Value Weighted vs. Equally Weighted Portfolios

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Abstract: Passive investment has become more popular over the last two decades. This investment strategy has attracted a significant proportion of equity assets. So far, cap-weighted equity indices have played a dominant role within the paradigm of passive investment. However, cap-weighted indices have been criticised for placing too much concentration on individual large-cap stocks and dominant industries. This study examines whether industry diversification enhances the portfolio return in the context of a small market that is heavily concentrated with a few industries. The results indicate that industry-neutral portfolios improve industry diversification and achieve a more desirable performance attributes, after adjusting for risks and transaction costs. The findings suggest that investors selecting industry-equal weighting in place of cap-weighting could gain significantly higher returns without being exposed to excessive risks.

Keywords: passive investment, diversification, equally weighted portfolio

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1. Introduction

The performance of passive indexing has long been argued to be superior to that of active investment management (Bogle, 1996; Malkiel, 2003; Sharpe, 1991). Offering investors an investment opportunity with low fees, reliable performance relative to their active strategies counterpart, and broad exposure to the stock market, passive strategies have attracted an increasing proportion of equity assets (Amenc, Goltz and Le Sourd, 2009; Branch and Li, 2010; Siegel, 2006). Within the paradigm of passive investment, capitalization-weighted equity indices have, until recently, played a dominant role (Arnott, 2006). The inception of cap-weighted indices could be dated back to Sharpe (1964) and Lintner (1965) with their introduction of the Capital Asset Pricing Model (CAPM). The CAPM has theoretically shown that the value-weighted market portfolio is a mean-variance efficient portfolio that is optimal to all investors. Consequently, cap-weighted indices, such as the S&P 500 or ASX 200, have become increasingly important as passive investment options and as benchmarks to assess the added values of other investment alternatives (Mar et al., 2009; Tabner, 2009).

However, in recent times, the largely unchallenged premise of the CAPM has been considerably questioned in the literature. The optimality of a cap-weighted market portfolio was derived based on several oversimplifying assumptions, including 1) minimum market frictions, 2) investors being mean-variance optimizers, 3) homogeneity in investors' beliefs when deriving the return distribution of securities and 4) unlimited borrowing and lending at the risk-free rate (see Sharpe (1964)). If all but the last assumption is unaltered, then it follows that the market portfolio is no longer efficient (Markowitz, 2005). In fact, it has been empirically shown that the returns of cap-weighted indices lied below the efficient frontier (Haugen and Baker, 1991; Hsu, 2006). In the light of the recent empirical evidence on the sub-optimality of cap-weighted indices and the increasing demand for index funds, it is desirable for both researchers and practitioners to consider alternative indexation methodologies.

An indexing mechanism that has recently been regarded as a "revolution" to stock market indexation is fundamental indexing (Siegel, 2006). Advocates of fundamental indexation propose that indices formed based on the market capitalisation of stocks would inherently incur the risk of overweighting the expensive stocks and underweighting the undervalued stocks (see Arnott, Hsu & Moore (2005) and Treynor (2005)). This causes a "performance drag" of cap-weighted indices relative to other "market-value indifferent" indices. These indices weight stocks based on metrics related to their fundamental values. Empirically, a growing body of the literature has documented evidence in favour of fundamental indices (Branch and Li, 2010; Houwer and Plantinga, 2009; Walkshäusl and Lobe, 2010). Furthermore, the industry demand and supply for fundamental indices have shown remarkable growth in the last few years (Amenc, Goltz and Le Sourd, 2009; Jun and Malkiel, 2007)[2].

Notwithstanding the recent success, fundamental indices are far from being indisputable. Critics of fundamental indexation demonstrate that fundamental indexing is effectively an active investment strategy, and that the outperformance of fundamental indices may not be persistent in the long-term (Amenc, Goltz and Le Sourd, 2009; Perold, 2007). Besides, even though the evidence suggests that investors would benefit from a "value-indifferent" weighting scheme, no theoretical guidance has been provided with regard to how to choose an optimal alternative. Furthermore, it has been argued that the underlying theory supporting fundamental indexation is essentially flawed (Perold, 2007).

The debates around cap-weighted and fundamental indexing thus far mostly focus on features such as the risk-return performance, liquidity and capacity of the indices. Little emphasis has been paid to the last important facet of index investment, that is, broad diversification. Investors are attracted to passive investment management for several reasons, one of which is the exposure to the broad

[2] Jun and Malkiel (2007) documented that fundamental indices attracted over $10 billion of asset under management within a period as short as 2 years during the 2000s.

stock market, which is the key to reducing diversifiable risks. Within the context of the Australian stock market, there has been evidence that both the cap-weighted S&P ASX 200 and the recently created fundamental indices are significantly concentrated. Out of ten industry sectors, Basic Materials and Financial sectors make up more than 50% of the components of these indices (Mar et al., 2009). Similar patterns are also documented in the U.S. market (see Amenc, Goltz & Le Sourd (2009)). A strong tilt towards a few particular industries potentially exposes investors to industry-specific risks, especially in extreme market conditions with the tech-bubble being a vivid example. Overall, the evidence suggests that existing indices in fact do not fulfill their objectives of providing investors with the best-possible diversified investment portfolio. This could also be a potential underlying cause for the deficiency of cap-weighted indices documented in the literature thus far.

This raises the question as to whether there exists an alternative weighting-scheme that provides passive investors with both better exposure to the broad stock market and superior performance to the prominent S&P ASX 200. This study explores this question by examining the performance of *industry* equally weighted indices for the period April 2001 to November 2010 in the context of the Australian equity market. Existing literature has explored the concept of equally weighted indexation with the aim of lessening the concentration of current cap-weighted indices in a few individual stocks. However, these indices are subject to several criticisms regarding their capacity (Dash and Loggie, 2008) and their performance during periods of market stress (Tabner, 2009). As opposed to the basic equal weighting scheme, this study takes a different approach to form indices that are industry neutral, in order to not only preserve the benefits of cap weighting, but also achieve superior performance, at least over the sample period.

This study finds that, relative to conventional cap-weighted indices, industry neutral portfolios improve industry diversification, evident in more desirable performance attributes, after adjusting for risks and transaction costs. Investors opting to industry equal weighting in place of cap

weighting could achieve significantly higher returns without being exposed to excessive risks. The underlying argument for this paper is that equal weighting overcomes the over-concentration inherent in the commonly used cap-weighted indices, thus resulting in indices that are *potentially closer* to the efficient frontier. Section 2 of the paper examines the relevant literature. Section 3 outlines the methodology and data. Section 4 analyses the average and time-series performance of industry equally weighted portfolios. A summary of the findings and suggestions for future research are outlined in section 6.

2. Literature Review

2.1. Value-Weighted Indices

The CAPM theoretically justifies capitalisation weighting as the optimal weighting mechanism for market benchmark indices. Within the framework of the CAPM, there is only one optimal mean-variance efficient portfolio, namely, the "market portfolio" (see Sharpe (1964) and Lintner (1965)). The market portfolio is optimal in that it offers investors the highest return given the associated risk. Theoretically this portfolio consists of all risky assets in the market, with their weights being proportional to their market values. There have been countless attempts at constructing sufficient proxies for the CAPM market portfolios, majority of which thus far have been value-weighted.

Not only is capitalization weighting theoretically justified but it is also renown for numerous practical merits (Arnott, Hsu and Moore, 2005; Perold, 2007). It provides passive investment options that mostly consist of highly liquid stocks and requires little trading, necessitating low transaction costs and management fees. Cap-weighted indices, such as the S&P 500 or ASX 200, offer passive investors broad exposure to equity markets, allowing individuals to enjoy the maximal diversification benefits. More importantly, cap-weighted strategies, with their high investment capacity, could be easily followed by most investors. These favorable facets necessitate the

popularity of value-weighted indices in the investment industry, evident in the increasing growth in asset under management of the existing index funds (Amenc, Goltz and Le Sourd, 2009; Branch and Li, 2010).

Notwithstanding a sound theoretical rationale, value-weighted indices have been subject to harsh criticisms in recent times (see Arnott, Hsu & Moore (2006) and Hsu (2006)). Not only is the CAPM based on several oversimplifying assumptions, it also heavily relies on the perception of financial markets being efficient. If the market is inefficient, evident in the increasing number of market anomalies documented in the literature, capitalization weighting could well underperform other weighting schemes (Hsu, 2006). More importantly, it has been demonstrated that capitalisation weighting offers suboptimal and inefficient investment options (Haugen and Baker, 1991; Roll and Ross, 1994). In light of these criticisms, numerous alternative weighting mechanisms have been explored and are reviewed in the following sections.

2.2. Fundamental Indexation

Fundamental indexation originates from a finance theory dubbed the "noisy market hypothesis", in which prices do not always accurately reflect the underlying fundamental values of securities. The noise embedded in the market values of equities essentially lead to random overpricing and underpricing. If stock prices were determined in accordance with the Efficient Market Hypothesis, then market value would be the best indicator for the fundamental value of a company. However, with the presence of pricing noise, it has been demonstrated that market prices are insufficient to measure a company's fair value, necessitating the sub-optimality of cap-weighted portfolios (Arnott, Hsu and Moore, 2005; Siegel, 2006). Subsequently, advocates of fundamental indexation have attempted to capture the size of a company by using different indicators for fundamental values in place of market prices. The commonly used metrics for fundamental weighting

mechanism include book value, cash flow, revenue, dividends, employment, smoothed market capitalization, or composites of these metrics.

The construction of fundamental indices preserves the major beneficial features of value-weighted indices, including high liquidity, reasonably low turnover, low transaction costs and great investment capacity (Arnott, Hsu and Moore, 2005). The outperformance of fundamental indexation relative to cap-weighted indices has been widely documented in the recent literature. Arnott, Hsu and Moore (2005) and Branch and Li (2010) document an outperformance of approximately 0.3 to 2 percentage points per year of alternative fundamental indices relative to the cap-weighted S&P 500. This outperformance is robust to transaction costs and consistent over time and across different market conditions. Additionally, evidence supporting the outperformance of fundamental indices has been documented in different international markets (see Hemminki and Puttonen (2008), Walkshäusl and Lobe (2010) and Houwer and Plantinga (2009)).

However, the concept of fundamental indexation has been highly debatable. Not only is the logic underlying the inception of fundamental indexation proven to be flawed (Perold, 2007), but the outperformance of fundamental indices also appears to be highly questionable. Walkshäusl and Lobe (2010) show that evidence of outperforming fundamental indices is not robust to bootstrap testing and controlling for data snooping biases. Furthermore, it has been argued that fundamental indexation is essentially an active investment with a value tilt, and that after accounting for the value premium, the outperformance of fundamental indices diminishes significantly (Blitz and Swinkels, 2008; Jun and Malkiel, 2007; Mar et al., 2009; Walkshäusl and Lobe, 2010). More importantly, Blitz and Swinkels (2008) propose that fundamental indexation does not resemble a passive strategy in that it entails numerous subjective choices with regard to the underlying fundamental metrics and their construction. Thus far, little guidance has been provided to shed light on the construction of an optimal fundamental index.

2.3. Equally Weighted Indices

The practice of value-weighted indexation is likely to suffer from portfolio concentration (Maillard, Roncalli and TeÏLetche, 2010), with the Australian market being a vivid example (Mar et al., 2009). Even the recently growing fundamental indices appear to be heavily concentrated in a few large companies (see Mar et al. (2009) A simple solution to improve the diversification of a portfolio is to follow a "naïve diversification" approach, which assigns equal weights to all assets in the portfolio. The problem of over-concentration in the major cap-weighted indices has led to the inception of numerous versions of equally weighted indices or indices with "capped weights", i.e. indices in which the weight of individual stock is capped at a certain level (Tabner, 2009). These benchmark indices were launched largely to provide investment options with better diversification and lower volatility.

Treynor (2005) demonstrates that a simple equal weight mechanism possesses the most important feature of fundamental indexation, that is, reducing the overweighting of overvalued stocks and increasing the underweighting of undervalued stocks. Additionally, Dash and Loggie (2008, p.1) proposes that equally weighting "randomizes factor mispricing, and is thus an attractive (investment) option". McQuarrie (2008) perceives equal weighting as a challenge and a "rival approach" to both cap-weighted and fundamental indices. Equal weighting is perceived to be a simple alternative to cap-weighted indices for its ease of implementation and little requirement of additional information. McQuarrie (2008) subsequently shows that equally weighted indices are better investment options in terms of performance, relative to both value-weighted and fundamental indices. The outperformance of equally weighted indices over cap-weighted indices in an international context, after controlling for transaction costs, is again confirmed in Branch and Li (2010), Neukirch (2008), and Dash and Loggie (2008). However, a simple equal weight approach suffers from various counter arguments that mainly focus on its capacity and liquidity (Arnott, Hsu

and Moore, 2005), even though it has been argued that these theoretical criticisms do not pose such a challenging hurdle in practice (Dash and Loggie, 2008).

Previous literature has examined equal weighting with the objective of lessening individual stock concentration in some of the most commonly used cap-weighted indices. This article explores equal-weighting indexation from a different perspective that focuses on the cross-industry-sector diversification of the portfolio. The Australian equity market, with its heavy concentration in the Financial and Basic Materials sectors, makes an excellent setting for our study. In order to overcome the main disadvantages of equal weighting documented in the literature, this article takes equal weighting to a different level, in which, combined with different sets of industry and stock selection criteria, an equally weighted index not only preserves the strengths of a passive investment strategy, but also offer a broader diversification and greater increment in performance relative to its counterpart value-weighted indices.

3. Data and Methodology

3.1. Data

The dataset utilized in this study is sourced from the Datastream database. Our analysis examines a sample period of more than nine years, from April 2001 to November 2010. The main objective of this study is to compare the performance of our industry equally weighted indices with that of the most commonly used value-weighted index, the S&P ASX 200. Therefore, the beginning date of the sample period is largely defined by the availability of data related to the S&P ASX 200 in Datastream. The ending date is chosen in order to enable an assessment of the performance of our industry equally weighted indices during the recent financial turmoil. Only stocks that are part of the S&P ASX 200 constituent list can be included in our industry equally weighted indices. If a stock leaves the S&P ASX 200 then it is liquidated at the next rebalancing period. The industry and

stock selection criteria of our indices require that, for each stock, data relating to its industry classification, past 12-month performance, market capitalisation and a size-related measures, including dividend yield and price-earnings values, be collected. Our industry equally weighted indices are to be rebalanced every 3 months. Therefore, for each stock, the returns over the next 3 months are also required. Stock prices are adjusted for dividend payments, stock splits, and any other company event-driven mechanism that would affect share listings. In addition to individual stock data, we require market capitalisation and past 12-month performance data of each industry, as well as the returns of the S&P ASX 200 and the risk-free rate, proxied by the 3-month interbank offered rates, over the sample period.

3.2. Index construction

This study aims to construct well-diversified equally weighted portfolios that are industry neutral in terms of dollars held in proportion of the portfolio. We assess the performance of numerous indices that are equally weighted by industry sectors. The index construction process necessitates a set of selection criteria for both industry sectors and individual stocks within each sector to be included in the portfolios. This study employs passive selection criteria that are easy to understand and follow in order to illustrate the superior characteristics of our industry equally weighted indices. The industry sectors included in our indices are selected on the basis of their market capitalisation or past 12-month performance. Periods other than 12 months such as 3 months and 6 months have also been employed to select the industry leaders and the results are quantitatively similar. However, it is suggested that employing a longer period of 12 months would reduce the possibility of industry sectors turning over in the indices, thus resulting in lower turnover of industry sectors and stocks in our portfolios.

Once the industry sector constituents are established, individual stocks within each sector are determined on the basis of their market capitalisation, past 12-month performance, dividend yield or price-earnings ratios. Since low liquidity is characteristics of Australian stocks with small

capitalisation, our selection criteria aim to not only improve the diversification but also maintain the liquidity of the standard value-weighted indices. Consequently, our selection criteria select stocks that are leaders in an industry in terms of past performance, or stocks with the largest size or other size-related metrics. Market capitalisation is chosen as the major selection metric to illustrate that without diminishing the mechanism and capacity of value weighting, via a weighting scheme that allocates neutral weights to industry sectors, our equally weighted indices exhibit favourable performance features. The leaders in terms of performance in each industry sector are chosen as a mechanism to pick stocks with reasonably high liquidity. Price-earnings and dividend yield are two fundamental metrics chosen arbitrarily mainly to demonstrate that equal weighting scheme, despite the underlying stock selection mechanism, is always superior to the conventional value weighted indices.

The number of industry sectors and stocks in each sector varies from 4 to 8 sectors and 4 to 12 stocks per sector. It is noted that this study does not aim to establish an optimal equal weighting mechanism. The numbers of sectors and stocks are set as a variable to establish that once industry-specific related risks are better diversified away, *any* equally weighted index would perform better than the commonly used S&P ASX 200. Theoretically our industry neutral indices could include up to 10 industry sectors. However, since some sectors are too small in terms of size and number of stocks, the number of industries included in our portfolios is capped at 8 sectors. In terms of market capitalisation, dividend yields and price-earnings, the constituent list is determined by the last reported values of each metric at the beginning of every rebalancing period. For example, an index consisting of 4 sectors based on size and 12 stocks based on price-earnings would be determined as following. At the beginning of each rebalancing period, all the industry sectors are independently ranked according to their market capitalisation. The 4 largest industry sectors are then selected, with their weights being equal in our index. Subsequently, all the stocks within each of these sectors are then ranked based on their price-earnings. In each sector, the 12 stocks with highest price-earnings

become part of the constituent list. In the case of past performance, our indices select the top sector and stock leaders using the past 12-month total returns. Even though an equal weighting mechanism is straightforward, it is important to emphasize that for each rebalancing period, our indices are designed to hold the same amount of capital in each industry; however, the same is not true for the stocks in each industry. Since only stocks that are part of the S&P ASX 200 are to be included in our indices, for relatively *small* industries, there may not be a sufficient number of stocks available. In this case, more money could be placed in a single stock than for stocks within an industry with more stocks listed on the S&P ASX 200.

In determining the rebalancing frequency, we aim to balance the tradeoff between increasing index turnover and maintaining the equal weight mechanism. Since the main objective of this study is to assess the performance of industry equally weighted indices against the traditional S&P ASX 200, we employ a re-balancing frequency of 3 months, which is also the standard practice of the benchmark S&P ASX 200. The results in this article focus on a balancing frequency of 3 months, or every quarter. It is noted that we do not aim to adjust for the actual trading costs in the index construction. However, we do examine the impact of a 0.3% (per transaction) transaction costs. The literature suggests that it is possible for institutional investors to take advantage of significantly low commissions than this[3].

Our indexation methodology is more than simply replacing the value-weighting mechanism with an equal weighting scheme, as has been explored in the existing literature. If we simply re-weight the stocks in the constituent list of the S&P ASX 200, we achieve only little in terms of resolving the concentration of the S&P ASX 200 in the Basic Materials and Financial sectors. In order to illustrate this argument, a simple equally weighted index that attributes equal weights to the

[3] See for example Bertkowitz, Logue and Noser (1988), which stated that one-way transaction costs for institutional investors were as low as 23 basis points.

constituents of the S&P ASX 200 is also formed over the sample period. The performance of our "industry neutral" indices is then assessed against both the value-weighted S&P ASX 200 and this simple equally weighted index.

3.3. Methodology

In order to assess the relative performance of different indices, this study employs their total returns, i.e. returns that are computed based on the beginning and ending values of individual indices, over the holding period. The utilization of dividend-adjusted prices accounts for dividend yield when computing total returns. The annualized geometric returns of numerous equally weighted portfolios, calculated based on their total holding period returns, are subsequently compared to that of the benchmark index (the S&P ASX 200). Such comparison enables a primary assessment of the relative performance of our industry equally weighted indices.

A simple analysis of relative performance fails to take into account the exposure to systematic risk of the industry equally weighted indices. Any outperformance of the equally weighted portfolios could simply be the results of their additional risk taking in relation to the S&P ASX 200. In order to address the issue of risk-adjusted performance, this study employs the traditional risk-adjusted performance indicators, including the Sharpe's (1966) measure and Jensen's (1968) alpha.

Sharpe ratio, also termed reward-to-variability, measures the excess returns per unit of risk. This measure demonstrates the degree to which the indices compensate investors for taking the risk associated with the investment.

$$\text{Sharpe ratio (S)} = \frac{R_i - R_f}{\sqrt{Var(R_i - R_f)}} \quad (1)$$

where,

R_i is the return of index *i*

R_f is the risk-free rate, proxied by the 3-month interbank offered rates

$\sqrt{Var(R_i - R_f)}$ is the standard deviation of the excess return of index *i*

The Sharpe ratios of our industry equally weighted indices are compared to that of the benchmark as a mechanism to assess their risk-adjusted performance.

Jensen's alpha is determined based on the CAPM (see Sharpe (1964) and Lintner (1965)). This study employs daily data in the regression estimating Jensen's alphas of the equally weighted indices.

$$R_{it} - R_{ft} = \alpha_{it} + \beta_i(R_{Mt} - R_{ft}) + \varepsilon_{it} \quad (2)$$

where,

R_{it} is the daily return of index *i*

R_{ft} is the risk-free rate, proxied by the 3-month interbank offered rates

β_i measures the systematic risk of index *i*

The α_{it} equation (2) captures the Jensen's alpha of index *i*, that is, the abnormal return of index *i* that cannot be explained by the CAPM.

Sharpe ratio and Jensen's alpha, however, are only characteristic of the average relative performance of our industry equally weighted indices over the sample period. They fall short of illustrating the time-series behaviour of the equally weighted indices relative to the value-weighted benchmark. Even though the equally weighted indices may outperform the value-weighted benchmark on average over the sample period, considerable period of underperformance may also occur. In order to evaluate the robustness the results, this study also conducts a time-series analysis of the relative performance of the industry equally weighted indices. Based on the time-series analysis, this study estimates the longest period of time over which the equally weighted indices underperform the S&P ASX 200 and the corresponding underperformance accumulated during this period. From an investment perspective, this indicates the potential risk an investor may have to sustain when investing in industry equally weighted indices, that is, the risk of having to go through significant periods of substantial underperformance in relation to the value-weighted benchmark.

4. Relative Performance of Industry Equally Weighted Indices

4.1. Industry Attribution of The S&P ASX 200

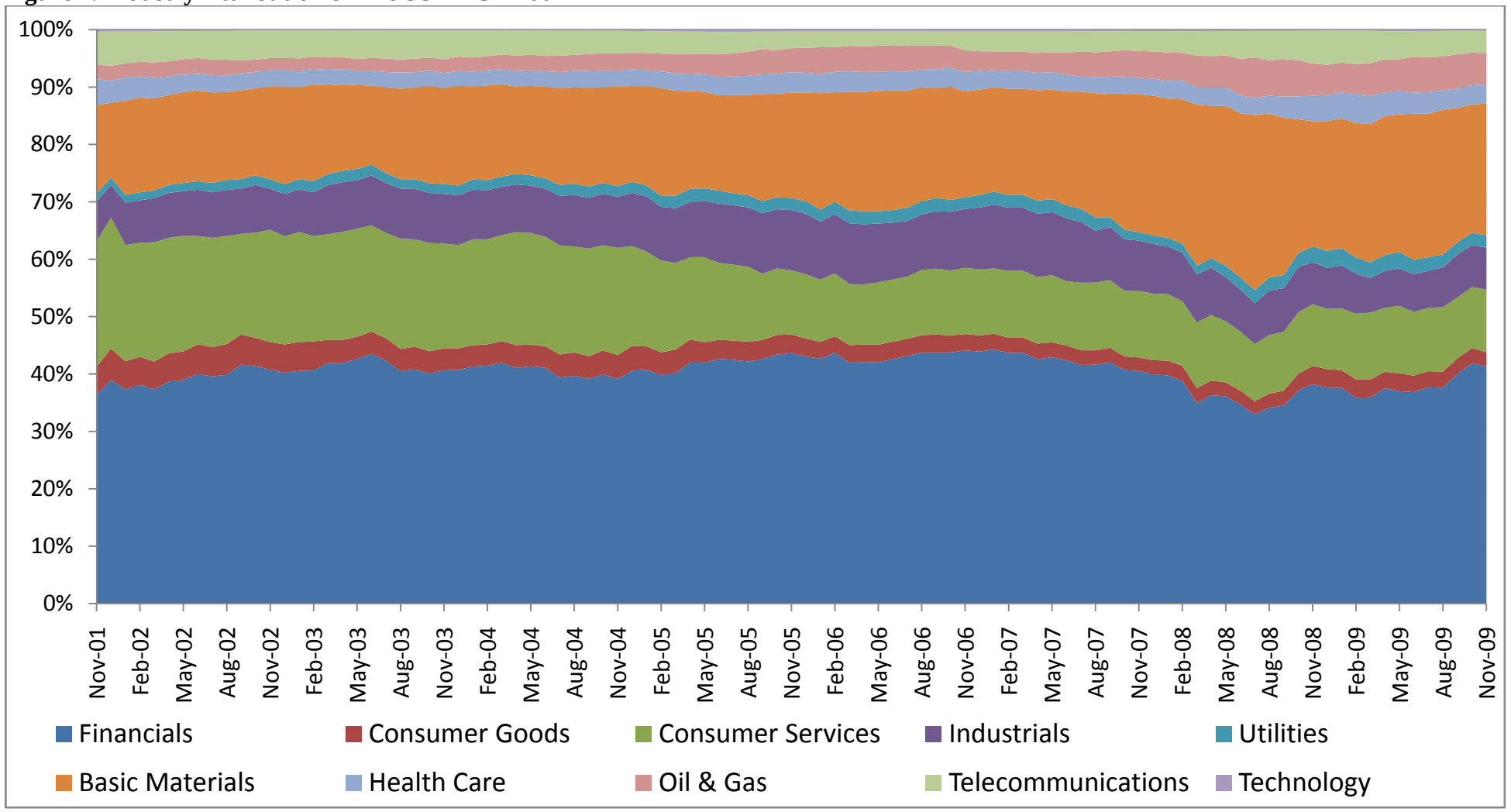
Figure 1 displays the times-series industry attribution of the S&P ASX 200. Due to the availability of data, the analysis in this section was only conducted over the period from November 2001 to November 2009. The most striking observation from the graph is the heavy concentration of the S&P ASX 200 in the Financial sector. Over the sample period, this sector makes up of approximately 40% of the S&P ASX 200. The proportion of the S&P ASX 200 allocated to Basic Materials varies from approximately 15% to more than 20%. As a result, more than 60% of the S&P ASX 200 consists of stocks from only two sectors, Financials and Basic Materials. Industry sectors such as Consumer Goods, Utilities, Telecommunications, Oil & Gas and Health Care receive little attribution significance. A closer examination of the statistics reviews that together these five industry sectors on average account for as little as 16% of the S&P ASX 200. Even though similar concentration has been documented in other majors cap-weighted indices such as the S&P 500 (see Amenc, Goltz and Le Sourd (2009)), a relative comparison shows that the problem of over concentration in a small market like the Australian market is by far considerably more severe. Low level of industry diversification renders the cap-weighted S&P ASX 200 susceptible to industry-specific risks, in this case, mostly to risks that are associated with the Financials and Basic Materials sectors.

In order to better demonstrate the over-concentration issue of the S&P ASX 200, Figure 2 plots the volatility of the S&P ASX 200 from November 2001 to November 2009, as measured by rolling annualized standard deviations computed using daily data. The two sectors dominating the S&P ASX 200 display reasonably high relative volatility, with Basic Materials being the sector with the third highest volatility over time. Sectors with the lowest volatility, such as Consumer Goods, Consumer Services and Oil & Gas, receive much less relative importance. Another interesting observation is the changes in the proportion of different industry sectors during the recent financial

turmoil. Years 2007 and 2008 experience considerable elevation in volatility of all industry sectors. During this period, an increasing proportion of the S&P ASX 200 is allocated to Basic Materials, one of the sectors with the highest hike in volatility. On the contrary, sectors such as Consumer Services and Consumer Goods with relatively insignificant changes in volatility experience slight cutback in terms of their proportion in the S&P ASX 200.

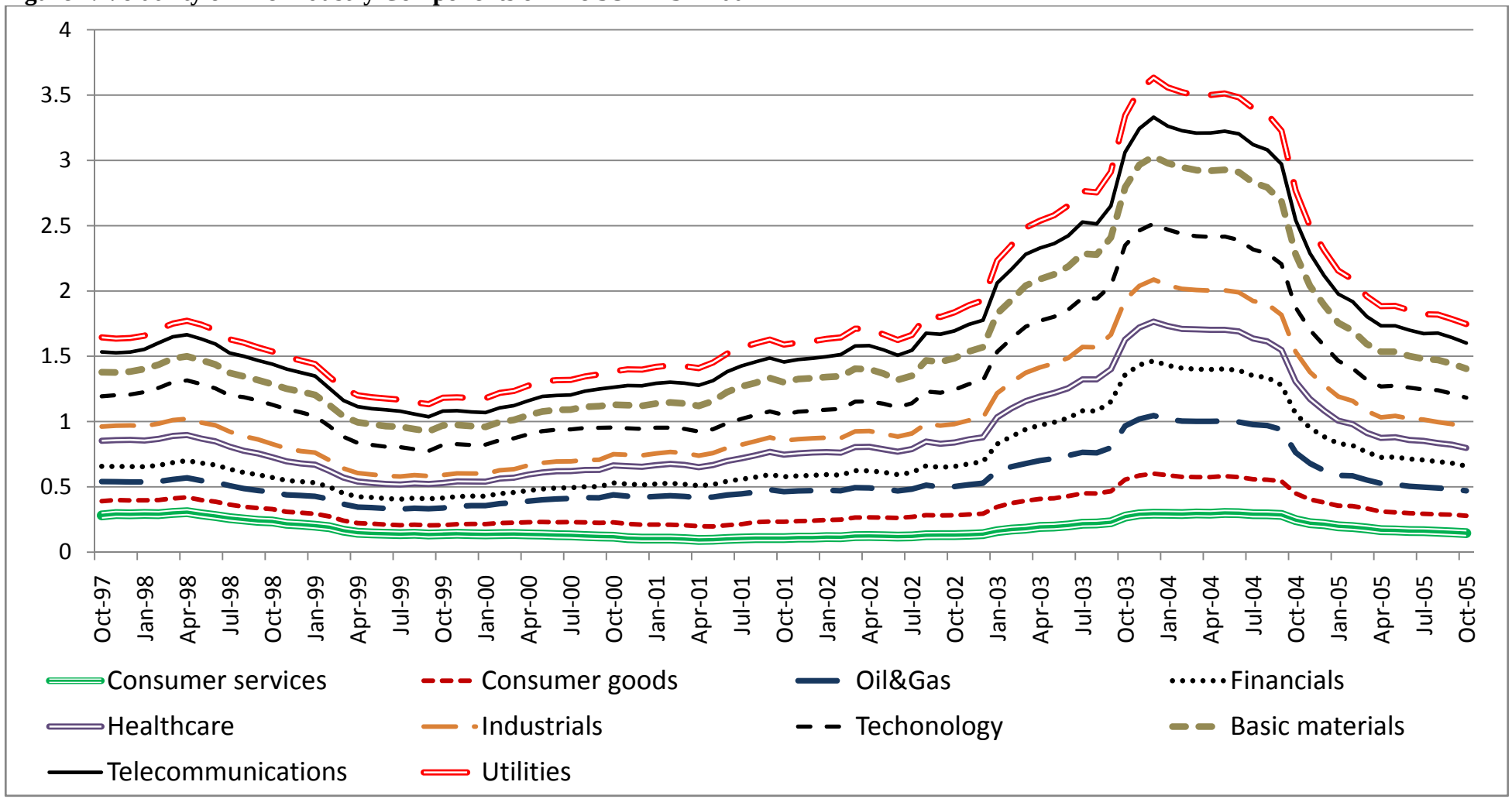
The evidence suggests that portfolios with better industry diversification features could potentially possess more favourable performance attributes relative to the traditional cap-weighted S&P ASX 200. It could be argued that an equally weighted index could suffer from high volatility of sectors such as Utilities and Telecommunications. However, it is proposed that a carefully designed and well-diversified index would not be susceptible to any industry-specific risk. It will not only overcome the over-concentration issue of the S&P ASX 200 but also preserve the practical merits of capitalisation weighting. The performance of industry equally weighted indices is analysed in the next sections.

Figure 1. Industry Attribution of The S&P ASX 200



This figure provides an overview of the industry attribution of the cap-weighted S&P ASX 200 over the period of November 2001 to November 2009. The weights of industry sectors are computed on a monthly basis.

Figure 2. Volatility of The Industry Components of The S&P ASX 200



This figure displays the volatility, as measured by rolling annualized standard deviations computed using daily data, of individual industry sectors over the period of November 2001 to November 2009.

4.2. Performance Measures of Industry Equally Weighted Indices

Table 1 presents the performance attributes of the industry equally weighted indices, in comparison to the benchmark S&P ASX 200. We only report the returns of the indices that equally weight the largest industries and the largest stocks in each industry sector, as well as returns of indices that equally weight the leading industries in terms of past 12-month performance and the leading stocks in each industry in terms of past 12-month returns. This section focuses on the results for the equally weighted portfolios using market capitalisation as the primary selection criterion in order to illustrate the superior attributes of the industry neutral benchmark portfolios while still preserving the mechanism of value weighting. We also assess the returns of the indices whose selection criterion is based on past performance of industries and stocks to demonstrate that our industry neutral indices could potentially generate considerably better performance through employing different metrics other than market value. Results for other indices, which employ dividend yield and price earnings as stock selection criteria, are quantitatively similar and reported in the Appendix.

Since the number of industries and the number stocks in each industry are set as variables, each of the selection criteria generates 60 equally weighted portfolios with different combination of number of industries and stocks. Table 1 reports the range of values of these portfolios for each of the performance measures (Jensen's alphas and Sharpe ratios). Over the sample period, the equally weighted indices consisting of the largest industry sectors and largest stocks in each sector could potentially generate a holding period return of 187.5%, after taking into account one-way transaction costs of 0.3%. This is significantly and economically superior to that of the value-weighted benchmark index, which returns a total of 117.25% over the sample period. It is noted that some of our portfolios underperform the S&P ASX 200, with the minimum holding period return being 108.47%. However, only 4 out of 60 equally weighted portfolios do not outperform the benchmark portfolio and they all consist of only four industry sectors. Once better diversification is

established through adding more industry sectors into our indices, industry equally weighted indices exhibit more desirable attributes. Similar results apply to the annualized geometric returns of the indices. The majorities of our industry equally weighted indices outperform the benchmark S&P ASX 200, with the maximum return of 11.61% being significantly greater than that of the benchmark, 8.4%.

The annualized standard deviation and beta values obtained from regression (2) further indicate that the superior performance of the industry equally weighted indices could be achieved without the investors being exposed to any significant additional risk. The standard deviations of the returns of industry equally weighted indices are on average similar to that of the benchmark index. The lowest standard deviation is 2% less than that of the S&P ASX 200, whilst some indices exhibit volatility that is approximately 1% higher than the benchmark. Furthermore, the systematic risks indicated by the CAPM beta values show that the majority of our industry equally weighted indices exhibit lower risk characteristics.

The risk-adjusted performance measures further confirm the outperformance of the industry neutral portfolios. More than 90% of the equally weighted portfolios (56 out of 60 portfolios) record positive Jensen alpha. The abnormal returns after adjusting for systematic risk could be as significant as 3.22% per year. The diversification benefit is better illustrated using the Sharpe ratio. The equal weighting mechanism essentially allocates an equal proportion of the overall portfolio to each of the industry component, thus moderating the concentration in the Financial and Basic Materials sector of the S&P ASX 200. Through diversifying away industry-specific risks, our industry neutral portfolios record significantly greater Sharpe ratios than that of the value-weighted benchmark.

The results for the indices consisting of past industry leaders and past stock leaders in each industry demonstrate that equal weighting using selection criteria other than only market capitalisation could potentially achieve significantly better performance measures. These indices outperform the S&P ASX 200 on average by 0.9% to 8% on an annual basis. Whilst the annualized standard deviations of the returns of these equally weighted indices are similar to that of the benchmark, their systematic risks relative to the benchmark portfolios are significantly less than unity. Consequently, the Jensen alphas are economically significant at 1.77% to 8.16% per year.

As previously mentioned, an industry neutral weighting mechanism is more than just a simple equal weighting scheme that equally re-weights the constituents of the S&P ASX 200. To validate this argument, we also assess the relative performance of a simple equal weighting scheme against the value-weighted benchmark and our industry neutral indices. The simple equally weighted index significantly underperforms the S&P ASX 200 by 1.5% annually. It is suggested that this relative underperformance is partly attributable to the transaction costs of 0.3% incurred by the simple equally weighted index. Despite a lower standard deviation relative to the benchmark and a beta value of less than 1, the simple equally weighted portfolio generates a negative abnormal returns after adjusting for market risk of -0.6% and a Sharpe ratio that is considerably less than that of the benchmark.

Overall, the evidence suggests that in a market that is dominated by a few large industries such as the Australian market, value-weighting results in industry concentration, which subsequently leads to sub-optimal performance. Even though this study does not claim that an industry-neutral weighting scheme is optimal, the results have illustrated that through allocating equal weights to different industry sectors, it is possible to create indices with better diversification and more desirable performance attributes, even after adjusting for risk and transaction costs.

Table 1: Returns Characteristics of Industry Equally Weighted Indices

	Performance Measures	Holding Period Returns (%)	Geometric Returns (%)	Standard Deviation (%)	CAPM Beta	Jensen's Alpha (%)	Sharpe Ratio
Industry Equally weighted Indices	Cap-weighted Industries Cap-weighted Stocks	(108.47; 187.50)	(7.94; 11.61)	(15.18; 18.53)	(0.83; 1.005)	(-0.06; 3.22)	(0.31; 0.51)
	Leading Industries Leading Stocks	(115.28; 258.72)	(9.31; 15.99)	(15.39; 17.49)	(0.76; 0.79)	(1.77; 8.16)	(0.40; 0.72)
Benchmark (S&P ASX 200)		117.25	8.40	17.16	-	-	0.33
Simple Equally Weighted Index		89.79	6.89	15.31	0.80	-0.59	0.26

This table reports the performance attributes of the industry equally weighted indices against that of the cap-weighted S&P ASX 200 and the simple equally weighted index over the sample period of April 2001 to November 2010. The simple equally weighted index equally weights all the constituents of the S&P ASX 200. The "cap-weighted industries, cap-weighted stocks" indices select industry sectors and stocks in each sector based on their market capitalisation, i.e. at the beginning of every rebalancing period these indices pick the largest industries and the largest stocks in each industries. The "leading industries and leading stocks" indices select industries and stocks with the highest past 12-month performance. All indices are rebalanced every 3 months, taking into account transaction costs of 0.5% (one way). The holding period returns are computed using the beginning and ending market values of each index over the sample period, taking into account dividend yield. The geometric returns are annualized using the holding period returns. The standard deviations are annualized daily standard deviation of the index returns. CAPM betas and Jensen's alphas are derived from the regressions of the indices' daily excess returns on the benchmark's daily excess returns. Sharpe ratios are computed as excess returns of indices per unit of risk.

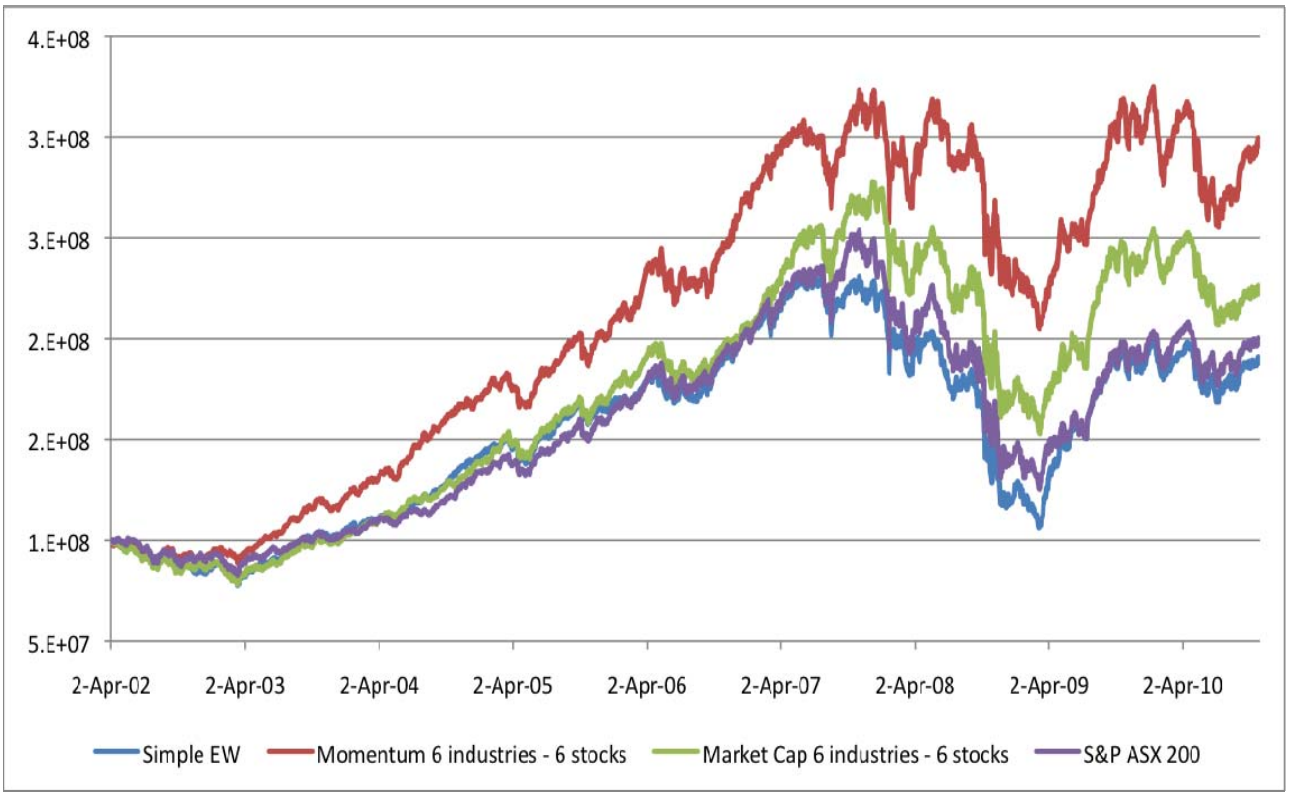
4.3. Robustness of Results

The previous results suggest that an industry equally weighted portfolio will, on average, have positive excess returns relative to the cap-weighted S&P ASX 200. Despite the average outperformance of industry equally weighted portfolios, as previously mentioned, sustained period of underperformance may also occur. Therefore, from an investment perspective, before making a decision about switching to an industry equal weighting mechanism, a passive investor would have to assess the risk that such weighting scheme may actually yield substantial losses, relative to the benchmark S&P ASX 200, over prolonged periods of time.

In order to demonstrate the robustness of the results, this section examines the time-series relative performance of the industry equally weighted indices. Following the previous section, we focus on the two indices that select industries and stocks based on their market capitalisation and past 12-month performance. Since each selection criterion yields 60 equally weighted portfolios, and an analysis of all 60 portfolios appears to be daunting, the analysis in this section focuses on only two portfolios with 6 industry sectors and 6 stocks in each sector. These two portfolios are arbitrarily selected. Results for other portfolios are quantitatively similar and are available upon request. However, it is suggested that a portfolio with too few sectors or stocks could give rise to insufficient diversification. For that reason, we select two portfolios with a neutral number of industries and stocks (within their range of values) to illustrate the average results.

Figure 3 graphs the changes in value of portfolios with different weighting schemes over the period of April 2002 to April 2010. All portfolios have a starting value of $100 million and are rebalanced every 3 months. The simple equally weighted index assigns equal weights to all of the stocks listed on the S&P ASX 200. A one-way transaction cost of 0.3% is applied to the equally weighted portfolios. Over the sample period, the simple equally weighted portfolio underperforms both the cap-weighted portfolio and the industry equally weighted portfolios. The industry equally weighted portfolios significantly outperform their cap-weighted counterpart. A portfolio starting at $100 million could potentially achieve an ending value of up to $222 - $296 million with an industry equal weighting mechanism, as opposed to $198 million with capitalisation weighting or $188 million with a naïve equal weighting scheme. With the exception of only the first few months, both the industry equally weighted portfolios persistently lead the cap-weighted benchmark in terms of value over the whole sample period. An explanation for the underperformance of the equally weighted portfolios in the first few months is the 0.3% transaction costs applying to the initial transaction. This essentially lowers the starting value of the equally weighted portfolios, thus leading to their temporary underperformance.

Figure 3. Relative Time Series Performance of Equally Weighted Portfolios



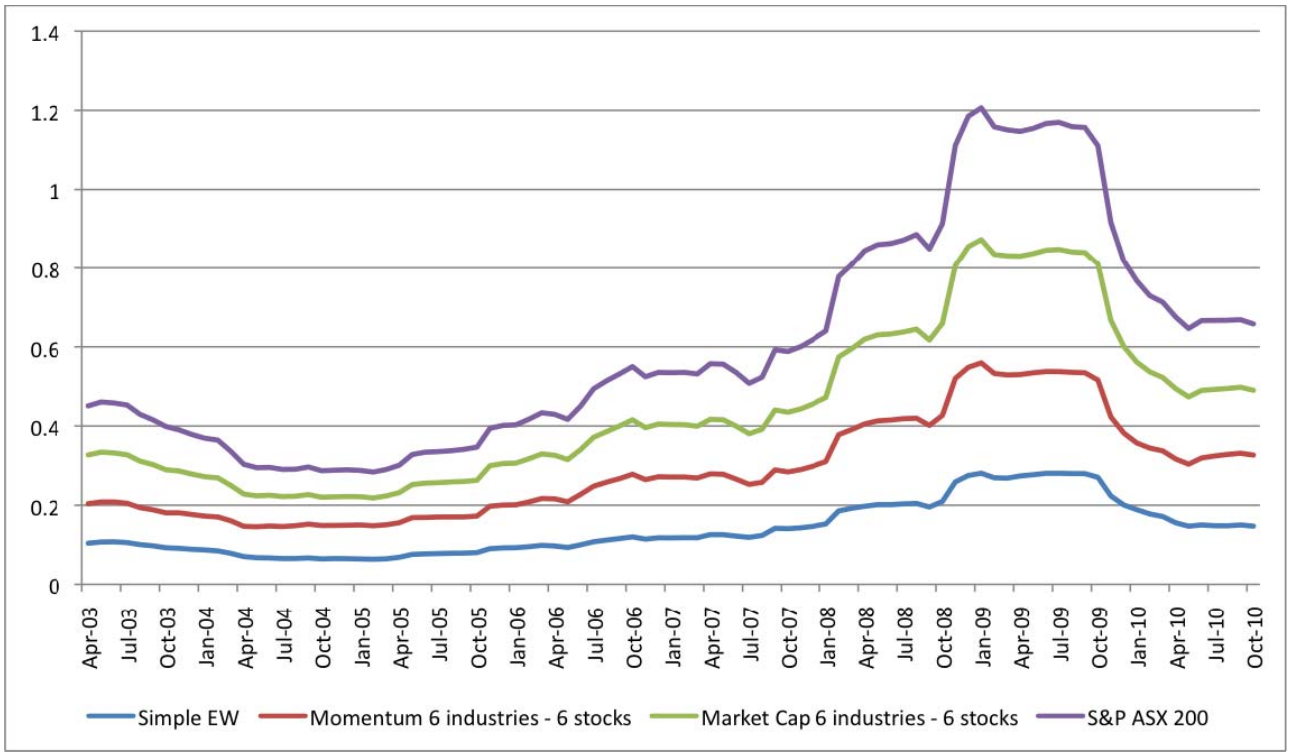
This figure displays the time-series performance of portfolios with different weighting schemes. The simple EW equally weights all the constituents of the S&P ASX 200. The "momentum 6 industries – 6 stocks" portfolio is an industry equally weighted portfolio that select 6 industries and 6 stocks in each industry based on their past 12-month performance. The "market cap 6 industries – 6 stocks" portfolios equally weights 6 industries and 6 stocks in each sector based on their market capitalisation. All portfolios have a starting value of $100 million and are rebalanced every 3 months. A one-way transaction cost of 0.3% is applied to the equally weighted portfolios.

Figure 4 plots the volatility of the previously mentioned portfolio, as measured by rolling annualized standard deviations computed using daily data. Strikingly, the cap-weighted portfolio experiences the highest volatility compared to an equal weighting scheme over the sample period. The simple equally weighted portfolio has the lowest relative volatility. This demonstrates that, as suggested by previous literature, an equal weighting scheme could potentially resolve the issue of over-concentration evident in the S&P ASX 200, increase diversification, thus lowering volatility. However, a naïve equally weighted portfolio does not offer investors desirable performance attributes. By carefully constructing *industry* equally weighted portfolios, our indices are able to

provide not only better performance measures, but also significantly lower volatility relative to the cap-weighted benchmark.

Table 2 indicates the maximum period over which the equally weighted portfolios underperform the S&P ASX 200, together with the corresponding relative losses over that period. Over the sample period, a passive investor opting to an equal weighting scheme would have experienced periods of underperformance of up to 6 months, with the associated accumulated losses ranging from 3% to 7.5%, relative to a cap-weighted benchmark. With the outperformance generated by the industry equally weighted indices, it is suggested that potential losses of this scale does not pose a risk sufficient to lure investors away from equal weighting.

Figure 4 - Volatility of Portfolios With Different Weighting Schemes



This figure displays the volatility, as measured by rolling annualized standard deviations computed using daily data, of portfolios with different weighting schemes over the period of April 2003 to November 2010.

Table 2. Maximum Underperformance of Equal Weighting Relative To Cap Weighting

	Simple EW	Momentum 6 industries - 6 stocks	Cap-weighted 6 industries - 6 stocks
Maximum period of underperformance (months)	5	6	6
Corresponding losses (%)	6.52	7.52	3.04

This table shows the maximum period of time over which an equally weighted portfolio underperformed the cap-weighted benchmark over the sample period and the associated accumulative losses during this period. The data are monthly total returns, taking into account dividend yield and transaction costs. The simple EW equally weights all the constituents of the S&P ASX 200. The "momentum 6 industries – 6 stocks" portfolio is an industry equally weighted portfolio that select 6 industries and 6 stocks in each industry based on their past 12-month performance. The "market cap 6 industries – 6 stocks" portfolios equally weights 6 industries and 6 stocks in each sector based on their market capitalisation. All portfolios have a starting value of $100 million and are rebalanced every 3 months. A one-way transaction cost of 0.3% is applied to the equally weighted portfolios.

To summarise, the above evidence suggests that industry equal weighting, via better diversification of industry-specific risks, overcomes the common problem of concentration of commonly used cap-weighted indices and gives rise to better performance attributes, even after taking into consideration risks and transaction costs. Furthermore, investors could achieve this outperformance without having to be exposed to excessive risks, evident in a lower volatility of the equally weighted portfolios, and relatively insignificant periods of underperformance and losses.

5. Summary and Conclusions

With the practice of indexing investments becoming ever popular in the investment world, the merit of traditional captalisation weighting has increasingly been the subject for debates in recent literature. Some critics propose that cap-weighting is essentially flawed in that it overweights the expensive stocks and underweights the value stocks, thus leading to a performance drag relative to other “market-value-indifferent alternatives” (Arnott, Hsu and Moore, 2005; Siegel, 2006) Another feature of cap weighting that has come in for criticisms is the overconcentration into individual large stocks and industries (Maillard, Roncalli and TeÏLetche, 2010). A small market with a few dominant industries such as Australia makes an excellent setting to examine the industry overconcentration of cap-weighted indices.

The main aim of this study has been to explore a solution for the heavy concentration of the commonly used S&P ASX 200 into two industry sectors, Financials and Basic Materials. A simple solution to use a naïve equal weighting mechanism has been suggested in previous literature. However, such a weighting scheme largely aims to resolve the concentration of cap-weighted indices in individual stocks. In order to overcome the heavy concentration of the S&P ASX 200 in a few dominant industries, we constructed numerous portfolios that are industry neutral, thus allowing industry-specific risks to be diversified away. The results indicate that not only do industry equally weighted portfolios perform significantly better than their cap-weighted counterpart, they also possess more desirable volatility, risk-adjusted performance measures and time-series behaviour. Over the sample period, the industry equally weighted indices consistently outperform the cap-weighted S&P ASX 200, and do so with lower volatility and minimal risk. Our findings suggest that industry equal weighting poses a challenge to the conventional capitalisation weighting.

Future research may explore the performance of similar weighting scheme in other market contexts over periods with diverse market conditions. It would be interesting to examine whether such a weighting mechanism works in markets with less industry concentration such as the U.S. Additionally, a style analysis that assesses the potential factors that generate the documented outperformance of equal weighting is warranted.

References

Amenc, N, Goltz, F & Le Sourd, V 2009, 'The Performance of Characteristics-based Indices', *European Financial Management*, vol. 15, no. 2, pp. 241-278.

Arnott, R 2006, 'An overwrought orthodoxy', *Institutional Investor*, vol. 40, no. 12, pp. 36-41.

Arnott, Hsu, J & Moore, P 2005, 'Fundamental Indexation', *Financial Analysts Journal*, vol. 61, no. 2, pp. 83-99.

Blitz, D & Swinkels, L 2008, 'Fundamental indexation: An active value strategy in disguise', *Journal of Asset Management*, vol. 9, no. 4, pp. 264-269.

Bogle, J 1996, 'Be Not the First… Nor Yet the Last'.

Branch, B & Li, C 2010, 'Fundamental Weighting', *Journal of Applied Finance*, vol. 20, no. 1, pp. 64-77.

Dash, S & Loggie, K 2008, 'Equal Weight Indexing - Five Years Later', *SSRN eLibrary*.

Haugen, RA & Baker, NL 1991, 'The efficient market inefficiency of capitalization-weighted stock portfolios', *Journal of Portfolio Management*, vol. 17, no. 3, Spring91, pp. 35-40.

Hemminki, J & Puttonen, V 2008, 'Fundamental indexation in Europe', *Journal of Asset Management*, vol. 8, no. 6, pp. 401-405.

Houwer, R & Plantinga, A 2009, 'Fundamental Indexing: An Analysis of the Returns, Risks and Costs of Applying the Strategy', *SSRN eLibrary*.

Hsu, J 2006, 'Cap Weighted Portfolios Are Sub-optimal Portfolios', *Journal of Investment Management*, vol. 4, no. 3, 2006 3rd Quarter, pp. 44-53.

Jun, D & Malkiel, BG 2007, 'New Paradigms in Stock Market Indexing', *European Financial Management*, vol. 14, no. 1, pp. 118-126.

Lintner, J 1965, 'The Valuation of Risk Assets And The Selection of Risky Investments in Stock Portfolios and Capital Budgets', *Review of Economics & Statistics*, vol. 47, no. 1, p. 13.

Maillard, S, Roncalli, T & TeÏLetche, J 2010, 'The Properties of Equally Weighted Risk Contribution Portfolios', *Journal of Portfolio Management*, vol. 36, no. 4, Summer2010, pp. 60-70.

Malkiel, B 2003, 'Passive investment strategies and efficient markets', *European Financial Management*, vol. 9, no. 1, pp. 1-10.

Mar, J, Bird, R, Casavecchia, L & Yeung, D 2009, 'Fundamental Indexation: An Australian Investigation', *Australian Journal of Management*, vol. 34, no. 1, pp. 1-20.

Markowitz, HM 2005, 'Market Efficiency: A Theoretical Distinction and So What?', *Financial Analysts Journal*, vol. 61, no. 5, pp. 17-30.

McQuarrie, EF 2008, 'Fundamentally Indexed or Fundamentally Misconceived: Locating the Source of RAFI Outperformance', *Journal of Investing*, vol. 17, no. 4, Winter2008, pp. 29-37.

Neukirch, T 2008, 'Alternative Indexing with the MSCI World Index', *SSRN eLibrary*.

Perold, AF 2007, 'Fundamentally Flawed Indexing', *Financial Analysts Journal*, vol. 63, no. 6, pp. 31-37.

Roll, R & Ross, SA 1994, 'On the Cross-Sectional Relation between Expected Returns and Betas', *The Journal of Finance*, vol. 49, no. 1, pp. 101-121.

Sharpe, WF 1964, 'Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk', *Journal of Finance*, vol. 19, no. 3, pp. 425-442.

—— 1991, 'The Arithmetic of Active Management', *Financial Analysts Journal*, vol. 47, no. 1, pp. 7-9.

Siegel, JJ 2006, 'The 'Noisy Market' Hypothesis', *Wall Street Journal - Eastern Edition*, vol. 247, no. 138, p. A14.

Tabner, I 2009, 'Benchmark Concentration: Capitalization Weights Versus Equal Weights in the FTSE 100 Index'.

Treynor, J 2005, 'Why Market-Valuation-Indifferent Indexing Works', *Financial Analysts Journal*, vol. 61, no. 5, pp. 65-69.

Walkshäusl, C & Lobe, S 2010, 'Fundamental indexing around the world', *Review of Financial Economics*, vol. 19, no. 3, pp. 117-127.