Fundamental Indexing Around the World

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ABSTRACT

Using a broad as possible worldwide data sample of 50 developed and emerging markets from July 1982 to June 2008, we investigate the performance of global and country-specific fundamentally weighted indices. In this way, we extend not only the empirical scope of existing analyses with out-of-sample evidence, but also expand the focus to a global level, since previous studies focused mainly on the U.S. or Europe. At first, we find evidence that fundamental indices can outperform their capitalization-weighted counterparts on a global level and in 44 countries. However, evaluating the performance of fundamental indices in a multi-factor framework, including our adjusted version of Carhart's four-factor model that accounts for the distinctiveness of fundamental weighting, reveals that the abnormal returns can be greatly explained by an augmented exposure to value stocks. Nevertheless, we can identify two global index versions and nine countries, where the fundamental weighting scheme adds significant positive value.

Keywords: Fundamental Indexing, Passive Investing, Market Efficiency, Performance Evaluation, Four-Factor Model

EFM Classification Codes: 380, 350, 330, 370

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I. Introduction

PASSIVE INDEX INVESTING has gained tremendous popularity and importance among institutional and private investors over the past thirty years. Reasons include the fact that index-based funds offer an easy and inexpensive way to invest in a well-diversified portfolio of equities. Furthermore, there is overwhelming empirical evidence that index investing, in the long run, outperforms active investing (see e.g. Jensen (1968), Malkiel (1995), Carhart (1997)).

While the first stock market index, the Dow Jones Industrial Average, initially published in 1896, is still calculated as a price-weighted average, the de-facto standard for indexing has become the market capitalization-weighted index: an index that weights each component by its stock price multiplied by its common shares outstanding. This methodology has strong appeal since the return on these indices represents the aggregated average market return to all shareholders.

However, one essential question is ordinarily overlooked in this context: Does the predominant weighting scheme for indices – market capitalization – really suit investor's needs? Or differently asked: can a capitalization-weighted index provide the best available risk and return relationship for investors in the first place?

The primary theoretical rationale for that design is rooted in the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), and Mossin (1966), which holds that an investor can have no better risk and return tradeoff than that available by holding a portfolio consisting of all

risky assets in the proportion that each asset in the market portfolio equals the market value of the asset divided by the total market value of all assets. Hence, a capitalization-weighted index of all tradable securities should be mean-variance optimal. Markowitz (2005) examines the assumptions that underlie the CAPM theory and finds several aspects that bring into question the robustness of the expectation that a capitalization-weighted market portfolio is mean-variance optimal: when one clearly unrealistic assumption of the model is replaced by real-world constraints this conclusion no longer follows.

Additionally, the prediction of the CAPM depends critically on market efficiency. The Efficient Market Hypothesis assumes that the price of a stock at every point in time represents the best, unbiased estimate of the true underlying value of the firm. Hsu (2006) rigorously shows that if stocks are mispriced in the sense that they do not fully reflect firm fundamentals, the traditional capitalization-weighting scheme leads to sub-optimal performance. This is because underpriced stocks will have smaller capitalizations than their fair equity value, and similarly, overpriced stocks will have larger capitalizations than their fair equity value. Thus, the sub-optimality arises because cap-weighting tends to overweight stocks whose prices are high relative to their fundamentals and underweight stocks whose prices are low relative to their fundamentals. The size of the capitalization-weighted portfolio underperformance is increasing in the magnitude of price inefficiency and is roughly equal to the variance of the noise in prices. Treynor (2005) formally demonstrates that

market-valuation-indifferent indices are superior to capitalization-weighted indices because their weights do not suffer from the error in market prices. It follows that market-valuation-indifferent indices will avoid the problem of overweighting overvalued stocks and underweighting undervalued stocks. This has led Arnott, Hsu, and Moore (2005) to propose a new index construction methodology, called *fundamental indexing*, which allocates capital to stocks based on the weights of price-insensitive fundamental metrics, such as book value, dividends, cash flow, sales, and number of employees. Reporting results for U.S. data for 43 years from 1962 to 2004, they find that fundamental indices outperform the capitalization-weighted S&P 500 by an average of 1.97 percentage points a year with similar volatilities. The analysis of the performance in a single-factor framework indicates significant positive CAPM alphas for their fundamental indices.

Since this seminal paper, the concept of fundamental indexing has aroused heavy debates with acknowledged academic authorities on both sides.[1] Perold (2007) criticizes the theory on which fundamental indexing is based, which is, that an investor can beat the market without knowing fair value, simply by avoiding the capitalization-weighting scheme. If one does not know fair value, then even though prices may move toward fair value, the direction of that movement is random. Based on a Bayesian analysis he demonstrates that if markets are inefficient, but one does not

[1] With Jeremy Siegel as a proponent (see 'The Noisy Market Hypothesis', Wall Street Journal, June 14, 2006) and Burton Malkiel as an opponent of fundamental indexing (see 'Turn on a Paradigm?', Wall Street Journal, June 27, 2006).

have knowledge pertaining to whether a given stock is over- or undervalued, then there is no performance drag from capitalization-weighting. Another way to state the preceding conclusion is in terms of the correlation of the pricing error with fair value and with market value. If a fundamentally weighted portfolio is to outperform a capitalization-weighted portfolio of the same stocks, then the fundamental variables used to construct the weights should contain more information about the fair values of the stocks than the market values of the stocks contain. Kaplan (2008) therefore develops a boundary condition that needs to be satisfied in order for a non-capitalization-weighting scheme to add positive value: if the correlation between the fundamental values and the fair values exceeds the correlation between the market values and the fair values, then fundamental indexing is the *a priori* superior approach. If the reverse is true, then capitalization-weighting is superior. Since fair values in these inequalities are not observable, one can only evaluate the historical performance, to see whether fundamental weighting or capitalization-weighting is the better way of investing.

Due to this fact, further empirical evidence is given for the theoretical findings of Treynor (2005) and Hsu (2006) by Hemminki and Puttonen (2008), who examine the benefits of the concept by re-weighting the actual capitalization-weighted Dow Jones Euro Stoxx 50 index by fundamental values. With a period under review from 1996 to 2006 they find consistently higher returns and higher risk-adjusted returns with an average excess return of 1.76 percentage points a year.

For the broader European stock market index, the Dow Jones Stoxx 600, Stotz, Döhnert, and Wanzenried (2007) investigate the concept of fundamental indexing also by re-weighting its constituents by fundamentals over the time period from 1993 to 2007. Since their finding of an annual excess return of about two percentage points over the capitalization-weighted index cannot be explained by a higher volatility risk, additional risk analyses are undertaken. Neither the analysis of risk in accounting data, nor the analysis of risk-adjusted returns, or the analysis of returns in different states of the economy indicate a higher risk for fundamental indices. Therefore, Stotz et. al. come to the conclusion that fundamental values reflect the fair value of a company better than market values do.

Amenc, Goltz, and Le Sourd (2008) analyze and compare the performance of fourteen commercially available fundamentally weighted indices based on return data made available by seven different index providers for the U.S. stock market, covering a time period up to 2006, with start dates between 1962 and 1998. The study confirms that fundamental indices outperform the capitalization-weighted S&P 500 index, though the return difference is not statistically significant for most indices. However, an outperformance of the equal-weighted version of the S&P 500 index is not achieved. The analysis of the exposure of fundamentally weighted indices to style and industry shows that these indices have significant value tilts, which explains why they outperform a capitalization-weighted index, but not an equally-weighted one. When adjusting for this value tilt and for the exposures to the small-cap and momentum risk in addition to the

market factor, the monthly alphas of fundamentally weighted indices are on average reduced to 9 basis points per month with only three significant instances (among others, the FTSE RAFI US 1000), compared to 31 basis points within the single-factor model. Further, the sector weighting confirms the value bias, in the sense that typical growth sectors (with high valuation ratios) are underweighted, whereas typical value sectors (with low valuation ratios) are overweighted. For that reason, Amenc et. al. conclude that the main value of these indices is to provide investors with a liquid, systematic, and relatively cheap way to pursue a value-investing strategy.

Jun and Malkiel (2008) assess the performance of the FTSE RAFI US 1000 fundamental index in a multi-factor framework. Using Fama and French's three-factor model, they find in contrast to Amenc et. al. (2008) that the alpha of this particular index is zero with statistical significance. For that reason, Jun and Malkiel argue that the outperformance over traditional capitalization-weighted indices has not been a result of the strategy's ability to arbitrage the inefficiency of capitalization-weighting, but a reward from loading on factor tilts – namely size and value.

Estrada (2008) links the issues of fundamental indexing and international diversification by evaluating whether capitalization or price-insensitive fundamentals are the best way to weight country benchmarks when building global portfolios. Considering 16 country benchmarks, he finds that a dividend-weighted fundamental index outperforms a global capitalization-weighted index by a substantial margin of 1.9 percent a

year during the sample period 1974 – 2005. Moreover, the study shows that a weighting scheme based on dividend yields generates an even higher excess return of 3.6 percent per annum over the same period.

Chen, Chen, and Bassett (2007) show how to implement the idea of fundamental indexing without directly measuring fundamental values. Their approach is motivated by the intuition behind Arnott, Hsu, and Moore (2005), but the estimation of fundamental weights based on accounting data is thereby replaced by a smoothed average of traditional capitalization-weights. Assuming that underlying fundamental values change slowly over time and observed market prices are unbiased but noisy approximations for fundamentals, they demonstrate that one can infer fundamental values by smoothing the time series of a stock's noisy prices, to obtain a more accurate estimate for the underlying firm's value than the current market price. Using U.S. data between 1962 and 2003, Chen et. al. find an outperformance over the capitalization-weighted benchmark by about one percent a year with significantly lower return volatility.

In view of the fact that one can only evaluate the historical performance to see whether a weighting scheme based on fundamentals or market capitalization is the better way of investing, we contribute in this study to the body of knowledge on fundamental indexing by investigating the benefits of this weighting scheme using a broad as possible worldwide data sample of 50 developed and emerging countries. In this way, we extend not only the empirical scope of existing analyses with out-of-sample evidence, but also expand the focus to a global level, since previous studies

focused mainly on the U.S. or Europe. Therefore, we construct on the one hand global fundamental indices to examine the performance of the fundamental index concept in a highly diversified environment and on the other hand, we create for each country in our sample a domestic fundamental index. This approach allows a comprehensive look at the risk and return characteristics of fundamentally weighted indices in comparison to capitalization-weighted indices at both a global- and country-based level.

Furthermore, we decompose the performance of fundamental indices in a single-factor framework, as well as by applying Fama and French's (1993) three-factor model and Carhart's (1997) four-factor model with global and country-specific constructed size, value and momentum factors. To account for the distinctiveness of the fundamental weighting scheme, we also calculate fundamental-weighted factor portfolios based on the book value. As a valuable by-product of our study, the empirical findings indicate that these adjusted models do a better job in explaining the return behavior of fundamental indices than the standard approach with capitalization-weighted factor portfolios.

Our results support the conclusion that the superior performance of fundamental indices is mainly driven by the augmented exposure to value stocks. Nevertheless, we can identify two global index versions and nine countries, where the fundamental weighting scheme adds significant positive value for an investor.

The remainder of the paper is organized as follows. In Section II, we describe the data in more detail and explain the construction methodology

of our fundamental indices. In Section III, we analyze the risk and return characteristics of fundamental indices in a global and country-specific environment. Section IV presents the results of the applied performance evaluation models and discusses their interpretations. Finally, Section V concludes.

II. Data and Index Construction Methodology

A. Data

Using *Thomson Financial Datastream*, we obtain monthly total return data (that is, including dividends) for all firms listed on the major exchanges of 50 developed and emerging countries from July 1982 to June 2008. To avoid a possible survivorship bias (Brown et. al. (1992)), delisted stocks are included until they disappear. Since we cover companies from different countries with different currencies, all data are converted to U.S. dollars. From this sample, we select those stocks that have at least one fundamental variable such as book value, cash flow, dividends, number of employees, income, and sales available. These company-accounts items are obtained from the Worldscope database. Since Ulbricht and Weber (2005) find no statistical or methodological shortcomings in Worldscope data for U.S. firms in comparison with COMPUSTAT, we employ Worldscope for all countries. The sample period was selected to encompass a history as long as possible with return data from Datastream, and a coverage of markets as broad as possible. Although Datastream has stock return data extending further back than 1982, the required accounting

data from Worldscope are not available before 1980. Since the calculation of the momentum factor requires a return history of at least 12 months, we have to choose 1982 as the earliest possible start date for our study.

In addition to the sampling criteria described above, we apply several screening procedures as suggested by Ince and Porter (2006) for studies involving large numbers of individual equities. We restrict our analysis to common stocks, excluding preferred stocks, warrants, unit or investment trusts, and depository receipts. Cross-listed firms identified as having a home country other than that of the country in which the market is located are excluded from the sample as well. In countries with multiple share classes, we select the most representative share class in terms of liquidity, ordinary voting rights, and accessibility to foreign investment.

For the calculation of monthly returns, any return above 300% that is reversed within one month is set to missing. In order to exclude remaining outliers in returns, we winsorize the monthly returns that fall out of the 0.1% and 99.9% percentile ranges in each country. To ensure that the results are not driven primarily by small and illiquid stocks or by bid-ask bounce, we exclude all stocks priced below $ 1 at the yearly rebalancing date of our fundamental indices.

While previous studies limited the constituents of the constructed fundamental indices to a specific number, for example 1,000 stocks (see Arnott et. al. (2005), Chen et. al. (2007), or merely reweighted an existing index fundamentally (see Hemminki and Puttonen (2008), Stotz et. al. (2007)), the number of firms in our indices grows steadily through time.

On the first index construction date, at the end of June 1982, we have data for 2,846 firms available from which the indices are formed. As of June 2007, the last index rebalancing date, the number of stocks in our sample amounts to 22,658 existing firms (5,280 firms deceased through time). Table I presents further summary statistics for each country in our sample. Most of the developed countries have return data available from the beginning of our sample period, whereas many emerging countries have return data initially available by the beginning of the 1990's. Altogether, our worldwide sample encompasses a total of 300,808 firm-years. The majority of firm-year observations are concentrated in the United States (72,955), Japan (56,805), and the United Kingdom (22,625).

[Please insert **Table I** about here]

B. Index Construction Methodology

Similar to Arnott, Hsu, and Moore (2005), we construct fundamental indices based on the fundamental metrics of book value, cash flow, dividends, employees, income, and sales. Since Boudoukh, Michaely, Richardson, and Roberts (2007) find that the stock return predictability in time-series is much stronger when (net) payout yields are used instead of the dividend yield, we construct an index based on the net payout of the firm. The net payout is defined as the sum of distributed dividends, plus the total expenditures used to decrease the outstanding shares (repurchases), minus the proceeds received from the sale of shares (equity issuance) over

the past year. In addition to the single metrics described above, we also examine a composite index combining the fundamental metrics of book value, cash flow, dividends, and sales. The weight of a firm in the composite index is calculated as the average of the weights each firm would have in the four individual metrics. Since this approach would exclude all firms that do not distribute dividends, the weight in the composite index for a non-dividend-paying firm is the average of the remaining three fundamental metrics. Because the four metrics used in the composite index are widely available in most countries, the composite index can be easily applied in an international environment. Moreover, the composite approach is expected to result in weights that reflect the fair value of a firm in superior way than each single metric, because possible valuation biases of a single metric should cancel out.

The specific construction of the fundamental indices then proceeds as follows: at the end of June of each year t (1982 to 2007) all firms in the considered sample (global and country-specific) are ranked by its fundamental metric. Each company in the fundamental index is assigned a weight according to its relative weight for that metric. If a fundamental metric is negative, it is set to zero. This approach excludes short positions in stocks. To ensure that the accounting data for all fiscal year ends in calendar year $t - 1$ are known before the returns are calculated, the index is rebalanced at the end of June of each year. The composition is then held constant and the returns for the index are calculated from July of year t to June of $t + 1$. For benchmarking purposes, we also create capitalization-

weighted reference indices (global and country-specific) by using the same construction method used for the fundamental indices. Thus, comparisons between the two weighting schemes can be clearly made.

III. Risk and Return Analysis

In this section, we analyze the risk and return characteristics of global and country-specific fundamental indices, to obtain a first insight in relation to their performance.

A. Global Fundamental Indices

Table II shows the risk and return characteristics for our global fundamental indices and their capitalization-weighted benchmark (reference index) for the 26-year period from July 1982 to June 2008.

[Please insert **Table II** about here]

The highest ending value for a $ 1 investment made at the beginning of our sample period is reached by the net payout-weighted index with an amount of $ 40.89, which corresponds to a 15.34 percent compound geometric return per annum and an excess return relative to the global reference index of 3.94 percent a year. The smallest ending value of our fundamental indices is produced by the book value-weighted index with $ 29.74. But compared to the capitalization-weighted reference index with a low of $ 16.57, it still exhibits an annual excess return of 2.53 percent.

Considering the annualized volatility of returns suggests that the higher returns cannot be attributed to higher risk. The reference index shows a standard deviation of 14.42 percent. For the fundamental indices the return volatility ranges from 12.55 percent for the dividend-weighted index to 14.31 percent for the sales-weighted index.

The annualized Sharpe ratio, which measures the excess return per unit of risk, yields a value of 0.421 for the reference index over the sample period. The global fundamental indices, however, display considerably higher values for the Sharpe ratio, which range from 0.627 for the book value-weighted index to 0.761 for the dividend-weighted index.

Table II also presents the tracking error, a measure of how closely a fundamental index follows the capitalization-weighted reference index, as well as ratios for the liquidity and concentration of each index.

The liquidity measure, which evaluates the relative investment capacity of an index, is defined as the fundamental-weighted average market capitalization of that index divided by the capitalization-weighted average market capitalization of the reference index. According to this figure, the possible investable amount is between 50 and 91 percent the amount that could be invested in the global reference index.

We also measure the concentration of an index in large-capitalization stocks. Therefore, we examine the fraction of the total market capitalization that belongs to the 100 highest ranked stocks in each index. Over the whole sample period, the lowest concentration in large stocks is exposed by the employees-weighted index with a ratio of 25.5 percent; the divi-

dend-weighted index exhibits the highest value with 40.5 percent, which is nearly identical to the reference index's fraction of 41.1 percent.

To draw a first conclusion based the descriptive results above, our global fundamental indices appear to be superior in comparison to the capitalization-weighted reference index regarding their risk and return characteristics. This finding is consistent with those reported by Arnott, Hsu, and Moore (2005) for the U.S. market. Figure 1 illustrates the superior performance of our global fundamental indices based on the cumulative growth of a $ 1 investment in the global reference index, the composite index, the top-performing index (net payout), and the bottom-performing index (book value).

[Please insert **Figure 1** about here]

B. Country and Sector Weighting

Since our global fundamental indices combine different countries in a single portfolio, we conduct in this subsection further analysis regarding the country and sector allocation over time. Considering regions and sectors, we find further evidence that capitalization weighting tends to overweight those whose prices are high relative to their fundamentals and underweights those whose prices are low relative to their fundamentals.

[Please insert **Figure 2** about here]

Figure 2 illustrates the allocation of the different regions in the composite index (Panel A) in comparison to the capitalization-weighted reference index (Panel B). In both indices, the highest influence is exerted by the American region, especially in the early years of our sample period. Within this region, the U.S. market share accounts on average for more than 90 percent. The lowest region weighting without considerable alteration is exposed by the African countries, which account on average for less than one percent of the index constituents. The traditional reference index shows a tendency to extreme allocations. This is apparent for the Asian region through the time period from 1986 to 1990, where Japan experienced a massive bubble in their asset prices. While the weighting for the Asian region (with a share of Japan of about 97 percent at this time) reached more than 50 percent in the capitalization-weighted index, the weighting in the composite index totaled merely 20 percent, since the price exuberance was not supported by enhanced underlying fundamentals. In general, the fundamentally weighted index exhibits a country weighting that is more stable and less volatile than the capitalization-weighted index.

[Please insert **Figure 3** about here]

The sector weighting for the composite index (Panel A) in comparison to the reference index (Panel B) presented in Figure 3 highlights a similar behavior. The capitalization weighting shows volatile upswing and down-

swing phases in the sector allocation, constantly representing the predominant investor preferences through time. Especially, the dot-com bubble covering the time period between 1998 and 2001, with an extensive shift towards technology and telecommunication stocks, shows once more the tendency of traditional indices to move away from underlying fundamentals through price exuberances. The fundamental index, in contrast changes the sector weightings gradually over time in response to the evolution of the economy.

C. Risk Analysis

Our results above show that in a global context fundamental weighting comes out superior to traditional capitalization weighting in the sense that it provides improved mean-variance optimal results. Since the higher returns cannot be explained by a higher volatility, one could argue that the standard deviation of returns may not capture the entire risk characteristics of the fundamental indices. Therefore, we conduct further risk analyses.

[Please insert **Table III** about here]

Table III presents measures to describe the return distribution of the global fundamental indices. All fundamental indices reveal a higher negative skewness, ranging from -0.51 (net payout) to -0.96 (employees), compared to the capitalization-weighted reference index (-0.47), indicating a

higher probability of extreme negative values in the historical record of returns. Furthermore, the likelihood of outliers in the return distribution on either side of the mean is noticeably higher for the fundamentally weighted indices, as denoted by the higher excess kurtosis. Both measures imply that the standard deviation of returns will underestimate the actual level of risk for the global fundamental indices.

Considering the returns for the best and worst month, we find that all global fundamental indices, with one exception (net payout), exhibit a lower maximum monthly return and a lower minimum monthly return than the capitalization-weighted reference index. Looking at the maximum trailing 12-month return, we observe that only two fundamental indices (employees and sales) have higher values than the benchmark. In contrast to this, the distribution of the worst outcomes does not carry through to a longer period: all fundamental indices have considerably higher minimum trailing 12-month returns than the reference index. Thus, the downside risk in the long run is smaller for the global fundamental indices. This is due to the fact that larger deviations from underlying fair values through exuberances are largely evaded by the fundamental weighting scheme.

This deduction is also confirmed by the value at risk (VaR), a widely used measure of risk, which measures the loss that will be exceeded with a specified probability of 5 percent. Since the return distribution of the indices is not adequately described by the normal, we base our calculation on the historical simulation of returns. The value at risk ranges for the

global fundamental indices from -4.50 percent (composite) to -5.09 percent (sales), whereas the reference index shows a VaR of -5.81 percent.

D. Country-Specific Fundamental Indices

After our initial analysis of the global fundamental indices, we take a closer look at the country-specific index versions, which draw a more heterogeneous picture. Table IV provides the geometric return per annum, the annualized volatility and the Sharpe ratio for the domestic fundamental index and the capitalization-weighted reference index for each country. The excess return measures the return difference between the two.

[Please insert **Table IV** about here]

Four out of the 50 domestic fundamental indices exhibit a negative excess return relative to their traditional market indices, namely Morocco, Colombia, Venezuela and Taiwan. This indicates that a construction methodology based on fundamental metrics is not able to create any value in these countries. The Colombian index even underperforms its capitalization-weighted counterpart by 5.15 percent a year. Since all four countries can be classified as emerging markets, the suggestion of Hsu, Li, Myers and Zhu (2007) that fundamentally weighted indices have the greatest advantage in emerging countries, where markets are presumably the least efficient, is somewhat contrasted. Nevertheless, the highest excess return of the domestic indices is produced by an emerging country: the funda-

mental index of Thailand stands out with an impressive annualized excess return of 8.08 percent. The average excess return over all considered markets is 2.46 percent per annum.

Looking at the standard deviation of returns, we find that 25 out of the 50 fundamental indices produce an annualized volatility that is lower than that of their corresponding traditional market index. With exception of Russia, which exhibits an additional volatility of 19.20 percent per year, the remaining fundamental indices show only a slightly higher volatility relative to their benchmarks.

Finally, the calculated Sharpe ratios provide evidence that in 44 countries fundamentally weighted indices are able to outperform their capitalization-weighted counterparts. Beside the countries with a negative excess return as mentioned above, Brazil and Russia can be added to the list of underperformers.

IV. Performance Evaluation

A. Methodology

Now that we have an idea of the risk and return characteristics of fundamental indices in the global and country-specific context, we will decompose the performance in a single- and multi-factor framework. This will enable us to determine whether or not fundamental indices outperform the market on a risk-adjusted basis. The three performance evaluation models we use in this study are (1) the classical CAPM described in Sharpe (1964), Lintner (1965), and Mossin (1966), (2) the three-factor

model by Fama and French (1993), and (3) the four-factor model by Carhart (1997). These models are estimated from the following regressions:

$$r_{i,t} - r_{f,t} = a_i + b_i(r_{m,t} - r_{f,t}) + \varepsilon_{i,t} \quad (1)$$

$$r_{i,t} - r_{f,t} = a_i + b_i(r_{m,t} - r_{f,t}) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t} \quad (2)$$

$$r_{i,t} - r_{f,t} = a_i + b_i(r_{m,t} - r_{f,t}) + s_i SMB_t + h_i HML_t + w_i WML_t + \varepsilon_{i,t} \quad (3)$$

Where $r_{i,t}$ is the return on fundamental index i in month t, $r_{f,t}$ is the three-month Treasury bill rate in month t, and $r_{m,t}$ is the return on the capitalization-weighted market portfolio in month t. SMB, HML and WML are designed to capture common non-market risk factors that are related to size, book-to-market ratio and momentum. Finally, the factor loadings are respectively b_i, s_i, h_i, *and* w_i.

The starting point for our performance evaluation is the classical CAPM by Sharpe (1964), Lintner (1965), and Mossin (1966), where the intercept of the regression, commonly called Jensen's alpha (1968) is usually interpreted as a measure of out- or underperformance relative to the market proxy used. However, later research documents empirical contradictions and anomalies that strongly question the validity of the CAPM. For example, Banz (1981) first documents the size effect, that firms with small market capitalizations significantly outperform firms with large market capitalizations. Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) find that average U.S. stock returns are positively correlated with the book-to-market ratio. Later, Fama and French (1992)

confirm that U.S. stock returns are significantly related to these two firm characteristics. As a consequence, the CAPM is extended by Fama and French (1993) to a multi-factor model with mimicking portfolios for the size and value effect as explanatory variables. At the same time, Jegadeesh and Titman (1993) find a significant one-year momentum anomaly for the U.S. stock market by documenting a positive return differential for portfolios formed of past winner and loser stocks. Since this momentum effect cannot be explained by the Fama and French (1993) model, Carhart (1997) proposes an extension by adding a mimicking portfolio for the momentum anomaly to the three-factor-model.

We construct domestic risk factors for each country in our sample, as well as global versions for the performance evaluation of our global fundamental indices. Since the findings of Griffin (2002) show that the Fama and French factors are country-specific, the application of international size and value factors to individual countries leads to disappointing results in relation to the explanatory power of time-series variation. Since we assume the same is true for the momentum factor, national and global versions are formed as well.

Although using capitalization-weighted components in mimicking portfolios captures the different return behaviors of stocks in a way that corresponds to realistic investment opportunities, we also calculate fundamentally weighted returns for the factor portfolios based on the book value, to account for the distinctiveness of the fundamental weighting

scheme. Our empirical findings indicate that this approach is able to explain the cross-section of average returns in a superior way.

For the construction of the SMB and HML factor, we follow the methodology of Fama and French (1993). Specifically, at the end of June of each year t (1982 to 2007), stocks are allocated to two groups small or big (S or B) based on whether their June market equity, ME (stock price times shares outstanding), is below or above the median for all stocks in the considered sample.

Similarly, stocks are allocated in an independent sort to three book-to-market equity (BE/ME) groups based on the breakpoints for the bottom 30 percent (L), middle 40 percent (M), and top 30 percent (H) of the ranked values of book-to-market for the stocks in the considered sample. The book-to-market ratio used to form portfolios in June of year t is calculated as the book equity for the end of calendar year t – 1, divided by market equity at the end of December of t – 1. We do not use firms with negative book equity when calculating the breakpoints for our portfolios.

The six portfolios (S/L, S/M, S/H, B/L, B/M, B/H) are then formed from the intersections of the two size and the three book-to-market equity groups. Monthly capitalization-weighted and fundamentally weighted returns on the six portfolios are calculated from July of year t to June of t + 1, and the portfolios are reformed at the end of June of t + 1. We calculate returns beginning in July of year t to be sure that book equity for year t – 1 is known. To be included in the portfolios formed in June of year t,

firms must have stock prices for December of year t – 1 and June of year t, and book equity for year t – 1.

The SMB (small minus big) portfolio, meant to mimic the risk factor in returns related to size, is the difference, each month, between the simple average of the returns on the three small-stocks portfolios and the simple average of the returns on the three big-stock portfolios, calculated as follows: (S/L + S/M + S/H)/3 – (B/L + B/M + B/H)/3.

The HML (high minus low) portfolio, meant to mimic the risk factor in returns related to book-to-market equity, is defined similarly. HML is the difference, each month, between the simple average of the returns on the two high book-to-market equity portfolios and the average of the returns on the two low book-to-market equity portfolios, calculated as follows: (S/H + B/H)/2 – (S/L and B/L)/2.

The approach chosen for the construction of the momentum factor WML is related to Carhart (1997) and Jegadeesh and Titman (1993). Specifically, at the end of each month, all stocks in the considered sample with a return history of at least 12 months are allocated to three momentum portfolios based on the breakpoints for the bottom 30 percent (Losers), middle 40 percent (Neutral), and top 30 percent (Winners) of their prior 12-month performance. These portfolios are then held for 12 subsequent months and monthly capitalization-weighted and fundamentally weighted returns are calculated for each.

The WML (winners minus losers) portfolio, meant to mimic the risk factor in returns related to momentum, is then the difference, each month,

between returns on the winner stock portfolio and the returns on the loser stock portfolio, calculated as follows: Winners – Losers.

To increase the power of the momentum effect, the winners (losers) portfolio is constructed as an overlapping portfolio, as suggested by Jegadeesh and Titman (1993). Therefore, in any given month t, the final winners (losers) portfolio consists of the portfolio formed in the current month t, as well as the portfolios formed in t – 1, t – 2, and so on up to t – 11. This approach is equivalent to a composite portfolio in which each month 1/12 of the holdings are revised. Thus, the return of the winners (losers) portfolio in t is respectively the average of 12 portfolio returns.

B. Results of the CAPM

In the following subsections, we will discuss the main conclusions that can be drawn from the results of the single-factor model. We compute all estimations by using Newey-West (1987) standard errors to adjust for any autocorrelation and hetereoscedasticity in the returns.

B.1. Results for the Global Fundamental Indices

Table V presents the results applying the classical CAPM for the global fundamental indices. Column 1 reports the CAPM alpha and Column 2 the beta coefficient. The fit of the model is based on the adjusted R^2 in Column 3.

[Please insert **Table V** about here]

The results from the single-factor model show that the monthly alphas generated by all global fundamental indices are highly significant and positive, ranging from 22 basis points for the book value-weighted index to 36 basis points for the fundamental index weighted by the net payouts of the firm. The beta coefficients, which measure the systematic risk of the fundamental indices relative to the market portfolio, are all below one. Particularly, the dividends-weighted index has the smallest beta coefficient with a value of 0.80, whereas the sales-weighted index exhibits with 0.96 the highest beta factor. Thus, the first results suggest that fundamental weighting is superior to capitalization weighting in the sense that it generates a positive Jensen's alpha with less exposure to the market risk.

B.2. Results for the Country-Specific Fundamental Indices

Considering the regression results of the CAPM for the country-specific fundamental indices, as reported in Table VI, we receive a much more heterogeneous picture.

[Please insert **Table VI** about here]

Only 14 out of the 50 national fundamental indices show an alpha that is significantly different from zero on a 5 percent level or better. The 14 countries are Canada, Japan, Malaysia, Singapore, South Korea, Aus-

tria, France, Germany, Greece, Italy, Poland, Portugal, Spain, and Australia. We observe that the statistically significant fundamental indices are also promising in terms of economical significance, since their monthly alphas range from 18 (Malaysia) to 50 (South Korea) basis points. Altogether, these countries generate on average an alpha of 31 basis points per month. The market exposure designated by the beta coefficient is on average similar to that of the global fundamental indices, but with a higher grade of dispersion, varying from a low of 0.66 for the Czech Republic to a high of 1.13 for Russia. However, in these two cases, we have to note that the fit of the single-factor model is below-average, as indicated by their adjusted R^2-values.

C. Multi-Factor Models

Since opponents of the fundamental indexing concept argue that the excellent performance does not come from their superior weighting scheme, but is rather due to their augmented exposure to value and small-capitalization stocks (see Jun and Malkiel (2008)), we apply multi-factor models for the further performance evaluation, as described above.

C.1. Results for the Global Fundamental Indices

Table VII presents the regression results for the global fundamental indices applying the four-factor model of Carhart (1997). We also made all calculations using the three-factor model of Fama and French (1993), but we obtained results very similar to those obtained with the Carhart mod-

el, so we do not report them here for the sake of brevity. Panel A reports results using the standard approach of capitalization-weighted components in the mimicking portfolios of SMB, HML, and WML, while Panel B reports results, where the returns of the factor portfolios are fundamentally weighted based on the book value.

[Please insert **Table VII** about here]

Panel A reveals that the loadings on the value factor (HML factor) are positive for all indices and highly significant. The exposures to the value premium range from 0.19 (sales) to 0.33 (employees), indicating that the returns of the fundamental indices are mainly driven by stocks with high book values relative to their market values. The loadings on the size factor (SMB factor) are positive, but only for three out of eight indices significant at the 5 percent level or better. The magnitude of the exposures to the size factor is considerably lower in comparison to the value factor, ranging only from 0.02 (sales) to 0.09 (employees). The loadings on the momentum factor (WML factor) are positive for all but one, however for none of the global indices statistically significant different from zero. After adjustment for the inherent value and size tilts in the returns, six out of eight global fundamental indices still exhibit a significant positive alpha, though the magnitude of the monthly alpha is considerably reduced in comparison to the single-factor model, now ranging from 9 basis points

(book value) to 25 basis points (dividends), compared to a distribution between 25 and 36 basis points in the single-factor model.

The results reported in Panel B, obtained with our adjusted model exhibit the same tendency in explanation as the results obtained by the standard approach, but in detail they are evidently more differentiated. Considering the higher adjusted R^2-values and the model selection measures of Akaike (AIC) and Schwarz (SIC), where smaller values are preferred, it seems that our model with fundamentally weighted factor portfolios does a better job in explaining the return behavior of fundamental indices. In particular, the exposures to the market, as well as to the value, size, and momentum factor are evidently more pronounced in the true underlying direction with the same or enhanced statistical significance as in the standard approach. For instance, the loading on the size factor for the employee-weighted fundamental index has more than doubled, which is much more consistent with our descriptive analysis in the previous section, as the concentration in large stocks is the smallest for this index. Furthermore, the indicated negative momentum factor for the book value-weighted index in Panel A is now evidently expressed and significant at the 5 percent level. The negative momentum factor suggests an aspect of contrarian investing in the return behavior of that index, that is, the tendency to reduce the weights in winning stocks and increase the weights in losing stocks, exactly the opposite of the momentum strategy. A comparison between the alpha distribution in Panel A and Panel B shows that when taking into account the distinctiveness of the fundamental weight-

ing scheme in the performance evaluation, only two out of eight indices are left with significant positive alphas at the 5 percent level (cashflow and income), but their magnitudes are greatly reduced: 10 and 11 basis points, compared to 32 and 33 basis points in the single-factor model.

C.2. Results for the Country-Specific Fundamental Indices

Across all countries, the results of the performance evaluation using the four-factor model are reported in Table VIII (capitalization-weighted factor portfolios) and Table IX (fundamental-weighted factor portfolios).

Because of the low number of stocks, we cannot calculate adequate factor portfolios for the following countries: Colombia, Venezuela, Sri Lanka, Czech Republic, and Estonia. Due to this fact, we have to exclude these markets from our further performance measurement.

[Please insert **Table VIII** about here]

Using at first the standard approach as presented in Table VIII, we identify 19 out of 45 domestic fundamental indices that have significant positive alphas on a 5 percent level or better. The magnitude ranges here from 14 basis points (United Kingdom) to 56 basis points (India). In comparison to the single-factor model, five additional countries exhibit now a positive alpha that is significant at the 5 percent level or better. These countries are the USA, India, Israel, Thailand, and the United Kingdom.

The results indicate that part of the risk-adjusted returns can be attributed to the value factor and to a lesser extent to the size and momentum factor. The alphas from the single-factor model are partly noticeably reduced, see e.g. the results for Austria or Italy. However, the Carhart alpha is for seven fundamental indices higher than the CAPM alpha. The exposure to the value premium is significant positive for 32 fundamental indices at the 5 percent level or better and ranges from 0.03 (Morocco) to 0.25 (Finland). The loading on the size factor – significant for 13 fundamental indices – is somewhat less clear, with some exposures positive and most negative. As we have already seen in the prior subsection, the momentum factor also plays only a minor role in explaining the return behavior of the domestic fundamental indices. An exception makes Russia, where the exposure is significant and 0.48 in absolute magnitude.

[Please insert **Table IX** about here]

Considering our adjusted model across all countries, Table IX reveals that the model's explanatory power, based on R^2 and the model selection criteria of Akaike and Schwarz, is in 29 out of 45 countries better than the standard approach. In comparison to the four-factor model with capitalization-weighted factor portfolios, we observe only nine fundamental indices that exhibit significant positive alphas at the 5 percent level or better, compared to 19 indices with the standard approach. The magnitude of the alphas displays an additional reduction, compared to the CAPM as well as

to the four-factor-model in the standard form. The level ranges now from 12 basis points (Germany) to 47 basis points (South Korea). In the cases, where our model with fundamentally weighted factor portfolios shows a superior way of explaining the return behavior of the indices, the reduction goes generally along with an increased loading on the value factor. The exposure to the value premium is now significant positive for 36 fundamental indices at the 5 percent level or better and ranges from 0.03 (Morocco) to 0.32 (Finland). Thus, the results imply that the superior performance of fundamental indices is mainly driven by the augmented exposure to value stocks. However, in nine countries the fundamental weighting scheme adds significant positive value for an investor, since the remaining abnormal returns cannot be explained by size, value or momentum. These countries are: Canada, South Korea, Austria, Germany, Greece, Poland, Portugal, Spain, and Australia.

V. Conclusion

This paper explores the concept of fundamental indexing around the world. Using a broad as possible worldwide data sample of 50 developed and emerging countries, we provide insight into the benefits of fundamental indices on a global- and country-specific level. In this way, we add to the existing literature on fundamental indexing by extending not only the empirical scope of existing analyses with out-of-sample evidence, but also expand the focus to a global level, since previous studies focused mainly on the U.S. or Europe.

Our analysis reveals the following main results. First, we find that all global fundamental indices and 44 out of 50 country-specific fundamental indices create higher returns than their capitalization-weighted counterparts with similar volatility. Hence, in a mean-variance sense, fundamental indexing creates better outcomes in a more efficient way. On average, the abnormal returns amount to 3.40 percent per annum on a global- and 2.46 percent on a country-specific level. Second, since the higher returns cannot be attributed to higher standard deviations, we take a closer look at the return distribution and find that fundamental indices are riskier in the short run, but their downside risk is smaller in the long run, compared to capitalization-weighted indices. This is due to the fact that larger deviations from underlying fair values through exuberances are largely evaded by the fundamental weighting scheme. Third, evaluating the performance of fundamental indices in a multifactor framework reveals that the abnormal returns can be greatly explained by an augmented exposure to value stocks. Nevertheless, we can identify two global index versions and nine countries, where the fundamental weighting scheme adds significant positive value for an investor.

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Table I
Sample Statistics

This table reports summary statistics for all countries in our sample, sorted by region. The start year of returns indicates the inclusion of that country in our sample. This is, when a return history of at least 12 months is available. The number of stocks is the total number of unique stocks in our sample as of June 2007, the last index rebalancing date. The last two columns show the number of firm years available for that country, and its proportion in the complete sample.

Country	Start Year of Returns	Number of Stocks	Firm Years	Portion
Africa				
Egypt	1999	50	380	0.13%
Morocco	2001	24	161	0.05%
South Africa	1984	244	3,592	1.19%
America				
Argentina	1994	61	793	0.26%
Brazil	1999	88	563	0.19%
Canada	1982	1,167	16,712	5.56%
Chile	1992	134	1,934	0.64%
Colombia	2005	12	31	0.01%
Mexico	1994	98	1,163	0.39%
Peru	1999	55	424	0.14%
USA	1982	4,589	72,955	24.25%
Venezuela	1994	16	255	0.08%
Asia				
China	2001	136	668	0.22%
Hong Kong	1987	606	6,301	2.09%
India	1992	872	10,262	3.41%
Israel	1994	94	1,089	0.36%
Japan	1982	3,665	56,805	18.88%
Malaysia	1989	810	10,150	3.37%
Pakistan	1994	113	1,207	0.40%
Philippines	1999	79	429	0.14%
Singapore	1988	560	4,627	1.54%
South Korea	1994	685	6,104	2.03%
Sri Lanka	1999	18	157	0.05%
Taiwan	1994	678	7,072	2.35%
Thailand	1990	332	4,217	1.40%
Turkey	1997	221	2,235	0.74%

Country	Start Year of Returns	Number of Stocks	Firm Years	Portion
Europe				
Austria	1986	81	1,253	0.42%
Belgium	1982	135	2,064	0.69%
Czech Republic	1997	16	268	0.09%
Denmark	1982	161	3,072	1.02%
Estonia	2005	7	15	0.00%
Finland	1989	125	1,582	0.53%
France	1982	802	10,197	3.39%
Germany	1982	949	12,089	4.02%
Greece	1990	262	3,380	1.12%
Hungary	1997	30	325	0.11%
Ireland	1987	49	803	0.27%
Italy	1982	267	3,513	1.17%
Luxembourg	1998	24	229	0.08%
Netherlands	1986	134	2,613	0.87%
Norway	1988	177	1,991	0.66%
Poland	1997	218	1,443	0.48%
Portugal	1990	51	1,017	0.34%
Russia	1998	90	476	0.16%
Spain	1989	130	2,013	0.67%
Sweden	1986	284	3,358	1.12%
Switzerland	1982	236	4,047	1.35%
UK	1982	1,693	22,625	7.52%
Oceania				
Australia	1982	1213	11,062	3.68%
New Zealand	1993	117	1,087	0.36%
Total		22,658	300,808	100.00%

Table II

Risk and Return Characteristics of Global Fundamental Indices

This table shows the risk and return characteristics of the global fundamental indices from July 1982 to June 2008. The first column reports the ending value for a $ 1 investment made at the beginning of the sample period in that index. The excess return measures the return difference per annum between the considered fundamental index and the capitalization-weighted reference index. The risk premium of the Sharpe ratio is measured as the excess return over the three-month Treasury bill rate. The tracking error measures how closely that fundamental index follows the capitalization-weighted reference index. The liquidity measure, which evaluates the relative investment capacity of an index, is defined as the fundamental-weighted average market capitalization of that index divided by the capitalization-weighted average market capitalization of the reference index. The last column reports the concentration of that index in large-capitalization stocks by the fraction of the total market capitalization that belongs to the 100 highest ranked stocks in that index.

Index	Ending Value of $1	Geometric Return	Excess Return	Volatility	Sharpe Ratio	Tracking Error	Liquidity	Concentration
Book Value	29.74	13.94%	2.53%	13.74%	0.627	3.30%	71.3%	32.6%
Cashflow	38.50	15.08%	3.67%	13.31%	0.732	4.31%	81.3%	38.5%
Dividends	36.87	14.88%	3.48%	12.55%	0.761	5.71%	91.0%	40.5%
Employees	38.92	15.12%	3.72%	14.03%	0.698	5.43%	49.9%	25.5%
Income	37.87	15.00%	3.60%	13.21%	0.733	4.33%	88.6%	39.0%
Net Payout	40.89	15.34%	3.94%	13.54%	0.740	6.66%	85.9%	37.3%
Sales	33.81	14.50%	3.10%	14.31%	0.641	3.64%	63.3%	28.9%
Composite	34.53	14.59%	3.19%	13.17%	0.704	4.27%	81.0%	36.2%
Reference	16.57	11.40%		14.42%	0.421			41.1%

Table III

Return Distribution of Global Fundamental Indices

This table presents measures to describe the return distribution of the global fundamental indices from July 1982 to June 2008. The first two columns report skewness and excess kurtosis of the returns. The maximum/minimum monthly return reports the return for the best/worst month in the sample period for that index. The maximum/minimum 12-month return reports the best/worst trailing 12-month return for that index. The value at risk (VaR) measures the loss that will be exceeded with a specified probability of 5 percent by that index. The last column reports the return correlation of that index with the capitalization-weighted reference index.

	Skewness	Excess Kurtosis	Maximum Monthly Return	Minimum Monthly Return	Maximum 12-Month Return	Minimum 12-Month Return	5% VaR	Correlation
Book Value	-0.69	2.19	10.64%	-17.33%	59.35%	-19.43%	-4.88%	0.97
Cashflow	-0.82	2.69	10.26%	-17.19%	58.21%	-18.59%	-4.76%	0.95
Dividends	-0.70	2.71	11.11%	-16.75%	52.44%	-17.62%	-4.51%	0.92
Employees	-0.96	3.26	10.35%	-20.17%	77.31%	-21.52%	-4.93%	0.93
Income	-0.79	2.76	10.64%	-17.78%	54.77%	-19.05%	-4.92%	0.95
Net Payout	-0.51	3.92	19.72%	-16.75%	52.44%	-17.53%	-4.56%	0.89
Sales	-0.59	1.72	11.46%	-16.34%	69.77%	-21.99%	-5.09%	0.97
Composite	-0.73	2.64	10.34%	-17.53%	56.97%	-18.84%	-4.50%	0.96
Reference	-0.47	1.35	12.98%	-15.44%	64.32%	-27.65%	-5.81%	

Table IV

Risk and Return Characteristics of Country-Specific Fundamental Indices

This table shows the risk and return characteristics of the country-specific fundamental indices and their capitalization-weighted reference indices. The time period under review for each country goes from the inception of returns for that country (see Table I) to June 2008. The risk premium of the Sharpe ratio is measured as the excess return over the three-month Treasury bill rate. The excess return in the last column measures the return difference per annum between the considered fundamental index and the capitalization-weighted reference index.

Country	Fundamental Index			Reference Index			Excess Return
	Geometric Return	Volatility	Sharpe Ratio	Geometric Return	Volatility	Sharpe Ratio	
Africa							
Egypt	21.32%	24.95%	0.641	15.57%	26.43%	0.388	5.75%
Morocco	28.43%	19.48%	1.186	29.60%	18.77%	1.293	-1.17%
South Africa	10.65%	26.10%	0.204	8.84%	26.08%	0.135	1.81%
America							
Argentina	-5.92%	35.15%	-0.320	-6.57%	35.37%	-0.336	0.65%
Brazil	29.92%	37.05%	0.664	29.61%	36.48%	0.666	0.31%
Canada	16.62%	15.73%	0.718	13.21%	17.39%	0.453	3.41%
Chile	13.03%	24.10%	0.320	11.78%	21.51%	0.300	1.25%
Colombia	31.23%	30.26%	0.856	36.38%	28.84%	1.077	-5.15%
Mexico	9.65%	30.86%	0.140	5.23%	30.01%	-0.003	4.42%
Peru	19.62%	24.17%	0.591	17.10%	25.83%	0.456	2.52%
USA	13.70%	13.76%	0.608	12.55%	14.73%	0.491	1.15%
Venezuela	-0.21%	53.58%	-0.103	3.04%	48.01%	-0.048	-3.25%
Asia							
China	13.08%	33.79%	0.229	6.55%	35.42%	0.035	6.53%
Hong Kong	13.88%	28.86%	0.296	12.30%	28.51%	0.245	1.58%
India	9.96%	31.76%	0.146	5.61%	30.34%	0.009	4.35%
Israel	13.72%	23.79%	0.353	10.79%	24.75%	0.221	2.93%
Japan	9.44%	21.80%	0.189	6.88%	22.21%	0.070	2.56%
Malaysia	3.66%	28.30%	-0.059	1.15%	29.72%	-0.140	2.51%
Pakistan	5.14%	30.78%	-0.006	2.70%	32.35%	-0.081	2.44%
Philippines	-1.79%	30.03%	-0.237	-4.37%	33.31%	-0.291	2.58%
Singapore	13.20%	23.17%	0.340	9.46%	22.09%	0.187	3.74%
South Korea	17.75%	48.87%	0.254	11.75%	45.63%	0.141	6.00%
Sri Lanka	0.89%	27.06%	-0.164	-0.65%	24.79%	-0.241	1.54%
Taiwan	-2.07%	26.68%	-0.277	-1.76%	28.83%	-0.246	-0.31%
Thailand	7.33%	37.05%	0.054	-0.75%	34.53%	-0.176	8.08%
Turkey	9.71%	57.53%	0.076	7.87%	56.59%	0.045	1.84%

Table IV–*Continued*

Country	Fundamental Index			Reference Index			Excess Return
	Geometric Return	Volatility	Sharpe Ratio	Geometric Return	Volatility	Sharpe Ratio	
				Europe			
Austria	15.15%	19.68%	0.499	11.25%	20.25%	0.293	3.90%
Belgium	16.76%	18.97%	0.603	15.42%	18.26%	0.553	1.34%
Czech Republic	21.74%	25.84%	0.635	21.43%	29.19%	0.552	0.31%
Denmark	15.31%	17.80%	0.561	14.63%	17.79%	0.523	0.68%
Estonia	12.69%	18.17%	0.405	7.63%	20.55%	0.112	5.06%
Finland	13.68%	22.61%	0.369	10.80%	29.21%	0.187	2.88%
France	18.55%	19.92%	0.664	15.70%	19.47%	0.533	2.85%
Germany	14.73%	19.26%	0.488	11.76%	19.72%	0.326	2.97%
Greece	8.37%	28.29%	0.108	3.52%	28.49%	-0.063	4.85%
Hungary	20.81%	31.42%	0.493	16.45%	30.69%	0.362	4.36%
Ireland	16.11%	21.47%	0.502	14.15%	22.30%	0.396	1.96%
Italy	14.29%	24.37%	0.368	10.79%	23.38%	0.234	3.50%
Luxembourg	8.65%	23.23%	0.143	5.92%	26.41%	0.023	2.73%
Netherlands	13.64%	18.10%	0.459	12.17%	17.04%	0.402	1.47%
Norway	16.03%	23.45%	0.457	14.61%	22.91%	0.405	1.42%
Poland	17.00%	31.31%	0.373	10.78%	32.02%	0.170	6.22%
Portugal	10.16%	19.55%	0.247	5.40%	20.01%	0.004	4.76%
Russia	27.26%	66.02%	0.332	24.37%	46.82%	0.407	2.89%
Spain	14.40%	19.66%	0.461	11.24%	19.81%	0.299	3.16%
Sweden	14.26%	23.57%	0.379	12.37%	26.22%	0.269	1.89%
Switzerland	15.19%	17.85%	0.553	14.45%	16.68%	0.547	0.74%
United Kingdom	14.53%	17.22%	0.535	12.79%	16.75%	0.446	1.74%
				Oceania			
Australia	16.17%	21.32%	0.509	13.44%	21.25%	0.382	2.73%
New Zealand	9.70%	21.71%	0.201	9.23%	22.10%	0.177	0.47%
Average							2.46%

Table V

Performance Measurement for Global Fundamental Indices using the CAPM

This table presents the regression results from applying the CAPM for explaining the excess returns of the global fundamental indices from July 1982 to June 2008. All the estimates are obtained by OLS. Newey-West robust standard errors are used. The regression R^2 is adjusted for degrees of freedom. *, **, and *** mean significant at the 10%, 5%, 1% level, respectively.

Index	a	b	R^2
Book Value	0.22%***	0.93***	0.95
Cashflow	0.32%***	0.88***	0.91
Dividends	0.35%***	0.8***	0.85
Employees	0.34%***	0.9***	0.86
Income	0.33%***	0.87***	0.91
Net Payout	0.36%***	0.83***	0.79
Sales	0.25%***	0.96***	0.94
Composite	0.30%***	0.87***	0.91

Table VI

Performance Measurement for Country-Specific Fundamental Indices using the CAPM

This table presents the regression results from applying the CAPM for explaining the excess returns of the country-specific fundamental indices. The time period under review for each country goes from the inception of returns for that country (see Table I) to June 2008. All the estimates are obtained by OLS. Newey-West robust standard errors are used. The regression R^2 is adjusted for degrees of freedom. *, **, and *** mean significant at the 10%, 5%, 1% level, respectively.

Country	a	b	R^2
Africa			
Egypt	0.52%*	0.89***	0.89
Morocco	-0.13%	1.03***	0.98
South Africa	0.13%	1.00***	0.96
America			
Argentina	0.13%	0.96***	0.94
Brazil	0.23%	0.93***	0.83
Canada	0.33%***	0.86***	0.90
Chile	0.10%	1.06***	0.94
Colombia	-0.48%*	1.03***	0.97
Mexico	0.39%	0.98***	0.91
Peru	0.27%	1.01***	0.88
USA	0.15%	0.89***	0.91
Venezuela	-0.10%	1.05***	0.89
Asia			
China	0.48%	0.94***	0.93
Hong Kong	0.13%	0.99***	0.97
India	0.39%	0.97***	0.85
Israel	0.33%*	0.88***	0.85
Japan	0.21%**	0.95***	0.95
Malaysia	0.18%**	0.94***	0.98
Pakistan	0.23%	1.01***	0.94
Philippines	0.22%	0.80***	0.87
Singapore	0.29%***	1.02***	0.94
South Korea	0.50%**	1.05***	0.93
Sri Lanka	0.19%	1.01***	0.93
Taiwan	-0.04%	0.82***	0.86
Thailand	0.67%*	1.01***	0.85
Turkey	0.21%	1.00***	0.96

Country	a	b	R^2
Europe			
Austria	0.32%***	0.95***	0.95
Belgium	0.09%	1.02***	0.96
Czech Republic	0.52%	0.66***	0.55
Denmark	0.11%	0.93***	0.86
Estonia	0.44%	0.83***	0.88
Finland	0.34%	0.69***	0.80
France	0.23%***	0.98***	0.92
Germany	0.24%***	0.96***	0.97
Greece	0.39%***	0.96***	0.93
Hungary	0.47%	1.01***	0.97
Ireland	0.24%	0.89***	0.86
Italy	0.27%***	1.02***	0.95
Luxembourg	0.22%	0.83***	0.89
Netherlands	0.12%	1.01***	0.90
Norway	0.15%	0.96***	0.88
Poland	0.49%**	0.95***	0.94
Portugal	0.37%***	0.96***	0.92
Russia	0.36%	1.13***	0.61
Spain	0.25%***	0.98***	0.98
Sweden	0.20%	0.85***	0.90
Switzerland	0.04%	1.04***	0.94
United Kingdom	0.13%*	1.01***	0.96
Oceania			
Australia	0.21%***	0.99***	0.98
New Zealand	0.06%	0.94***	0.92

Table VII

Performance Measurement for Global Fundamental Indices using Carhart's Four-Factor Model

This table presents the regression results from applying Carhart's four-factor model for explaining the excess returns of the global fundamental indices from July 1982 to June 2008. Panel A reports results using the standard approach of capitalization-weighted components in the mimicking portfolios of SMB, HML, and WML, while Panel B reports results, where the returns of the factor portfolios are fundamentally weighted based on the book value. The last two columns report the model selection measures of Akaike (AIC) and Schwarz (SIC). All the estimates are obtained by OLS. Newey-West robust standard errors are used. The regression R^2 is adjusted for degrees of freedom. *, **, and *** mean significant at the 10%, 5%, 1% level, respectively.

	a	b	s	h	w	R^2	AIC	SIC
Panel A: Capitalization-Weighted Factor Portfolios								
Book Value	0.09%*	0.99***	0.05***	0.22***	-0.01	0.98	-7.38	-7.32
Cashflow	0.18%***	0.95***	0.04*	0.24***	0.03	0.95	-6.64	-6.58
Dividends	0.25%***	0.87***	0.01	0.27***	0.02	0.90	-6.13	-6.07
Employees	0.09%	1.00***	0.09***	0.33***	0.03	0.92	-6.07	-6.01
Income	0.20%***	0.94***	0.03	0.22***	0.03	0.94	-6.57	-6.51
Net Payout	0.18%	0.90***	0.05*	0.21***	0.07	0.82	-5.33	-5.27
Sales	0.16%**	1.01***	0.02**	0.19***	0.00	0.96	-6.63	-6.57
Composite	0.19%***	0.94***	0.02	0.25***	0.01	0.96	-6.85	-6.79
Panel B: Fundamental-Weighted Factor Portfolios								
Book Value	0.04%	1.02***	0.07***	0.28***	-0.03**	0.98	-7.71	-7.65
Cashflow	0.10%**	0.99***	0.04	0.33***	0.02	0.96	-6.92	-6.86
Dividends	0.10%*	0.91***	-0.04	0.37***	0.01	0.92	-6.36	-6.30
Employees	0.04%	1.05***	0.22***	0.42***	0.02	0.94	-6.33	-6.27
Income	0.11%**	0.97***	0.02	0.30***	0.03	0.95	-6.76	-6.70
Net Payout	0.13%	0.94***	0.04	0.31***	0.04	0.83	-5.41	-5.35
Sales	0.08%	1.04***	0.06**	0.26***	-0.01	0.96	-6.80	-6.74
Composite	0.07%*	0.98***	0.00	0.34***	0.00	0.97	-7.22	-7.16

Table VIII

Performance Measurement for Country-Specific Fundamental Indices using Carhart's Four-Factor Model (Capitalization-Weighted Factor Portfolios)

This table presents the regression results from applying Carhart's four-factor model for explaining the excess returns of the country-specific fundamental indices using the standard approach of capitalization-weighted factor portfolios. The time period under review for each country goes from the inception of returns for that country (see Table I) to June 2008. Table VIII reports the alpha and factor loadings on the contemporaneous market, size (SMB), book-to-market (HML), and momentum factor (WML). The last two columns report the model selection measures of Akaike (AIC) and Schwarz (SIC). All the estimates are obtained by OLS. Newey-West robust standard errors are used. The regression R^2 is adjusted for degrees of freedom. *, **, and *** mean significant at the 10%, 5%, 1% level, respectively.

Country	a	b	s	h	w	R^2	AIC	SIC
				Africa				
Egypt	0.42%	0.89***	0.04	0.08***	0.03	0.89	-4.56	-4.44
Morocco	-0.19%*	1.05***	0.06***	0.03**	-0.03*	0.98	-7.02	-6.87
South Africa	0.06%	1.00***	0.08***	0.15***	-0.04***	0.98	-6.25	-6.18
				America				
Argentina	0.11%	0.97***	0.03	0.05	-0.04	0.94	-4.33	-4.21
Brazil	0.28%	0.90***	-0.11	-0.03	-0.01	0.83	-3.34	-3.22
Canada	0.38%***	0.89***	-0.01	0.10***	0.01	0.92	-5.90	-5.84
Chile	0.10%	1.08***	0.04*	0.02	0.06*	0.95	-5.47	-5.38
Colombia	[NA]							
Mexico	0.18%	0.96***	0.07**	0.21***	-0.06*	0.95	-4.89	-4.80
Peru	0.27%	1.03***	0.01	0.09***	-0.07*	0.90	-4.70	-4.51
USA	0.26%***	0.94***	-0.07***	0.19***	-0.03	0.95	-6.63	-6.57
Venezuela	[NA]							
				Asia				
China	0.56%*	0.99***	0.20***	0.11***	0.12**	0.95	-4.64	-4.46
Hong Kong	0.18%*	0.97***	-0.01	0.09***	-0.03	0.97	-5.66	-5.59
India	0.56%***	0.97***	-0.12***	0.08*	0.00	0.88	-3.99	-3.91
Israel	0.44%**	0.89***	-0.01	0.11***	-0.06	0.86	-4.49	-4.40
Japan	0.18%***	0.98***	-0.08**	0.19***	0.00	0.97	-6.04	-5.98
Malaysia	0.16%**	0.94***	0.00	0.04**	-0.01	0.98	-6.20	-6.12
Pakistan	0.26%	1.04***	0.00	-0.02	-0.09*	0.94	-5.24	-5.08
Philippines	0.07%	0.91***	-0.03	0.05*	-0.08	0.89	-5.74	-5.55
Singapore	0.26%**	1.00***	0.02	0.15***	0.00	0.95	-5.63	-5.55
South Korea	0.50%**	1.04***	-0.10*	0.04	0.00	0.94	-4.03	-3.95
Sri Lanka	[NA]							
Taiwan	-0.01%	0.87***	-0.08*	0.13***	0.01	0.88	-4.37	-4.27
Thailand	0.44%**	0.96***	0.02	0.24***	0.02	0.88	-3.72	-3.63
Turkey	0.24%	1.00***	-0.03	0.20***	0.08**	0.97	-4.11	-4.00

Table VIII–*Continued*

Country	a	b	s	h	w	R^2	AIC	SIC
				Europe				
Austria	0.24%***	0.96***	0.03	0.08***	0.02	0.95	-5.94	-5.87
Belgium	0.07%	1.02***	0.01	0.05**	0.04	0.96	-6.31	-6.25
Czech Republic	[NA]							
Denmark	0.01%	0.96***	0.10***	0.14***	-0.03	0.89	-5.27	-5.21
Estonia	[NA]							
Finland	0.29%*	0.79***	-0.03	0.25***	0.00	0.85	-4.49	-4.42
France	0.22%***	0.97***	-0.05	0.09***	-0.05	0.94	-5.71	-5.65
Germany	0.23%***	0.95***	-0.04**	0.07***	0.02	0.98	-6.64	-6.58
Greece	0.42%***	0.97***	-0.04	0.01	-0.06	0.94	-4.91	-4.83
Hungary	0.20%	0.99***	-0.12***	0.09***	0.10**	0.98	-5.33	-5.15
Ireland	0.24%	0.90***	0.03	0.10***	0.01	0.86	-4.61	-4.53
Italy	0.19%**	1.00***	-0.07**	0.15***	-0.01	0.96	-5.77	-5.71
Luxembourg	0.07%	0.91***	0.03	0.00	0.07	0.90	-5.60	-5.44
Netherlands	0.08%	1.02***	-0.02	0.13***	-0.02	0.91	-5.49	-5.42
Norway	0.12%	0.96***	0.01	0.04*	0.04	0.89	-4.69	-4.62
Poland	0.53%**	0.95***	-0.03	0.01	0.04	0.94	-4.70	-4.59
Portugal	0.37%***	0.96***	0.02	0.01	0.03	0.92	-5.44	-5.35
Russia	0.82%	0.97***	-0.16*	0.04	0.48**	0.70	-1.82	-1.69
Spain	0.20%***	0.99***	0.01	0.05***	0.04**	0.98	-6.69	-6.62
Sweden	0.20%	0.90***	0.01	0.20***	0.03	0.93	-5.14	-5.07
Switzerland	0.05%	1.03***	-0.05*	0.11***	0.01	0.95	-6.14	-6.08
United Kingdom	0.14%**	1.00***	-0.03**	0.09***	-0.03	0.97	-6.57	-6.51
				Oceania				
Australia	0.20%***	1.00***	-0.04**	0.05***	0.01	0.98	-6.78	-6.72
New Zealand	-0.14%	0.98***	0.06	0.15***	0.02	0.94	-5.53	-5.44

Table IX

Performance Measurement for Country-Specific Fundamental Indices using Carhart's Four-Factor Model (Fundamental-Weighted Factor Portfolios)

This table presents the regression results from applying Carhart's four-factor model for explaining the excess returns of the country-specific fundamental indices using fundamental-weighted factor portfolios based on the book value. The time period under review for each country goes from the inception of returns for that country (see Table I) to June 2008. Table IX reports the alpha and factor loadings on the contemporaneous market, size (SMB), book-to-market (HML), and momentum factor (WML). The model selection measures of Akaike and Schwarz are denoted by AIC and SIC. The last column indicates if the adjusted four-factor-model provides a better explanatory power in comparison to the standard approach based on R^2 and the model selection criteria of Akaike and Schwarz. '(+)' denotes a better explanatory power, whereas '(-)' denotes a inferior explanatory power. All the estimates are obtained by OLS. Newey-West robust standard errors are used. The regression R^2 is adjusted for degrees of freedom. *, **, and *** mean significant at the 10%, 5%, 1% level, respectively.

Country	a	b	s	h	w	R^2	AIC	SIC	Model
				Africa					
Egypt	0.50%*	0.89***	0.03	0.07**	0.01	0.89	-4.55	-4.43	(-)
Morocco	-0.19%*	1.04***	0.05**	0.03**	-0.01	0.98	-6.94	-6.80	(-)
South Africa	0.05%	1.00***	0.08***	0.16***	-0.03*	0.98	-6.20	-6.14	(-)
				America					
Argentina	0.13%	0.96***	0.01	0.03	-0.03	0.94	-4.30	-4.18	(-)
Brazil	0.23%	0.90***	-0.11	-0.01	-0.01	0.83	-3.34	-3.22	(+)
Canada	0.27%***	0.91***	-0.03	0.18***	0.04	0.94	-6.10	-6.04	(+)
Chile	0.10%	1.07***	0.04	0.06**	0.04	0.95	-5.49	-5.40	(+)
Colombia	[NA]								
Mexico	0.12%	0.96***	0.06	0.22***	0.01	0.94	-4.78	-4.68	(-)
Peru	0.24%	1.03***	0.01	0.09***	-0.04	0.89	-4.64	-4.45	(-)
USA	0.05%	0.96***	-0.08***	0.30***	-0.01	0.96	-6.94	-6.88	(+)
Venezuela	[NA]								
				Asia					
China	0.63%*	1.01***	0.18***	0.14***	0.08	0.95	-4.60	-4.42	(-)
Hong Kong	0.14%	0.96***	-0.04	0.09***	-0.03	0.97	-5.60	-5.53	(-)
India	0.36%*	0.96***	-0.12**	0.22***	0.04	0.89	-4.08	-4.00	(+)
Israel	0.37%*	0.91***	0.00	0.16***	-0.08**	0.87	-4.55	-4.46	(+)
Japan	0.01%	0.99***	-0.13***	0.28***	-0.02	0.97	-6.19	-6.13	(+)
Malaysia	0.11%*	0.94***	-0.01	0.07***	-0.03*	0.98	-6.26	-6.18	(+)
Pakistan	0.26%	1.03***	-0.03	-0.04	-0.13**	0.94	-5.25	-5.10	(+)
Philippines	0.01%	0.92***	-0.03	0.06***	-0.08	0.90	-5.86	-5.66	(+)
Singapore	0.20%*	1.00***	0.03	0.17***	-0.03	0.95	-5.62	-5.55	(-)
South Korea	0.47%**	1.04***	-0.11*	0.06	0.00	0.94	-4.04	-3.95	(+)
Sri Lanka	[NA]								
Taiwan	-0.07%	0.87***	-0.09*	0.19***	0.00	0.89	-4.45	-4.35	(+)
Thailand	0.42%*	0.97***	0.02	0.26***	-0.02	0.89	-3.74	-3.66	(+)
Turkey	0.11%	1.00***	0.02	0.29***	0.05	0.97	-4.08	-3.97	(-)

Table IX–*Continued*

Country	a	b	s	h	w	R^2	AIC	SIC	Model
				Europe					
Austria	0.23%***	0.99***	0.04*	0.11***	0.03	0.96	-5.98	-5.92	(+)
Belgium	0.05%	1.03***	0.03	0.07***	0.04	0.97	-6.32	-6.26	(+)
Czech Republic	[NA]								
Denmark	0.01%	0.96***	0.09**	0.12***	-0.03	0.88	-5.20	-5.14	(-)
Estonia	[NA]								
Finland	0.21%	0.81***	-0.03	0.32***	0.01	0.87	-4.64	-4.56	(+)
France	0.05%	0.99***	-0.05*	0.23***	-0.02	0.96	-6.05	-5.99	(+)
Germany	0.12%**	0.96***	-0.05***	0.16***	0.00	0.98	-6.90	-6.84	(+)
Greece	0.33%***	0.95***	-0.05*	0.09***	0.00	0.94	-4.93	-4.85	(+)
Hungary	0.28%	1.00***	-0.10**	0.10***	0.09*	0.98	-5.26	-5.08	(-)
Ireland	0.18%	0.96***	0.09***	0.17***	0.07	0.88	-4.79	-4.71	(+)
Italy	0.12%	1.00***	-0.08**	0.17***	0.04	0.97	-5.85	-5.79	(+)
Luxembourg	0.07%	0.91***	0.02	0.00	0.08	0.89	-5.57	-5.41	(-)
Netherlands	0.06%	1.01***	-0.04	0.10***	-0.03	0.91	-5.46	-5.39	(-)
Norway	0.10%	0.98***	0.03	0.03	0.05	0.89	-4.69	-4.62	(+)
Poland	0.44%**	0.94***	-0.02	0.03	0.07	0.94	-4.70	-4.59	(+)
Portugal	0.36%***	0.97***	0.03	0.02	0.01	0.92	-5.44	-5.35	(+)
Russia	0.32%	1.13***	0.04	0.01	0.13	0.60	-1.55	-1.42	(-)
Spain	0.19%***	0.99***	0.01	0.06***	0.04**	0.98	-6.69	-6.62	(+)
Sweden	0.06%	0.93***	0.03	0.26***	0.08**	0.95	-5.48	-5.41	(+)
Switzerland	0.01%	1.03***	-0.06*	0.08***	0.01	0.95	-6.07	-6.01	(-)
United Kingdom	0.04%	1.01***	-0.01	0.19***	-0.01	0.97	-6.69	-6.63	(+)
				Oceania					
Australia	0.17%***	1.00***	-0.03*	0.07***	-0.01	0.98	-6.84	-6.78	(+)
New Zealand	-0.01%	0.96***	0.06	0.13***	-0.05	0.95	-5.59	-5.50	(+)

Figure 1
Performance of a $ 1 Investment,
July 1982 to June 2008

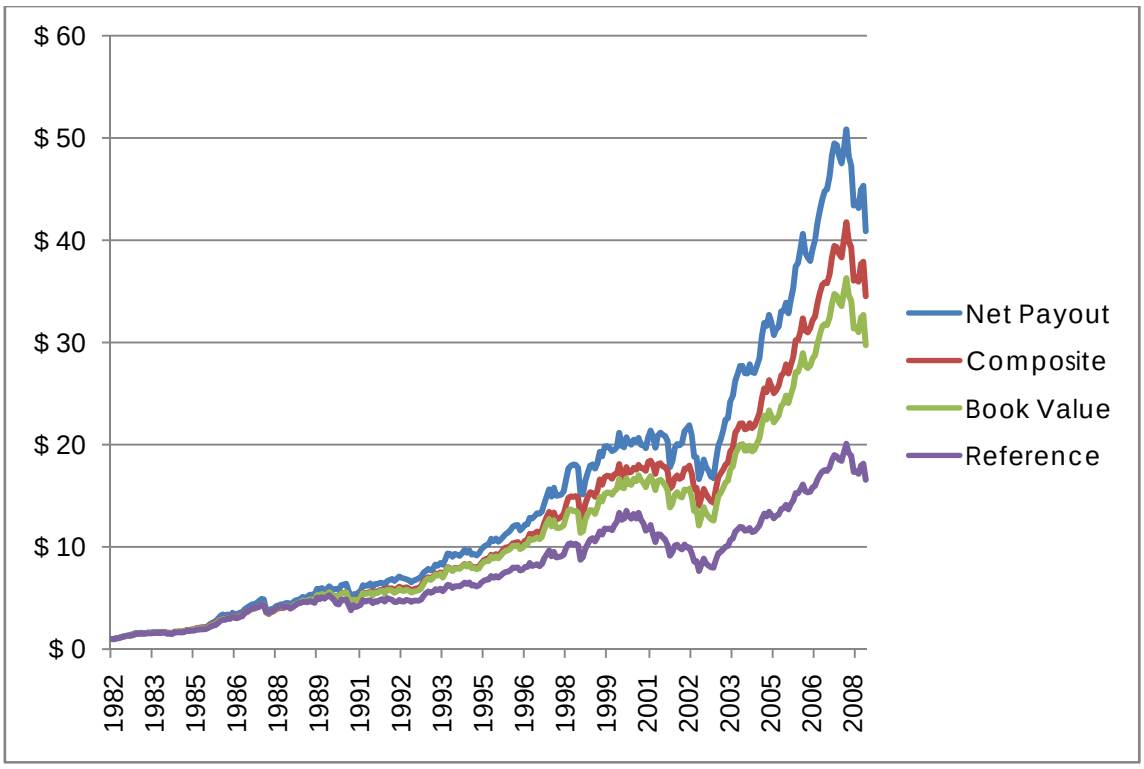
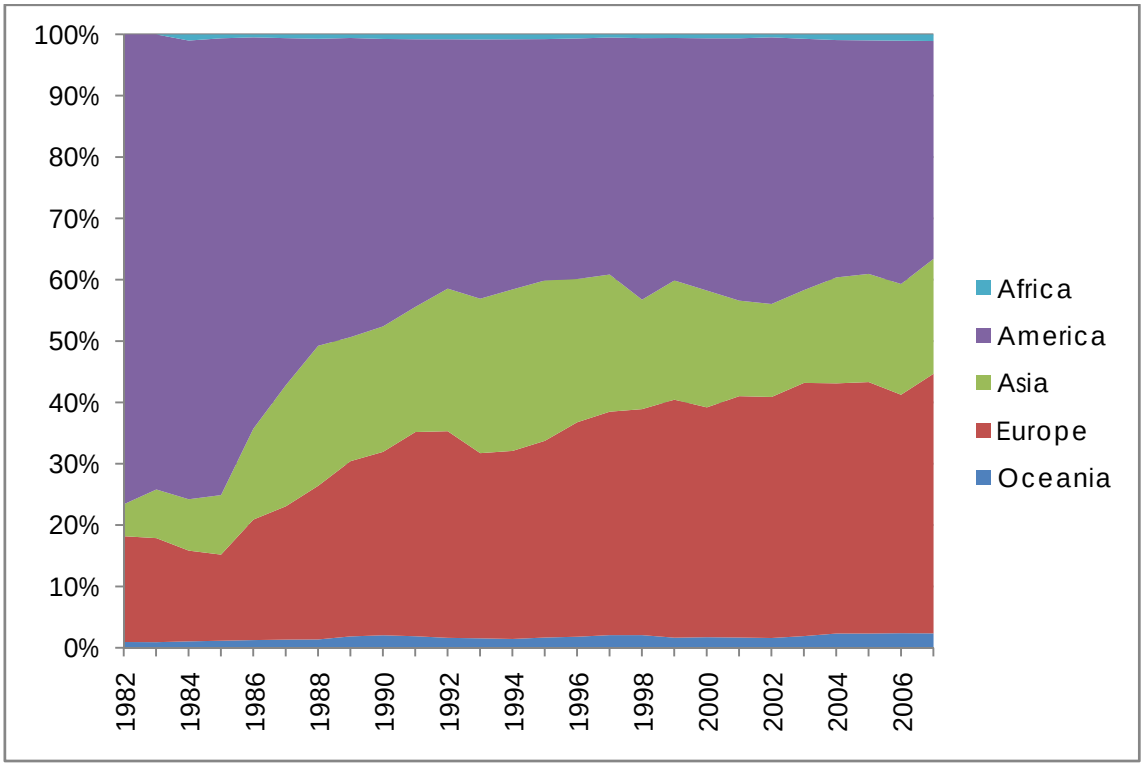


Figure 2
Country Weighting

Panel A: Composite Fundamental Index



B. Capitalization-Weighted Reference Index

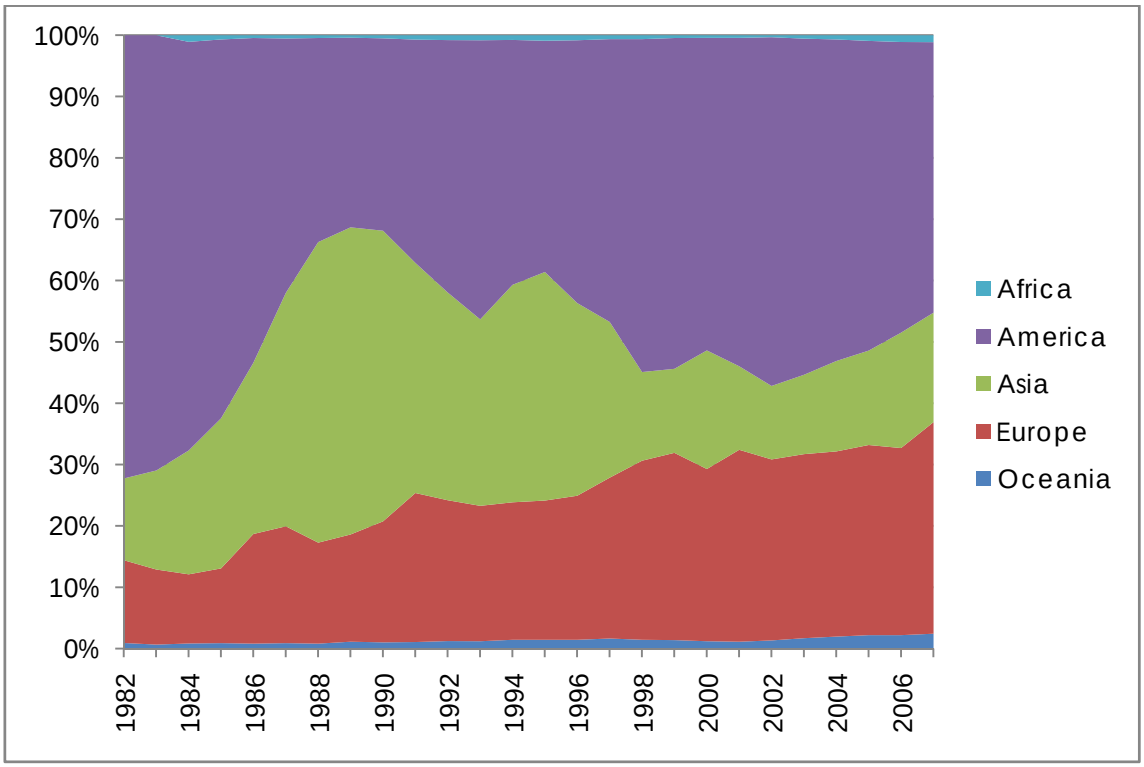
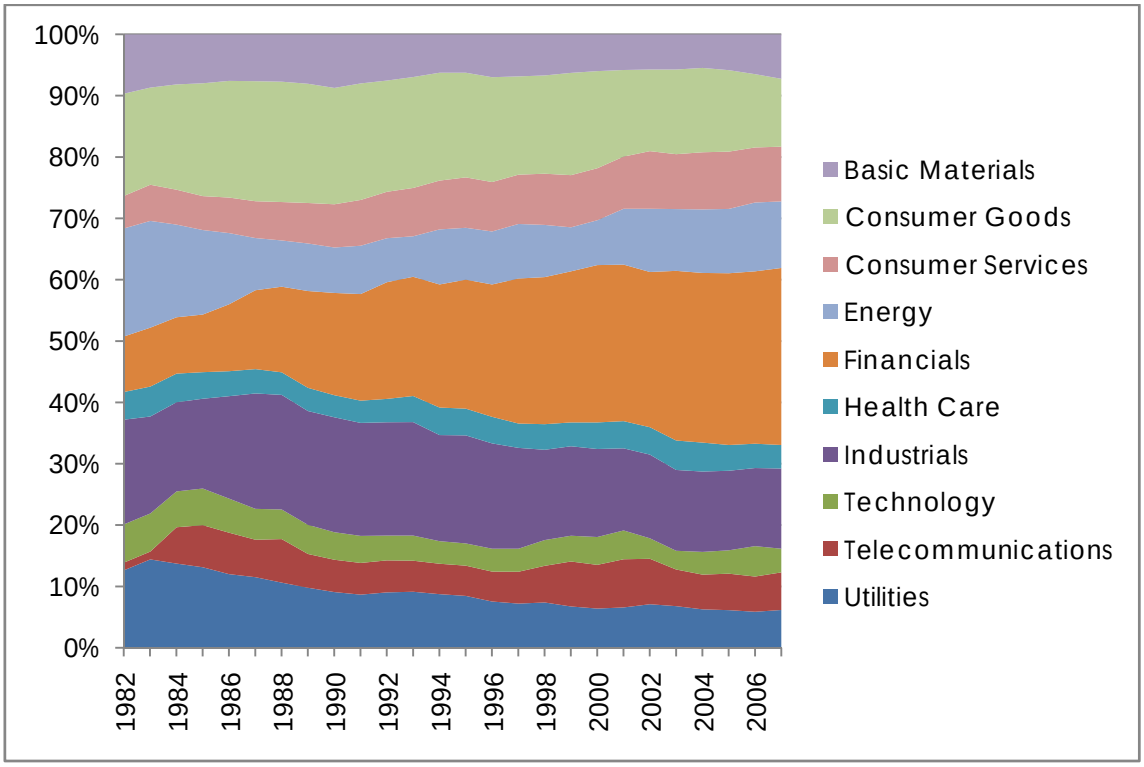


Figure 3
Sector Weighting

Panel A: Global Composite Fundamental Index



Panel B: Capitalization-Weighted Reference Index