencies in that they give equal weights to 20th largest company as to the largest company while giving no weight to the 21st largest company in a portfolio of 20 stocks. According to (Gastineau, 2006) the best index is the one that offers the broadest possible diversification and lowest transaction cost. Annual rebalancing of equal weighted indexes amounts to high transaction costs. This study thus diverts its focus to fundamental indexes which not only outpace cap-weighted indexes by exhibiting higher returns; but also preserve the benefits of cap-weighted indexes.

2.6 FTSE NSE Kenya index series

FTSE NSE Kenya Index Series was launched in November 2011. It represents the performance of the Kenyan companies listed on the Nairobi Securities Exchange (NSE), providing market participants with a transparent and complementary set of benchmarks to measure the performance of the major industry and capital segments of the Kenyan stock market, and to use as tools in the creation of index-linked products and derivatives. The indices are calculated in Kenyan Shillings and USD and are available in real time or as end of day products.

The series comprises:

- FTSE NSE Kenya 15 index which represents the largest 15 stocks trading in the NSE, ranked by full market capitalization.
- FTSE NSE Kenya 25 Index which represents the performance of the 25 most liquid stocks trading on the NSE.

This study focuses on the FTSE 15 which forms our reference portfolio. The study seeks to evaluate the performance of cap-weighted indexes against fundamental indexes. FTSE 15 forms a good proxy for evaluation since it is a cap-weighted index.

CHAPTER THREE

METHODOLOGY

3.1 Research design

This involves the strategy used to integrate different elements in the study to ensure the research problem is addressed. It also informs the collection, measurement and analysis of data. This study uses an exploratory research design in attempting to find out whether a fundamental index outperforms a cap-weighting index and whether fundamental indexes preserve the benefits of cap-weighted indexes.

3.2 Data collection

Primary and secondary data collection techniques will be employed. Prices for the FTSE NSE 15 and NASI index will be obtained from investing.com website. Fundamental variables will be obtained from published company financial statements. Interest rates on the 91 day T-bill will be obtained from the CBK website.

3.3 Population

The study will employ use of monthly returns for the period 2012-2015. All companies listed in the Nairobi securities exchange will be analyzed. Interest rates on the 91 day T-bill will be used as a measure of the risk free rate.

3.4 Index design

Index construction is inferred from the Russell Fundamental Index series (ftserussell.com, 2016) (Hsu, 2004) and (Treyner, 2005) show that portfolios need only be non-price-weighted to outperform standard cap-weighted indexes. Four factors: sales, cash flow, dividends and book value will be used. Cash flow, sales, gross dividend and book equity value work well as size metrics for constructing portfolio weights. (Robert D, Jason, & Philip, 2005)

Steps in constructing a fundamental index

1. The process starts with the selection of company universes.
All listed companies in the NSE are included in the sample. An additional liquidity screen will be applied. This removes securities that have a liquidity measure that is two

standard deviations from the mean of a lognormal distribution of the average daily price of listed securities. This is based on the last 12 months. Securities eligible for inclusion must have an average daily price greater than or equal:

$$\mu = \frac{\sum_{i=1}^n \ln(x_i)}{n} \quad \sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (\ln(x_i) - \mu)^2}$$

Where: $x = x_1, x_2, \dots, x_n$. x_1 is the average daily pricing for security i .

2. The universe companies are each ranked by the four fundamental measures of company size: book value, cash flow, sales and dividends.

The percentage weight that each company represents of the total value of each fundamental measure is calculated. Except in the case of book value, trailing five year average data is used to minimize the substantial volatility in the index factors that would result from using year to year data. Averaging also reduces index rebalancing turnover. Negative values in the fundamentals are replaced by zero.

Adjusted sales

Sales are calculated using average sales generated by each company over the past 5 years. An adjustment factor (ratio of average equity to average assets) is used to multiply the average sales to account for financial leverage.

Retained cash flows

Calculated using average retained cash flows over the prior five years, defined as operating income plus depreciation and amortization.

Dividends

Total dividend distributions averaged over the last five years including both special and regular dividends paid in cash.

3. An average for the four measures is obtained which will be used to form our composite fundamental value. Where there is missing information such as dividends, we average the other three factors.
4. The companies are then ranked based on the in descending order by their fundamental weights. The top 15 securities are selected. This is to have an equal number of securities as the FTSE NSE 15 index.
5. Fundamental weights are then normalized such that weights sum to 1.

The portfolio will be rebalanced in phases after every five years. This is to maintain a passive strategy as those of cap-weighted indexes hence preserve uniformity. This also aims at reducing transaction costs due to frequent rebalancing. (Carhart, 1997) Found out that rebalancing more frequently limits potential gains from momentum effect. Frequent rebalancing increases turnover which translates to higher trading costs.

3.5 Data analysis

Analysis of performance will be done using different measures. Including:

1. Returns from the index. This will be obtained using log returns on prices given by $\ln \frac{p_t}{p_{t-1}}$
2. Standard deviations of returns which will be computed using excel.
3. Cap ratio which will be obtained by dividing the fundamentals weighted average capitalization of each index by the cap-weighted average capitalization of the reference portfolio (FTSE 15).
4. Concentration ratio which represents the fraction of the total index capitalization that belonged to the top 10 stocks by metric weight in each index.
5. Sharpe ratio given by:

$$\frac{r_i - r_f}{\sigma_i}$$

Where the return on the index is r_i , r_f is the risk free rate of return and σ_i is standard deviation.

Alpha characteristic

CAPM model is used to evaluate the alpha characteristics of our model hence determine whether fundamental indexes are able to generate positive alphas.

CAPM model

$$r_i - r_f = a + b_i(r_m - r_f) + \epsilon_i$$

Where:

r_i = Return on fundamental index

rf = Risk free return rate and

rm = Return on the market portfolio

ϵ_i = Random error term

α = is the excess return not captured by the market factor

3.6 Limitations

1. Trading costs are not adjusted for since it would be difficult to measure trading costs with precision.
2. None of the measures used rely on price. Market valuations of perceived growth opportunities for companies were not taken into account. Young and fast growing companies are underrepresented in the fundamental index relative to their weights in cap-weighted indexes.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the findings and analysis of the research. The results will be presented in table format as well as graphs to give a pictorial representation of the findings. Analysis covers the period 2012-2015.

4.2 Performance of fundamental indexes

Four indexes were constructed based on book value, cash flow, revenues and a composite index which was an average of the three factors. The table below presents the performance of the alternative indexing strategies versus the FTSE 15 assuming a passive investment strategy.

Return characteristics of alternative indexing metrics from 2012-2015

Table 4.1

Index	Geometric return	Mean return	Volatility	Excess returns vs FTSE 15	t-Statistic for Excess Return
FTSE 15	1.40%	1.51%	4.74%	-	-
Book value	2.96%	1.34%	25.29%	1.56%	1.34
Revenue	1.51%	1.59%	4.10%	0.10%	0.08
Cash flow	1.61%	0.82%	4.23%	0.21%	0.2
Composite	1.45%	1.53%	4.02%	0.05%	0.02

The alternative fundamental indexes i.e. revenue and cash flow exhibit almost similar volatility to cap-weighted index in our case FTSE 15 aside from our book value index which has a high volatility of 25.29%. However, despite the high volatility, our book value index has a higher geometric return to other indexes at 2.96% which somewhat compensates for the high volatility.

The returns from the fundamental indexes of book value, revenue, cash flow outpace the cap-weighted FTSE 15 index. They all display higher returns over the period 2012-2015. The average excess returns from the fundamental indexes as given by the composite are still positive at an average of 5 basis points. The book value index outperformed all the other indexes with a geometric average return of 2.96%. Our t-statistics are low implying that our returns though positive, are not statistically significant.

4.3 CAPM characteristics of the fundamental indexes in relation to FTSE 15

Table 4.2

Portfolio index	Geometric return	Beta	Alpha	t-statistic for CAPM alpha
Book value	2.96%	5.59	-10.14%	0.4612
Cash flow	1.61%	0.94	0.17%	0.2
Revenue	1.51%	0.76	0.53%	0.802
Composite	1.45%	0.87	0.35%	0.345
Reference	1.40%	1.07	-0.31%	-

The fundamental indexes display positive alphas of 0.17, 0.53 and 0.35% for the cash flow, revenue and composite index respectively. The book value index has a negative alpha of -10.14%. The reference index has a negative alpha of -0.31%. These alphas however, are not statistically significant.

4.4 Portfolio liquidity / capacity characteristics and diversification aspect

To measure the liquidity aspect of the fundamental indexes, CAP ratio is used. The fundamentals weighted average capitalization of each index is divided by the cap-weighted average capitalization of the reference portfolio (FTSE 15).

The table below represents the capacity characteristics of the fundamental indexes.

Table 4.3

Portfolio/index	Concentration ratio	Cap ratio
BOOK VALUE	1.137	1.978
CASH FLOW	1.020	0.831
REVENUE	1.112	1.354
COMPOSITE	1.083	0.711
FTSE	1.009	1.000

The cap ratio helps us understand the investment capacity of our index. A cap ratio of 0.71 implies that the weighted average capitalization in the particular index 70 percent as large as FTSE 15. As such, the average amount that can be invested in the index is 70%. This is a positive sign. A cap ratio of 0.71 as displayed by the composite index implies that our fundamental index has a high investment capacity.

It is quite amusing that the fundamental indexes present very high cap ratios. The cash flow index has a cap ratio of 0.83 while the composite index has a cap ratio of 0.71. The book value and revenue indexes present even better results giving cap ratios of 1.97 and 1.35 respectively. The book value index closely doubles the cap ratio of FTSE 15. The concentration ratios are also greater than one. The concentration represents the fraction of the total index capitalization that belonged to the top 10 stocks by metric weight in each index.

Liquidity characteristics of alternative indexing Metrics 2012-2015

Our indexes as well constitute the most actively traded securities which can be likened to the most liquid securities. From the daily statistics, the most actively traded stocks are:

- Kenya Commercial Bank
- Cooperative Bank
- Barclays Bank
- Equity Bank
- Safaricom
- Kenya Airways TZ

- Cfc Stanbic
- Kengen
- East African Breweries
- British American Investments

Source: (Kenya Financial Markets, 2016)

Diversification aspect

Table 4.4

Sector representation in comparison to FTSE 15.

BOOK VALUE	CASH FLOW	REVENUE	COMPOSITE
KENGEN	SAFARICOM	SAFARICOM	SAFARICOM
BAMBURI	KENYA POWER	TOTAL	KENYA POWER
SAFARICOM	EQUITY	KENOL	TOTAL
BARCLAYS	COOPERATIVE BANK	KENYA POWER	BAMBURI
EQUITY	KENGEN	BAMBURI	KENGEN
ARM	EABL	KCB	EQUITY
KCB	KCB	BAT	KCB
CENTUM	CFC	EQUITY	COOPERATIVE BANK
COOPERATIVE BANK	SCBK	SCAN GROUP	KENOL
CFC STANBIC	BARCLAYS	NATION MEDIA	BARCLAYS
KENYA POWER	BAMBURI	EABL	EABL
BAT	BAT	KENYA RE	CFC
SCBK	TOTAL	KENGEN	BAT
EABL	JUBILLE	UNGA	SCBK
NATION MEDIA	KENYA OIL	CENTUM	CENTUM
80%	80%	50%	80%

Return Characteristics of Alternative Indexing Metrics on annual basis 2012-2015

Table 4.5

Index	2015	2014	2013	2012
<i>Geometric return</i>				
FTSE 15	-1.35%	1.81%	2.46%	2.74%
Book value	-17%	4%	14%	15%
Cash flow	-0.86%	1.27%	3.18%	2.89%
Revenue	-0.42%	0.64%	3.12%	2.73%
Composite	-0.90%	0.97%	3.15%	2.64%
<i>Annualized Standard deviation of returns</i>				
FTSE 15	5.75%	3.31%	5.98%	2.24%
Book value	30.35%	13.53%	30.35%	10.59%
Cash flow	5.24%	2.80%	5.28%	1.49%
Revenue	4.99%	2.67%	4.96%	1.49%
Composite	4.98%	2.64%	4.78%	1.88%
<i>Sharpe ratio</i>				
FTSE 15	0.85	0.90	0.59	5.13
Book value	-0.37	0.40	0.49	2.20
Cash flow	1.03	0.87	0.81	7.81
Revenue	1.17	0.68	0.85	7.70
Composite	1.07	0.81	0.89	6.08

4.5 Discussion of findings

The fundamental indexes exhibit higher returns to the reference index. The book value index performs better than all the other indexes with a higher geometric return of 2.96%. This however comes with a higher volatility of 25.29%. This implies that it is not very mean variance efficient.

Looking at the betas, book value index displays a higher beta compared to all other indexes at 5.59. This corresponds to high volatility resulting from this index. The book value index has a

high sensitivity to the market compared to the other alternative fundamental indexes which also supported by the high volatility associated with this index. The revenue, cash flow and composite index have lower betas compared to the reference index. This is positive since it implies that our indexes are less sensitive to the market hence can be used as alternatives to the cap-weighted indexes by investors.

The alphas also suggest positive results. All the indexes exhibit positive alphas apart from the book value index. The negative value from the book value index can be attributed to the high sensitivity displayed by this index as shown by beta. The reference index on the contrary has a negative alpha. These results confirm the ability of fundamental indexes outperforming cap-weighted indexes. While cap-weighted indexes exhibit negative alpha the fundamental index display positive alphas.

The results as given by the Sharpe ratio similarly agree with the fact that fundamental indexes are able to outperform cap-weighted index. The Sharpe ratios from these indexes are significantly higher than that of the reference index displaying exemplary performance of these indexes. Only the book value index drags behind. The fundamental indexes are able to compensate the investor for added risk taken.

The fundamental indexes also display commendable liquidity and investment capacities. Most of the stocks forming the index represent the most actively traded stocks in the market. The investment capacity is high at 80% on average implying a great amount can be invested in these indexes. The concentration ratio is also greater than one. This implies that the fundamental indexes present a convenient way to participate in the broad equity market. The t-statistics for the high returns and positive alphas is low implying that the results are not statistically significant.

CHAPTER FIVE

SUMMARY OF STUDY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the study

This study examines the concept of fundamental indexing in Kenya as an alternative to cap-weighted indexing over the period 2012-2015. All listed companies in the NSE are examined based on fundamental factors of book value, cash flow and revenue. The top 15 companies based on the fundamental weights are then selected to form the composite index. Results from these indexes are then evaluated against the reference index which is FTSE 15.

Book values, cash flow and revenue metrics are obtained from the financial statements of all the listed companies. Performance is evaluated using monthly returns on share prices of selected companies. The volatility, Sharpe ratios alphas and geometric returns are used to evaluate the mean variance performance of the fundamental indexes against the reference index. Cap ratio, concentration ratio and composition of securities in each index are used to determine whether a fundamental index preserves the benefits of cap-weighted indexes.

5.2 Conclusion

From the findings it is true to say that the fundamental indexes outperform the cap-weighted index on a risk adjusted basis. The fundamental indexes exhibit higher geometric returns over the cap-weighted index. The book value index displays even better performance with the highest geometric returns. This notwithstanding, the fundamental index as well exhibits low volatility while compared to the reference index with the exception of book value index. We can thus prudently say that fundamental indexes are mean variance efficient to the cap-weighted index and should be considered as an alternative to cap-weighted indexes. Investors nevertheless, should exercise caution and utmost prudence when using fundamental indexes. In the case of Kenya, these indexes high returns are not significant.

The fundamental indexes likewise preserve the benefits of cap-weighted index when it comes to liquidity, investment capacity and diversification ability. The fraction of the weighted average capitalization of the fundamental index to the cap-weighted index is on average 71% implying a high percentage of investment capacity. The fundamental index also comprises similar stocks as the reference index thus preserving the diversification aspect. The high concentration ratio also

shows that an investor using fundamental indexing is able to participate in the broad equity market.

5.3 Limitations of the study

The indexes were constructed based on only three factors due to lack of data especially on dividends paid and time constraints. This limits the scope of the study; more factors should be considered. However, this doesn't nullify the findings that the fundamental index outpaces cap-weighted indexes.

The study doesn't establish how robust this outperformance is. Some authors say the outperformance of the fundamental index is attributed to a value tilt in the index. The paper doesn't prove whether this premise is true. Further study should be done on this possibly through use of the Fama French models.

The study covers a short period of time i.e. 2012-2015 since the FTSE 15 which is the reference index was established in 2011. Study that extends this period should be done to establish whether fundamental indexes can consistently outperform the cap-weighted index in the long term.

5.4 Recommendations

This study seeks to determine whether an alternative fundamental index is able to outperform a cap-weighted index owing to the return drag attributed to cap weighted indexes. The study concentrates on the FTSE 15 index only. Further research should be done on the NSE 20, NASI and FTSE 25 to establish whether fundamental indexes exhibit similar results on these indices.

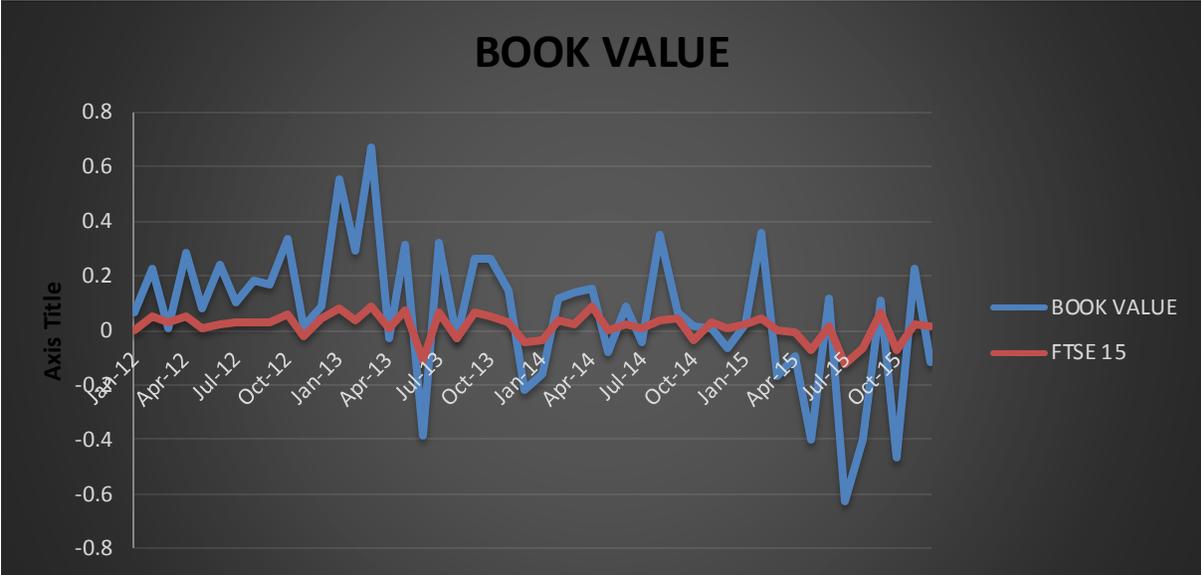
It is true that fundamental indexes have higher returns but it is still not clear how robust these returns are and what drives these excess returns. Further research should be done to determine the return drivers of these indexes. The factors that result into these outperformances should also be explored; whether it is a result of value tilt strategy or mispricing.

The findings give adequate support on the use of fundamental indexes as alternative indexing metrics. Fund managers and investors can use these indexes as benchmarks in portfolio evaluation and construction and they are able to generate high returns and at the same time have a high investment capacity. Fund managers should however proceed with caution since the high returns and positive alphas exhibited by these indices are not significant.

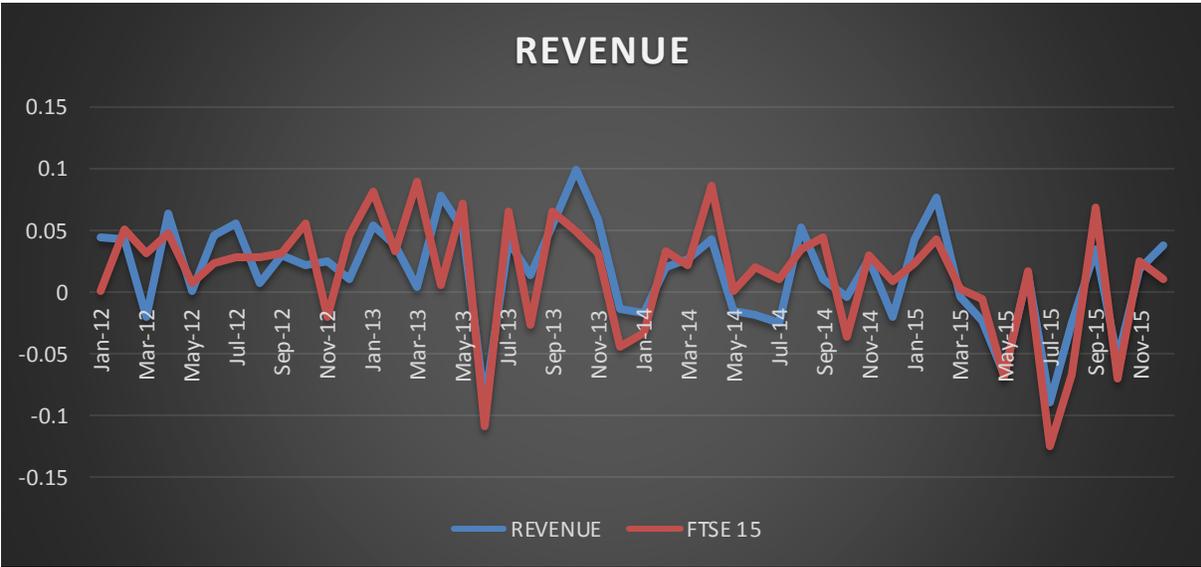
Appendix 1

Return performance

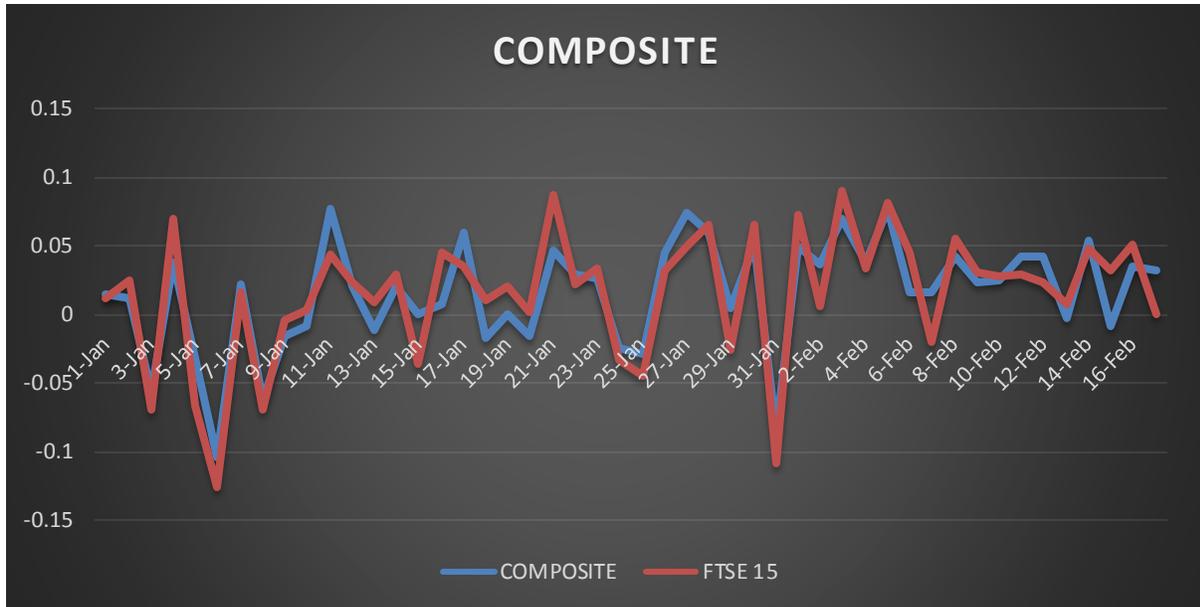
1.1 Performance of Book value index relative to FTSE 15.



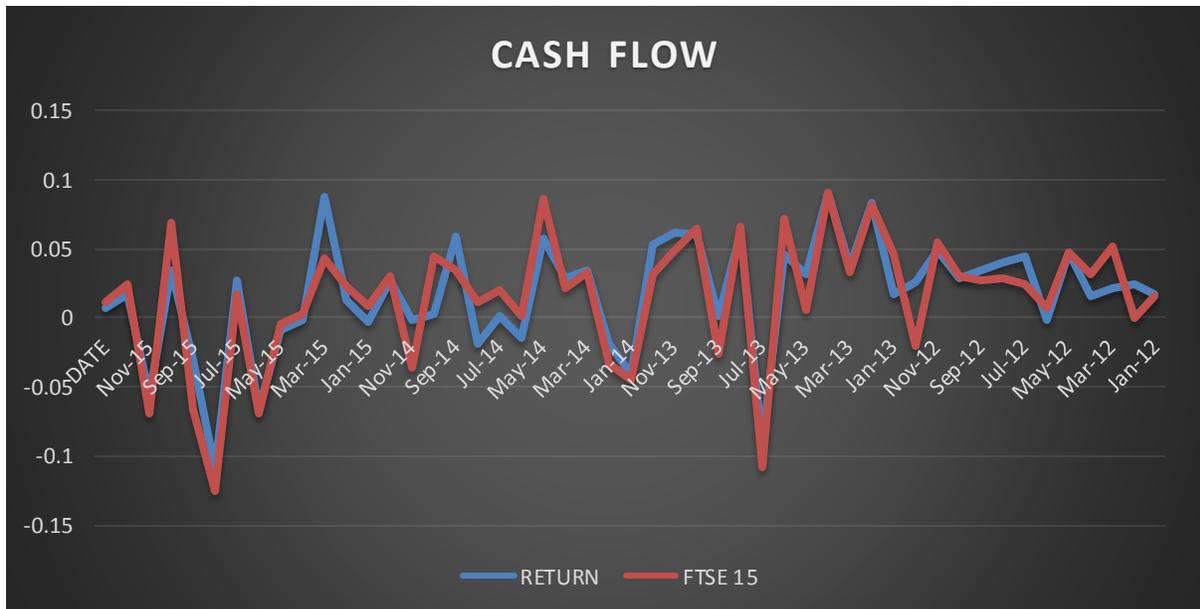
1.2 Performance of Revenue index relative to FTSE 15



1.3 Performance of composite index relative FTSE 15

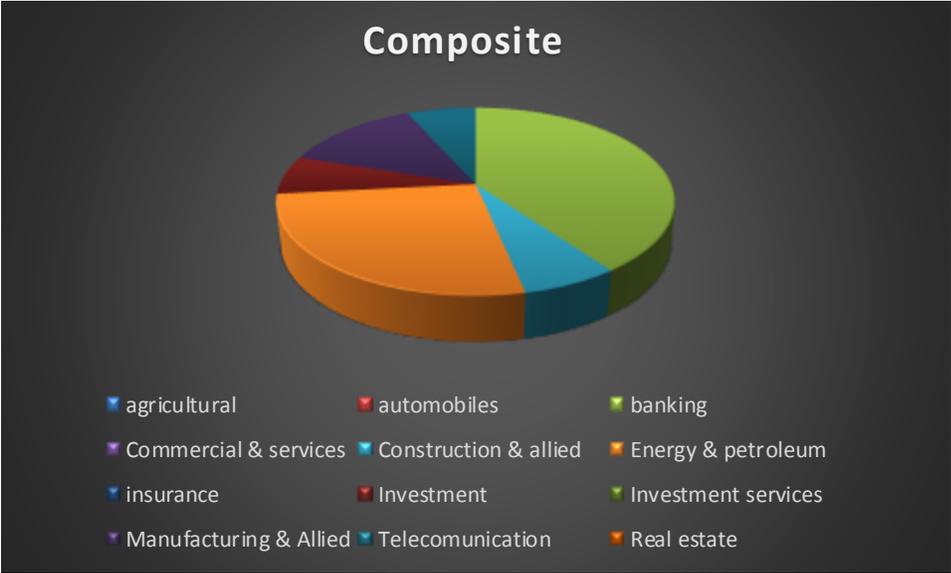
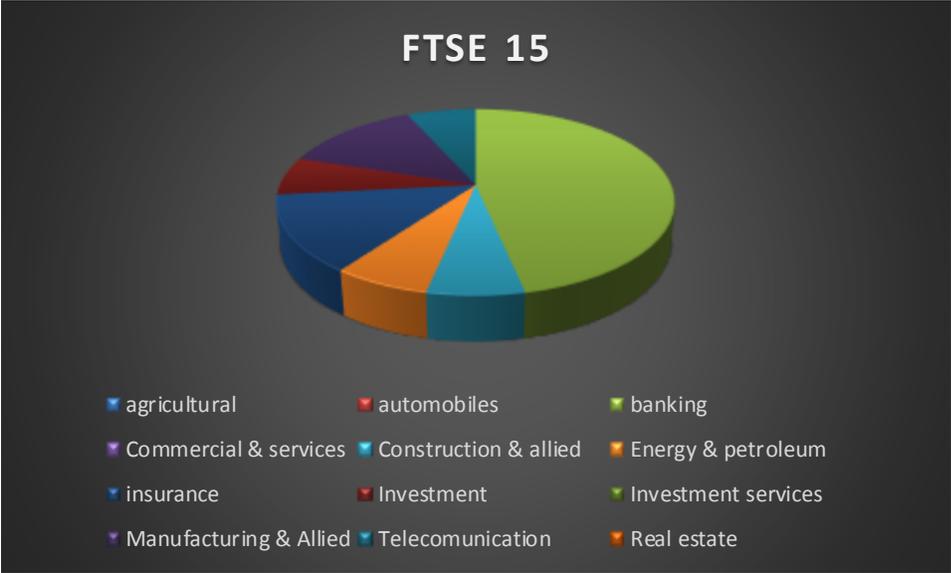


1.4 Performance of cash flow index relative to FTSE 15



Appendix 2

Sector representation



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