ETF indexation methods: A risk-adjusted performance analysis

Increasing sophistication of exchange-traded fund (ETF) indexation methods required that a comparison be drawn between various methodologies to establish the benefits of such product innovations. A risk-adjusted performance evaluation of four pre-selected ETF indexation categories was conducted to establish how alternative ETFs compare to standard market capitalisation–weighted ETFs. The research methodology involved that fundamentally weighted, equally weighted and leveraged ETFs were compared to traditional market capitalisation–weighted ETFs on the basis of risk-adjusted performance measures. Using a sample of South African and American ETFs, several risk-adjusted performance measures were employed to assess the risk and return of each indexation category. Special emphasis was placed on the Omega ratio because of the unique interpretation of the return series distribution characteristics. Findings show that fundamentally weighted ETFs outperformed the other categories during an upward moving market when using standard risk-adjusted performance measures. Moreover, the Omega ratio analysis revealed inherent unsystematic risk in alternatively indexed ETFs, and ranked market capitalisation–weighted ETFs as the best performing category. Equal-weighted ETFs delivered consistently poor rankings, whilst leveraged ETFs exhibited a high level of risk associated with the amplified returns of this category. The study highlights that recent ETF developments bring unique risks that require cautious implementation of alternative ETFs into a portfolio.

Introduction

Exchange-traded funds (ETFs) have gained popularity as investment vehicles over the decade spanning from 2003 to 2013 (Fuhr 2013). The increased popularity brings with it continuous innovation and increased sophistication in the product offerings. Traditionally, ETFs have been structured in such a way as to track the returns of a specific index or benchmark (inter alia, ETFs historically delivered the beta or market average). However, recent developments in the ETF market offer even more options to investors, and alternative ways in which the ETF index can be structured are emerging (Stevenson 2012). ETFs offer increasingly sophisticated ways to gain exposure to the market and provide a cost-effective way to restructure a portfolio by gaining access to a diverse variety of market segments. Initially, ETFs have been considered only as passively managed investments, and hence, there has always been the need to combine these investments with other kinds of investment vehicles in a portfolio. As ETFs develop, the basic structure of merely tracking a market capitalisation–weighted index is being replaced by more complex methods of indexing. More advanced approaches are challenging the conventional passively managed ETFs by adding a degree of activeness to the index composition (Chow et al. 2011). Traditional market capitalisation–weighted ETFs, by means of allocating the weights in the fund according to the market capitalisation of each security, will only offer positive returns to an investor when securities with greater market capitalisation exhibit positive returns. Therefore, during economic slowdowns or recessions, these investments may lose value. As such, conventional ETFs historically needed to be complimented with other investment products or asset classes to eliminate the systematic risk of the market. With the development of fundamentally weighted ETF indexation, equally weighted ETF indexation and leveraged ETFs, the aim is to add portfolio exposure beyond the single market factor (Fama 2000). These products do not merely track the market but have the ability to outperform the market index (Arnott, Hsu & Moore 2005; Plyakha,

1. Amenc, Goltz and Martellini (2013), Hsu (2014), Hsu and Kalesnik (2014) and Siracusano (2014) have provided research on the innovation in ETF industry with the development of the smart-beta ETFs. Furthermore, a growing number of wealth managers (such as Betterment and Wealthfront) are utilising increasingly sophisticated algorithmic portfolio construction strategies (so-called Robo advisor services) to build customized ETF portfolios for customers pointing to further enhancements in the ETF industry.

2. The core satellite approach is one such strategy and focuses on holding a selection of passively managed funds at the core of a portfolio. The desired market outperformance (alpha) in the portfolio is then achieved by selecting strategic actively managed funds/instruments as ‘satellite’ holdings in the portfolio (Waring & Siegel 2003).

3. Market capitalisation indexation creates a similar effect to a momentum strategy as over longer time periods securities that have increased in price the most relative to other securities in the index will carry the greatest weight. This weighting method leads to overweighting stocks that have risen in price (and may be overvalued) and underweighting stocks that have declined in price (and may be undervalued) (Hsu 2006).

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Uppal & Vilkov (2012). The more sophisticated ETF indexation methods claim to offer additional returns to investors in excess of that which can be achieved with conventional ETFs by tilting the portfolio weights in favour of factors other than the market beta. This research is aimed at testing this claim by considering not only the absolute returns of the various indexation methods, but also by incorporating risk adjustments, a risk-adjusted performance evaluation can be conducted.

The absence of such a cross-category analysis within the South African (SA) market prompted this research to be conducted. SA ETF performance measurements were supplemented with performance measurements of United States (US)–traded ETFs to allow for the inclusion of leveraged ETFs into the comparison. Various risk-adjusted performance measures were calculated for each ETF indexation category and compared to similar metrics of ETFs in the other categories. The selected risk-adjusted performance measures provide a view of the risk–return characteristics of each ETF category by incorporating the amount of risk that has to be incurred to achieve the level of return (Bacon 2004). For the purposes of the study, six performance measures were used to rank the risk-adjusted performance of ETFs. The Sharpe, Treynor, Sortino, Calmar, Information and Omega ratio were all used to evaluate the ways in which the ETF indexation methods compared with each other.

**Literature review**

**Market capitalisation–weighted (traditional) indexation**

The market capitalisation (market cap)–weighted method for index construction assigns a weight to each security in the index relative to the size of the company as measured by its market capitalisation. Traditionally, the idea to base passive investment funds on a market cap–based index followed from the efficient market hypothesis (EMH), as it reflected the underlying notion that the market price of the company will be representative of all the information currently available for that particular company. According to this methodology, the market cap is believed to be a reasonable representation of the true fair value⁴ of each company comprising the index. However, the existence of an efficient market is questionable, and some studies have subsequently proposed that alternative indexation strategies are preferable (Siegel 1994).

Choueifaty and Coignard (2008) and Hsu (2006) state that there are increased claims that the market capitalisation–weighted indices are not an efficient way to obtain optimal risk-adjusted returns. Studies have proven that the high concentration of the market capitalisation indices towards specific sectors create a bias towards highly correlated stocks, which do not provide ideal levels of diversification (Stevenson 2012:59). Mean–variance diversification can only be achieved when low or negatively correlated securities are added into the portfolio, which might not be the case for a sector ETF containing highly correlated stocks.

Market cap indices, furthermore, have the characteristic that these indices (by design) are heavily weighted towards the large cap stocks in the market (Clare, Motson & Thomas 2013). An added benefit of market cap indices that follows closely with this characteristic is the high liquidity associated with large (and frequently traded) stocks (Arnott et al. 2005). The bias towards large stocks has the disadvantage that stocks with higher market prices (inter alia popular stocks) are given a greater weight in the index. The market cap indexation method can be said to be flawed as it overweights expensive companies (Arnott et al. 2005; Hsu 2006). By definition, companies that are overvalued will have an extra weight in the index at the expense of undervalued companies (Hsu & Campollo 2006).

The construction of the index using the market cap indexation technique creates a momentum bias. As popular stocks increase in value at a relatively fast rate, the share price and subsequently the market value will increase. A passive fund manager with an index tracker based on market cap will, as a result, have to increase the weightings of ‘hot stocks’ on a continuous basis (Stevenson 2012). As a negative consequence, an investor is always invested largely in the sectors that are popular and conversely have reduced exposure to the unpopular sectors, regardless of the valuations of the sectors. The momentum bias of market cap indices was proven during the extended bull run of the markets in the 1990s, when the market cap–based index method outperformed all the other indexation methodologies (Clare et al. 2013). In reaction to the drawbacks of the traditional indexation methodology, a few alternatives were developed. Fundamentally weighted indexing represents one such substitute method.

**Fundamentally weighted indexation**

In order to overcome the bias of the market cap–weighted index towards the more popular stock in the market, an alternative indexation method was developed. The fundamentally weighted indices assign larger weightings to stocks that are expected to offer the best value in terms of a set of selected fundamental characteristics, rather than using the market value of stocks as the selection criteria. It can also be said that fundamental indexation aims to deliver not only beta (market risk) but instead provide an alternative or smart beta (Chow et al. 2011). Fundamentals of companies form the selection criteria, which are used in the construction of a fundamentally weighted index. Variables such as the book value, revenues (cash flows), gross sales, dividends and employment are some of the factors that are considered the drivers of the future expectations for returns. The fundamentally weighted methodology seeks to create a value bias, which can produce extra returns over a long time frame by including securities that display favourable fundamental ratios (Stevenson 2012).

According to Fama (2000), the single risk factor (beta) that is used by the market cap methodology cannot be considered

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⁴ The true fair value of a company should be based on the discounted future cash flows expected from the company (Arnott et al. 2005).
the only source of risk for all stocks. A three-factor risk model that includes the size of the company, book-to-market value, as well as the market index, was proposed by Fama and French (1996). Small company stocks expose an investor to a different form of volatility and exhibit unique risk–return characteristics when compared to larger sized companies. ‘In the presence of more than one risk factor, the goal of indexing switches from diversification across the available stocks to diversification across the available risk-return dimensions’ (Fama 2000:2). Constructing an index based on fundamentals holds a particular challenge when trying to retain the advantages of the market cap methodology. The two main advantages of market cap weightings, liquidity and low turnover, must be compared to fundamentally weighted indices. Firstly, the increased market value of large capitalised stocks provides an inherent liquidity benefit. Smaller stocks with favourable fundamentals might not necessarily be as liquid. Arnott et al. (2005) found that a strong correlation exists between liquidity and other company fundamentals such as book value, cash flow, sales, revenue and dividends. Subsequently, liquidity is not compromised because of fundamental indexing, because the size of the firm is in a large part determined by these fundamental variables.

Secondly, fundamental indexing cannot provide the same low-turnover benefits as market cap–weighted indices. Fundamental indices do have higher turnovers and need to be rebalanced on an annual basis to reassign weights according to changes in fundamental valuations (Arnott et al. 2005). Davies (2012) states that the danger with this technique is that, the data can become very stale as the annual rebalancing approaches. Rebalancing of fundamental indices only occurs on an annual basis because of frequency of the available annual reports from the companies. Arnott et al. (2005) oppose Davies’ view and found no meaningful return advantage when rebalancing of the fundamental indices was carried out on a more frequent basis. Higher turnovers than market cap indices are however noticeable.

Arguments both for and against the use of fundamental indexation have been put forward by critics. On the downside, the fundamental indices tend to under-represent fast-growing or young companies relative to their weighting on traditional indices. Fundamental valuations of such companies might not be in line with current market pricing. The negative effects of this bias towards fundamental value instead of market value are the missed opportunities of capturing sudden upward movements in the market. Hsu and Campollo (2006) confirm that fundamental indices will underperform relative to other methodologies in a bubble environment when rapid and irrational expansions in market prices provide better results for large market-capitalised companies. The momentum bias of market cap–weighted indices is apparent in markets with extreme momentum, which will hurt the performance of fundamental indexation (Hsu & Campollo 2006).

Fundamental indexation also provides the opportunity to gain returns above that shown by the traditional indexation method. Arnott et al. (2005) state that the fundamental (non-capitalisation-based) indices consistently provide higher returns than the traditional cap-weighted equity market indices. The explanation for superior returns from fundamental indexation can be found in the validity of the EMH. In an inefficient market, the market cap–weighted indices will experience a return drag as rebalancing occurs at a slower rate, providing a better opportunity for a fundamental index. However, in an efficient market, an investor will be indifferent in regard to selecting a specific risky portfolio, and as such, the fundamental index will perform on par with the market cap–weighted index (Hsu & Campollo 2006).

It has also been suggested that a portfolio should, if the market is efficient, be ‘mean-variance efficient’, but there is no reason why this should be the case on an ex ante basis (Clare et al. 1997). Arnott et al. (2005:97) concur by stating that ‘The fundamental indices are materially more mean-variance efficient than standard cap weighted indices’. It can be said that fundamental indexation is a viable alternative to the traditional market cap–weighted indices. The equally weighted index method is another alternative indexation method.

**Equally weighted indexation**

Equally weighted indices assign the same weight to each of the n stocks comprising the index. Unlike market cap and fundamental indexation methodologies, no bias is created towards any stocks in the index, as each carries an identical weight. The construction methodology followed by equally weighted indices creates unique characteristics, which are different from the underlying headline indices. Concentration risk that might arise with the market cap approach will not be present in equally weighted indices, as larger sectors are not over-represented by this methodology (Zeng & Luo 2013).

Three drawbacks of equally weighted indices can be identified when compared to traditional market cap indices. Firstly, equally weighted indices will have reduced liquidity because of the larger proportion of the index that comprises smaller (and possibly less traded) stocks. When the fund rebalances and acquisitions of smaller stocks are required, a lack of supply in the market could affect the ultimate weightings. Secondly, an equally weighted index will not provide the return characteristics that are representative of the aggregate equity market (Arnott et al. 2005). Greater allocation towards smaller stocks in the market will deliver significantly altered returns, as opposed to those of the traditional market cap indices. A final drawback can be found in the higher turnover rate of equally weighted indices (Zeng & Luo 2013). This is the result of a quarterly rebalance schedule, followed by equally weighted indices.

Despite the theoretical limitations of equally weighted indices, it has been shown empirically that equally weighted indices...
have outperformed market cap–weighted indices over longer periods (Plyakha et al. 2012; Zeng & Luo 2013). However, these results have varied considerably over different market conditions. Burgess (cited by Stevenson 2012:59) states ‘in bull markets, the equal weight index does seem to produce better returns than the standard index, if only because of its relative weight towards smaller stock’. Fernholz and Shay (1982) also found that an equally weighted portfolio has the potential to earn returns that are greater than buy-and-hold portfolios. Outperformance of equally weighted indices over traditional market cap indices is clearly visible, given the correct market conditions. Differing weightings and rebalancing practices can be seen to be the major contributors to such outperformances.

**Leveraged indexation**

Leveraged ETFs are linked largely to an underlying market cap–weighted index. However, instead of seeking to mimic the exact return of the underlying index, leveraged ETFs will aim to deliver a multiple of the index value. An inverse ETF ties in closely with leveraged ETFs as it seeks to deliver a negative multiple of the index. The leveraged factor, which leveraged ETFs aim to deliver, ranges from two times (2×) or three times (3×) the index (for a long position on the market), to negative two times (-2×) or negative three times (-3×) the index (for a short position on the market) (Stevenson 2012:128). Leveraged ETFs can be considered as a magnified variation on the market cap–weighted index. Any increases in the market cap–weighted indices will result in an amplified increase in the leveraged ETF.

A critical area to note is that most leveraged ETFs in existence are daily leveraged ETFs (Johnston 2010). Daily leveraged ETFs as such seek to deliver the stated leveraged factor on a daily basis. The compound returns of daily leveraged ETFs will, over a longer time period, differ significantly from expected levels. Daily leveraged ETFs are by design structured to deliver superior returns to that of the market on a daily basis. However, longer term results of such products will deviate from the underlying market index, depending on the volatility of the market index. Leveraged ETFs have the requirement that both the direction and magnitude of market movements be predicted correctly in order to gain over the longer term (Johnston 2010).

Very little literature (and in the case of SA none at all) exists that compares the performance of a leveraged indexation approach to others, such as fundamentally weighted and equally weighted indices. This study seeks to fill precisely this gap.

**Research methodology**

**Data**

Data collection for the study was limited to selected equity ETFs in SA and the US. Equity funds were selected over bond or commodity funds because the largest part of the ETF market comprises equity ETFs. Equity ETFs provided the benefit that a comparable market index could be used as a benchmark in which to relate return performance. For the SA market, the JSE Top 40 index was selected as the market index, whereas in the US, the S&P 500 index served as a similar benchmark index. The US was selected as the country of comparison because of the vast amount of ETFs traded in the US market and because it is the birthplace of the ETF product.

Returns for all the above-mentioned ETF categories were calculated from the ETFs’ daily closing prices. The creation and redemption whereby new ETF shares are created or eliminated reduces any arbitrage between the NAV and market prices for an ETF. As a result, the market prices of ETFs will not differ dramatically from the net value of the underlying assets (Pennathur, Delcoure & Anderson 2002), hence the decision to use market prices instead of the NAV for each ETF. Market prices for SA ETFs were obtained from the McGregor BFA Expert (2014) database, whilst the Yahoo Finance (2014) database provided the historical prices for US ETFs. The risk-free rate of return (as used in many performance measures) was based on the 91-day Treasury bill rates for SA and the US. Risk-free rates were obtained for the same observation period as the price data. SA treasury rates were obtained from the South African Reserve Bank (SARB 2014), whilst US treasury rates were obtained from the Board of Governors of the Federal Reserve System’s (2014) website.

Traditional market capitalisation ETFs were selected from funds that aim to replicate the performance of these benchmark indices as closely as possible. For both the SA and US market, three traditional market capitalisation ETFs were selected. For SA, this was the complete list of ETFs available in the market, which aim to replicate the JSE Top 40 index. The same sample size from the US ensured consistency in comparisons. The selection of fundamentally weighted ETFs in SA was based on the availability of historical data. Only two SA equity ETFs, with a close relation to the benchmark index, fulfilled the criteria for sufficient historical information. A similar sample size was selected for the US market. Only one equally weighted ETF is traded in the SA market, and subsequently, one equally weighted ETF was selected from the US market. Because of the regulations imposed on the SA ETF industry, no leveraged ETFs are in existence in the SA market. A comparison of the three above-mentioned indexation methods to leveraged ETFs was as a result restricted to the US ETF market. Both leveraged and inverse ETFs were included as part of the analysis. One two-times and one three-time leveraged ETF was selected. Similarly, one negative two-times and one negative three-time inverse (short) leveraged ETF was included into the analysis. To allow as many ETFs to be analysed as possible, a period from December 2010 to January 2014 was selected. The restrictive sample and period under consideration limits the generalisability of the findings to only an upward trending market and the four indexation methods under review.

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7. Buy-and-hold strategies are in most cases synonymous with traditional passive investing, which is associated with market cap–weighted indices.

8. The compounded value of the leveraged ETF is expected mistakenly to be the underlying index value multiplied by the leveraged factor.

9. This is a result of the regulation prohibiting leveraged ETFs in the SA market.
Risk-adjusted performance measures

The study follows industry best practice and conducts the return performance analysis of the various ETFs using an array of risk-adjusted performance measures. The six performance measures used as part of the study differ primarily with the adjustment for risk (Mayo 2000:249). The Sharpe ratio considers total risk; the Treynor ratio considers only the systematic risk; the Sortino ratio accounts for the downside risk below a specified threshold rate; the Calmar ratio considers risk as the maximum downturn that an investment exhibited; and the Information ratio incorporates the tracking error as its risk measurement. A detailed examination of each measure is provided to emphasise the importance of its use in the study.

Various characteristics of each of these measurements validated its use in the study. In addition, however, some shortcomings with each of the above-mentioned measurements created the need for results to be compared to other measures of portfolio performance. The total risk measurement used by the Sharpe ratio ensured that less diversified ETFs could be evaluated (Le Sourd 2007). However, the use of the standard deviation of returns as risk measure essentially penalises upside variation in the return series (De Wet, Krige & Smit 2008). The Sharpe ratio relies on the assumption that returns are normally distributed (Eling & Schuhmacher 2007:2633), which is not the case for our sample of ETFs. The Treynor ratio can be considered a closely related portfolio performance ratio, which uses the beta of the portfolio as the risk measurement (Bacon 2004).

Both the Sortino and Calmar ratios hold the benefit that upside risk is not penalised, as risk measurements are incorporated differently into each of these ratios. The use of downside risk in the Sortino ratio ensures that a specified minimum level of return could be selected to determine the deviation of returns away from such a level. The Sortino ratio allows for a user-defined minimum level of return to be set which, if chosen incorrectly, could over- or understate the downside risk (Amenc et al. 2004:21). Because of the use of daily data for the study, the minimum level of return was set at zero. The limited data for the study allowed for only a three-year bull market to be included. As such, no extreme downturns were observed in the period under review. However, incorporating the Calmar ratio into the analysis provided some manner to observe the performance of each ETF in reaction to its most extreme event (maximum downturn).

The Information ratio holds particular importance for its application to ETF performance measurement. The use of the tracking error as the risk measurement is of great importance with passively managed investment products such as ETFs. The inclusion of the tracking error in the calculation of the information ratio provided a good comparison of how well each ETF performed relative to the benchmark market index. The information ratio as a

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10. Measured by the standard deviation of returns.

11. The mean and variance.

12. Skewness can be considered as the third moment of the distribution.

13. The importance of the higher moments is dependent upon the existence of normality in the return distribution.

Eling and Schuhmacher (2007:2633) stated that a primary argument for the selection of a performance measure rests on the fund’s return distribution. Investment funds exhibiting non-normal return distributions cannot be evaluated sufficiently with the use of performance ratios such as the Sharpe and Treynor ratios (Sharma 2004). The use of only the first two moments of the return distribution in the Sharpe and Treynor measurements can provide inconsistent results when returns are not normally distributed. The Sortino ratio improves on this drawback of the Sharpe and Treynor measures by allowing asymmetrical return to be evaluated (Kanellakos 2005:76). Utilising downside risk allows for the skewness of the distribution to be incorporated into the calculation (Amenc et al. 2004:21). Similarly, the Calmar ratio is not only concerned with the mean and variance but also applies to the maximum downturn experienced over the period under review. However, the Calmar and Sortino ratios only consider the lower partial moments, which reflects upside and downside variability differently.

The final performance measure, the Omega ratio, overcomes all the limitations experienced by the other performance measures. The Omega ratio incorporates all four moments of the distribution of returns; inter alia the mean, variance, skewness and kurtosis (Togher & Barsbay 2007). The Omega performance measure considers both the upside potential (higher partial moments) and the downside potential (lower partial moments) of a portfolio for the entire distribution of return (Kazemi, Schneeweis & Gupta 2003). By using the entire cumulative distribution function, the Omega ratio needs to make no assumptions about the shape of the distributions (Keating & Shadwick 2002). Subsequently, fund rankings obtained using the Omega ratio will be noticeably different from those obtained by other performance measures. Keating and Shadwick (2002) state that when the higher moments of the distribution are important, the Omega will provide a correction for the simplifying assumptions made in other performance measures. The Omega also differs from other measures of performance as the ratio is expressed as gains to losses, rather than in the form of (expected) return and risk (Van Dyk, Van Vuuren & Styger 2012). Botha (2006:1) summarises the supremacy of the Omega ratio by stating that the Omega is superior to both the Sharpe and Sortino ratio.

The above-mentioned comparison between the different performance measures highlights the importance of each ratio as part of the overall analysis. The Omega ratio exhibits some distinct characteristics, and subsequently, the findings obtained with the use of the Omega ratio will carry a greater weighting in the conclusion.
Findings and discussion

Distribution statistics

The return distribution characteristics for the ETFs included in the study are presented in Tables 1 (South Africa) and 2 (United States). It is important to evaluate the descriptive statistics associated with each ETF and the market index to determine to what extent the return distributions compare with a normal distribution.

The negative skewness and high kurtosis values will cause any performance measures that rely heavily on the first two moments of the distribution to misrepresent the overall level of risk. Traditional performance measures such as the Sharpe ratio and Treynor ratio, therefore, need to be interpreted with caution. Results obtained by performance ratios (such as the Omega) that do incorporate higher order moments will deliver more consistent rankings (Eling & Schuhmacher 2007:2633). The descriptive statistics for the data set reveal that the assumption of normality does not hold for the period under review and as such requires a metric that incorporates the higher order moments of the distribution. The Omega ratio was identified as the superior ratio in this regard as it contains the ability to deliver consist ranking results at various levels of a return threshold.

Performance measurement

Table 3 and Table 4 provide a summary of the performance measurement ranking obtained from the selected ETFs during the period under review. The Sharpe ratio analysis provided a means to compare the ETF indexation methodologies on a risk-adjusted basis. The use of standard deviation as the risk measure delivered results that incorporated total risk into the computation. For the SA sample, it was indicated that the rankings of the Sharpe ratios were consistent with the absolute return rankings. Fundamentally weighted ETFs were dominant, whilst the equally weighted ETF ranked poorly. For the US sample, the risk-adjusted rankings of the Sharpe ratio differed considerably from the absolute return rankings, which indicated that the equally weighted ETF was most affected by the risk adjustment. The leveraged ETF category revealed risky characteristics and significantly poor risk-adjusted rankings.

TABLE 1: Descriptive statistics for SA market ETFs.

<table>
<thead>
<tr>
<th>Market</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Standard deviation</th>
<th>Skewness</th>
<th>Excess kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSE Top 40 Index</td>
<td>0.0006</td>
<td>0.0010</td>
<td>0.0414</td>
<td>-0.0338</td>
<td>0.0104</td>
<td>-0.1541</td>
<td>1.2421</td>
</tr>
<tr>
<td>ETF U</td>
<td>0.0006</td>
<td>0.0010</td>
<td>0.0416</td>
<td>-0.0341</td>
<td>0.0105</td>
<td>-0.1662</td>
<td>1.2491</td>
</tr>
<tr>
<td>ETF V</td>
<td>0.0006</td>
<td>0.0013</td>
<td>0.0387</td>
<td>-0.0385</td>
<td>0.0107</td>
<td>-0.2383</td>
<td>1.0594</td>
</tr>
<tr>
<td>ETF W</td>
<td>0.0006</td>
<td>0.0000</td>
<td>0.2454</td>
<td>-0.1846</td>
<td>0.0178</td>
<td>1.8515</td>
<td>76.2768</td>
</tr>
<tr>
<td>ETF X</td>
<td>0.0006</td>
<td>0.0012</td>
<td>0.0471</td>
<td>-0.0481</td>
<td>0.0096</td>
<td>-0.1833</td>
<td>2.0936</td>
</tr>
<tr>
<td>ETF Y</td>
<td>0.0006</td>
<td>0.0012</td>
<td>0.0349</td>
<td>-0.0326</td>
<td>0.0105</td>
<td>-0.0510</td>
<td>0.6980</td>
</tr>
<tr>
<td>ETF Z</td>
<td>0.0004</td>
<td>0.0000</td>
<td>0.0991</td>
<td>-0.1119</td>
<td>0.0139</td>
<td>-0.3860</td>
<td>14.8989</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors

TABLE 2: Descriptive statistics for US market ETFs.

<table>
<thead>
<tr>
<th>Market</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Standard deviation</th>
<th>Skewness</th>
<th>Excess kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500 Index</td>
<td>0.0005</td>
<td>0.0007</td>
<td>0.0474</td>
<td>-0.0666</td>
<td>0.0103</td>
<td>-0.4768</td>
<td>5.2160</td>
</tr>
<tr>
<td>ETF A</td>
<td>0.0006</td>
<td>0.0008</td>
<td>0.0465</td>
<td>-0.0652</td>
<td>0.0102</td>
<td>-0.5000</td>
<td>4.9624</td>
</tr>
<tr>
<td>ETF B</td>
<td>0.0006</td>
<td>0.0009</td>
<td>0.0448</td>
<td>-0.0641</td>
<td>0.0102</td>
<td>-0.4710</td>
<td>4.6956</td>
</tr>
<tr>
<td>ETF C</td>
<td>0.0006</td>
<td>0.0009</td>
<td>0.0516</td>
<td>-0.0648</td>
<td>0.0103</td>
<td>-0.4742</td>
<td>5.3082</td>
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<tr>
<td>ETF D</td>
<td>0.0006</td>
<td>0.0013</td>
<td>0.0507</td>
<td>-0.0709</td>
<td>0.0105</td>
<td>-0.5241</td>
<td>5.3333</td>
</tr>
<tr>
<td>ETF E</td>
<td>0.0006</td>
<td>0.0010</td>
<td>0.0513</td>
<td>-0.0732</td>
<td>0.0114</td>
<td>-0.5021</td>
<td>5.0418</td>
</tr>
<tr>
<td>ETF F</td>
<td>0.0006</td>
<td>0.0008</td>
<td>0.0364</td>
<td>-0.0553</td>
<td>0.0094</td>
<td>-0.5087</td>
<td>3.8237</td>
</tr>
<tr>
<td>ETF G</td>
<td>0.0011</td>
<td>0.0015</td>
<td>0.0934</td>
<td>-0.1287</td>
<td>0.0205</td>
<td>-0.4973</td>
<td>5.0574</td>
</tr>
<tr>
<td>ETF H</td>
<td>-0.0012</td>
<td>-0.0016</td>
<td>0.1290</td>
<td>-0.0948</td>
<td>0.0205</td>
<td>0.4718</td>
<td>5.0142</td>
</tr>
<tr>
<td>ETF I</td>
<td>0.0017</td>
<td>0.0025</td>
<td>0.1430</td>
<td>-0.1970</td>
<td>0.0310</td>
<td>-0.5027</td>
<td>5.1318</td>
</tr>
<tr>
<td>ETF J</td>
<td>-0.0019</td>
<td>-0.0027</td>
<td>0.2021</td>
<td>-0.1507</td>
<td>0.0311</td>
<td>0.5109</td>
<td>5.3641</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors

TABLE 3: SA ETFs – Overall summary.

<table>
<thead>
<tr>
<th>Ranking key</th>
<th>Best</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Worst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual compound returns</td>
<td>Fundamental</td>
<td>Fundamental</td>
<td>Index</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
</tr>
<tr>
<td>Sharpe</td>
<td>Fundamental</td>
<td>Fundamental</td>
<td>Index</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
</tr>
<tr>
<td>Treynor</td>
<td>Market cap</td>
<td>Fundamental</td>
<td>Fundamental</td>
<td>Market cap</td>
<td>Index</td>
<td>Market cap</td>
</tr>
<tr>
<td>Calmar</td>
<td>Index</td>
<td>Fundamental</td>
<td>Market cap</td>
<td>Fundamental</td>
<td>Market cap</td>
<td>Market cap</td>
</tr>
<tr>
<td>Sortino</td>
<td>Fundamental</td>
<td>Fundamental</td>
<td>Index</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
</tr>
<tr>
<td>Information</td>
<td>Fundamental</td>
<td>Fundamental</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
</tr>
<tr>
<td>Omega (+RFR threshold)</td>
<td>Fundamental</td>
<td>Index</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Fundamental</td>
</tr>
<tr>
<td>Omega (-RFR threshold)</td>
<td>Index</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Market cap</td>
<td>Fundamental</td>
<td>Fundamental</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors
The Treynor ratio analysis incorporated beta as the risk measurement. The analysis of the ETF indexation categories on the basis of their systematic risk characteristics proved to deliver alternate rankings. The SA sample highlighted the importance of beta values, as market cap–weighted ETFs ranked better when compared with the Sharpe rankings. A noticeable difference between the Treynor and Sharpe rankings exemplified the existence of higher levels of unsystematic risk in alternatively indexed ETFs. Inverse leveraged ETFs provided misleading results during the US Treynor analysis. The negative beta values and negative excess returns of this category skewed results in favour of inverse leveraged ETFs. However, the close similarity between the Treynor and Sharpe rankings was a noticeable observation in the US sample. The improved diversification within the US sample, as indicated by this finding, could have resulted from the relatively large number of underlying securities included in the US ETF index.

The Sortino rankings obtained from the SA sample showed inconsistent results to the Sharpe and Treynor rankings. In general, fundamentally weighted ETFs proved to outperform relative to other ETF categories, with some noticeable outliers observed for the market cap–weighted category. The downside risk measure used during the Sortino analysis penalised those ETFs that showcased a severely skewed data distribution. The significantly skewed distributions of leveraged ETFs in the US sample subsequently were affected greatly as these ETFs delivered poor Sortino rankings. The inclusion of the Calmar ratio in the study allowed for a measure to capture the extreme downturn of the ETF returns. The examination of a predominant bull market phase of the economy in the study, however, nullified the true benefit of the Calmar ratio. The Calmar ratio rankings for both the US and SA market provided mixed results, with no clear ranking of ETF categories.

The importance of tracking errors led to the inclusion of the Information ratio into the performance evaluation. Comparisons in the SA ETF market showed that fundamentally weighted ETFs performed better when compared to alternative indexation methodologies. The US sample showed contrasting results as market cap–weighted ETFs outperformed when analysing the Information ratios. The importance of the number of securities in the underlying index, the beta values of the ETFs and the impact these factors have on the tracking errors were combined factors that create such differences between the various samples. Leveraged ETFs, as measured in the US sample, delivered good ranking results after adjusting tracking errors for the leveraged factor.

The Omega ratio was the decisive performance ratio for the study, as it exhibited unique characteristics that allowed the incorporation of higher order moments of the return distributions. The Omega ratio was considered at both a positive (positive value of the risk-free rate) and negative (negative value of the risk-free rate) threshold level. The separation between the threshold levels was made to illustrate the change in rankings that resulted from the respective threshold levels. Fundamentally weighted ETFs were shown to possess the ability to deliver an outperformance of alternatively indexed ETFs when returns were positive, as was indicated by the positive threshold level in the SA sample. Similarly, the US sample illustrated that leveraged ETFs, with the support of the significant benefits that they hold, could deliver substantial outperformance when returns were positive.

The negative Omega threshold analysis provided the most significant finding of the study. Analysis of a negative threshold level allowed for the riskiness of each ETF category to be evaluated. Rankings obtained from the negative Omega threshold analysis delivered significantly altered rankings compared to other performance measures. In the SA sample, the market cap–weighted ETFs dominated and proved to be the preferred ETF indexation category when considering negative returns. The US sample delivered similar results and also proved the market cap–weighted ETFs to be superior. Leveraged ETFs performed poorly when analysed on a negative return threshold basis. The high number of negative returns in the data series of leveraged ETFs had a severe impact on the rankings of both long- and short-leveraged ETFs.
Conclusion

Based on the risk-adjusted performance measurements in the study, the following key conclusions can be made. Fundamentally weighted ETFs can be seen to be performing better when analysed with standard performance metrics that do not incorporate the distribution characteristics of returns. During a market upswing, measures such as the Sharpe ratio, Treynor ratio, Sortino ratio and Calmar ratio, which do not incorporate all moments of the distribution function, can show preferential results for fundamentally weighted ETFs. The Omega ratio holds the ability to capture higher order moments for the distribution of returns. This conveys alternative rankings of the indexation categories, particularly when analysed at a negative threshold level. Market cap–weighted ETFs can be said to hold lower levels of risk than all other ETF categories when measured by a negative Omega threshold. Leveraged ETFs hold the capacity to deliver substantial returns, but significant risks are linked to improved returns. A strong upward trending market does not present favourable conditions for the performance of equally weighted ETFs, in comparison to alternatively indexed ETFs.

Future research could include a comparison of ETF diversification with a measurement such as the principal component analysis, which is not dependent on the existence of a true market portfolio. The data frequency and observation period are other noteworthy areas of future improvement for the study. With restricted historical data availability for some fundamentally weighted ETFs, the study was reduced to the most recent three-year period. Extension of the time period would allow for analysis beyond that of an ordinary bull market phase. Inclusion of data from multiple countries could further enhance the robustness of the findings. However, in the present moment, in consideration of the available time frame and data, the study proved successful in its findings. At the time of writing, two new fundamentally weighted ETFs were being launched into the SA market, which indicated the continuous innovation in the SA ETF market. The study, however, highlights that such developments bring with it unique risks that justify thoughtful adoption of alternative ETFs into a portfolio.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors’ contributions

W.P.(North-West University)and A.M.(North-West University) contributed equally to the writing of this article.

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