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Unlocking the secrets of fundamental indexes: size effect or value effect? Evidence from emerging stock markets

Abstract

Despite the abundant successful evidence of fundamental indexation in recent international literature, it is argued that the performance of fundamental indexes is primarily attributed to their inherent value bias or avoidance of large caps. To clarify whether the merits of fundamental indexation represent reward to priced value and size risk factors, performance attribution analysis is conducted on the fundamental indexes in emerging stock markets based on the Fama and French (1993) 3-factor model. The results of this study indicate that with the exception of the sales indexes, the majority of the fundamental-weighted indexes have significant exposures to the size and value risks in emerging stock markets, and earn significantly negative abnormal returns after the size and value risks are controlled for. It is also found that although fundamental-weighted indexes accumulate positive residuals during the crash of the dot.com bubble in 2000 and the global financial crisis in 2008, they also experience severe drawdown during these periods. This observation suggests that fundamental indexation might have significant exposures to known risk factors in emerging markets during turbulent times.

Keywords: fundamental indexes, efficient market hypothesis (EMH), value effect, size effect, style anomalies, overreaction hypothesis, emerging markets.
JEL Classification: G11, G12, G14, G15.

Introduction

Central to capital market theories is the market portfolio that contains all risky assets in the universe. Since the market portfolio is located on the Markowitz (1952) efficient frontier of risky assets, it is a mean-variance efficient portfolio that offers the highest compensation for its risk. All investors should hold the market portfolio in combination with the risk-free asset, depending on their risk appetite, as suggested by the separation theorem of Tobin (1958). The market portfolio adopts a market capitalization weighting (cap-weighted) methodology that invests in its constituent assets proportional to their market capitalizations. This weighting method seems appropriate if asset prices reflect their intrinsic worth as postulated by the efficient market hypothesis (EMH) of Fama (1970). However, when the systematic overshooting of asset prices is present in the market due to investor overreaction, the cap-weighted method ceases to be mean-variance efficient as it continues to overweight overvalued assets and underweight undervalued assets in the portfolio. Since most of the broad market indexes are cap-weighted, the above argument has serious concerns for investors who track the performance of broad market indexes or use broad market indexes as their benchmarks.

Arnott, Hsu and Moore (2005) propose that broad market indexes should allocate constituent weights based on firms' fundamental values as opposed to their market caps. They claim that fundamental indexes are insensitive to the noise trading of irrational investors in real economic conditions and thus are more mean-variance efficient compared to otherwise identical cap-weighted indexes. Although the "price noise resistant" argument provides support to alternative indexing strategies, fundamental indexation is criticized to have inherent value and large cap avoidance biases, and hence does not represent a unique investment style that is new to the investment universe. This paper undertakes to examine the performance of fundamental indexes over the period from January 1, 1996 to December 31, 2010; and investigates whether the performance of fundamental indexes is attributed to value and size related risks in emerging markets. The study results provide indications as to whether fundamental indexation captures unique dimensions of risk in emerging markets that are independent of known risk factors.

1. Pricing noises, cap drag and the legacy of fundamental indexation

Due to the unobservable nature of the true market portfolio highlighted in Roll's critique (1977; 1978), broad stock market indexes are often used as proxies of the market portfolio. The appropriateness of the market proxy employed is crucial for both active and passive portfolio managers. Active managers use the market proxy as the benchmark against which their performance is evaluated. On the other hand, passive managers deliver a buy-and-hold performance by tracking the movements of the market proxy. In line with the theoretical market portfolio, broad market indexes, such as the Standard and Poor (S&P) 500 index and the Morgan Stanley Capital International (MSCI) index, mostly follow the cap-weighted methodology. "*In slicing the market by size, the industry has typically relied*

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on market capitalization (market price times shares outstanding) both to measure the size of a company and to weight each company in the index, so that the performance of the largest companies has the greatest impact on the performance of the overall index" (Schoenfeld and Ginis, 2006). The cap-weighted methodology is theoretically sound under the framework of the efficient market hypothesis (EMH) of Fama (1970; 1990) in that the market capitalization of a firm is an indication of its true worth and reflective of the firm's dominance in the market. Thus, firms with relatively larger market values are justified to receive greater weights in the market proxy.

A cap-weighted market proxy offers investors cost-effective opportunities to achieve portfolio diversification as it rebalances continuously via changes in the prices of its constituents. The cap-weighted methodology also ensures that the portfolio is invested in the most liquid stocks since there is a high correlation between market capitalization and liquidity (Hsu, 2006). However, the price-sensitive nature of a cap-weighted index implies that the index is as efficient as the pricing of its constituents. The overreaction hypothesis proposed by De Bondt and Thaler (1985; 1987) argues that investors place undue weight on new information and overreact to its announcement, which leads to mispricing of the affected stocks.

Arnott et al. (2005) propose the use of price-insensitive fundamental indexes as the proxies for large well-diversified portfolios. Allocating capital in proportion to the fundamental values of the constituents prevent the index from placing uncertain weight on future prospects of the firms that have not yet materialized. Siegel (2006) proposes the noise market hypothesis, criticizing cap-weighted portfolios being suboptimal due to "noise traders" in the market. The author argues that "*prices can be influenced by speculators and momentum traders, as well as by insiders and institutions that often buy and sell stocks for reasons unrelated to fundamental value, such as for diversification, liquidity and taxes*". Siegel (2006) suggests that the size and value anomalies are attributed to the noise trading in the market and claims that fundamental indexation offers a convenient way for investors to capture the mispricing of securities and, in turn, outperform the cap-weighted indexes.

As long as pricing errors are not persistent, mean reversion towards the intrinsic values of the stocks will create a drag in the performance of cap-weighted indexes due to their inappropriate exposures to overvalued and undervalued stocks. Each time a constituent becomes overvalued (undervalued), a cap-weighted index increases (reduces) its allocation in the constituent. Consequently, cap-weighted indexes are likely to underperform over time, preventing them from being mean-variance efficient under real economic conditions when investor overreaction is present (Hsu and Campollo, 2006). Hsu (2006) estimates the cost of cap-weighting as the square of the noise in the stock price, which is commonly known as the "cap drag" on the performance of cap-weighted portfolios. Arnott and Hsu (2008) mathematically demonstrates that the size and value anomalies and stock market mean reversion are all driven by price noises in the economy, which results in contrarian strategy profits.

Using book value, cash flow, revenue, employment, sales and dividends as proxies for firms' fundamental values, Arnott et al. (2005) construct fundamental-weighted indexes of 1,000 constituents in the U.S. stock markets from 1962 to 2004. The composite fundamental-weighted index constructed by allocating weights in accordance with the average fundamental values of sample stocks earns an annualized geometric return of 12.47% compared to 10.53% for the S&P500 index and 10.35% for the cap-weighted benchmark. The sales-weighted index achieved the highest annualized geometric return of 12.91%. Overall, the fundamental-weighted indexes earn higher returns than the S&P 500 market proxy and the cap-weighted index with similar or lower levels of risk across different phases of the economic cycle. Although the portfolio turnover is higher than the cap-weighted index, fundamental-weighted indexes are less concentrated and thus are more diversified compared to the cap-weighted indexes.

Hemminki and Puttonen (2008) investigate the performance of fundamental indexes in the European stock markets over the period from 1996 to 2006 based on constituents of the Dow Jones (DJ) Euro Stoxx50 Index that covers the largest 50 stocks by market cap in the Eurozone. All of the fundamental-weighted indexes are found to outperform the cap-weighted benchmark on a risk-adjusted basis. Arnott and Shepherd (2012) claim that fundamental indexation is also applicable to emerging markets that are more volatile and less efficient. The FTSE RAFI (Research Affiliates Fundamental Index) Emerging Market Index achieved an annual return of 15.9% compared to its benchmark (6.9%) with similar level of standard deviation over the period from 1994 to 2009. The RAFI indexes in Europe, Japan, and global stock markets also outperform their comparative benchmarks over various periods from 1980s through 2009 on a risk-adjusted basis.

2. Criticisms

2.1. Bias to known anomalies? In the opinion of Arnott et al. (2005), fundamental indexes enjoy the benefits offered by value stocks and small firms, and simultaneously avoid the cap drag bias in the portfolio. Kaplan (2008) argues that avoiding the cap drag bias in the indexing methodology inevitably introduces weighting errors by ignoring firms' future prospects embedded in their stock prices. In addition, fundamental indexes will naturally bias towards smaller caps in a strong, bullish market. Schoenfeld and Ginis (2006) criticize the work of Arnott et al. (2005) by arguing that the fundamental composite index is indeed a naïve multifactor model with well documented anomalies (in empirical literature) as model inputs. The results of the performance analysis conducted by Schoenfeld and Ginis (2006) reveal that size, style and industry exposures account for approximately 90% of the variation in RAFI returns over the period from 2000 to 2005. Although RAFI outperforms the benchmark in each year of the examination period, the major outperformance only comes in the first two years. RAFI returns also have significantly higher correlations with the S&P and Russell value indexes compared to its correlations with the returns on the S&P500 and Russell 1,000 core indexes. In addition, the examination of the relative return patterns reveals that the RAFI index and the value indexes outperform and underperform the core indexes over similar periods.

Proponents of fundamental indexation, Hsu and Campollo (2006) indicate that fundamental indexation effectively reduces the weights of stocks with share prices growing faster than their fundamental values, which is far from value investing. In addition, fundamental indexes are more diversified and offer broader market participation compared to value portfolios. Contradicting to the findings of Schoenfeld and Ginis (2006), studies conducted by Hsu and Campollo (2006) indicate that fundamental indexes not only outperform the Russell value indexes over the period from 1979 to 2004, but also outperform the S&P500 index during the expansionary business cycle, which are not achieved by the Russell value indexes.

More recently, Chow, Hsu, Kalesnik and Little (2011) construct alternative indexing strategies over the period from 1964 to 2009 in the U.S. stock markets; and over the period 1987 to 2009 for global stocks. The regression results from the Carhart (1997) 4-factor model reveal that the outperformance of the alternative indexing strategies, including fundamental indexes are primarily attributed to their exposures in the size and value factors, with risk-adjusted alpha not significantly different from zero.

Amenc, Goltz and Ye (2012) criticize the justification of fundamental indexation based on the argument of Arnott and Hsu (2008) that pricing noises explain both the cap drag and empirical anomalies. They argue that "*such a theory does not justify any particular fundamentals-based weighting scheme. Rather, such a theory suggests that any non-price related weighting scheme, including for example equal or random weights, would lead to higher performance than using cap-weighting*" (Amenc et al., 2012, p. 9).

2.2. Active or passive? Schoenfeld and Ginis (2006) refer fundamental indexation as a "quasi-active" indexing strategy. Unlike cap-weighted indexes, fundamental indexes are not regarded as passive investment strategies in a traditional way, as constant rebalancing is required to ensure that a large proportion of the index worth remains undervalued. The trading costs, price impact and taxes incurred through the rebalancing of fundamental indexes would not be incurred by a cap-weighted index (Estrada, 2008). However, fundamental indexes constructed from global exchange traded funds (ETF) are highly liquid and are not subject to high rebalancing costs. Having this argument in mind, Estrada (2008) constructs a dividend-weighted index, a value index proxied by dividend yield, an equally-weighted index and a cap-weighted index from the stock market indexes of 16 countries, including Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, the Netherlands, Singapore, South Africa, the United Kingdom and the United States of America. According to Siegel (2006), dividends are the only fundamental factor that is completely objective, transparent and not subject to accounting manipulations. Study results of Estrada (2008) indicate that although the global dividend-weighted index outperforms the global cap-weighted index on a risk-adjusted basis, it is itself outperformed by the equally-weighted index and the dividend yield-weighted index over the examination period from 1974 to 2005. This finding casts doubt about the mean-variance efficiency of fundamental indexation in the global equity market since better reward is available to investments in alternative indexing strategies.

3. Data and index construction methodology

This study employs the constituents of the Standard and Poor (S&P) Emerging Large-Mid-Cap (LM) Index to represent emerging market equities. The S&P Emerging LM Index forms subset of the S&P Global Broad Market Index (BMI). Preference stocks, mutual fund stocks and unit trusts are not included in the index[1]. As of December 31, 2010,

[1] The specifications of the index construction methodology are obtained from the S&P Dow Jones Indexes Methodology factsheet.

the U.S. dollar values of the monthly total return, market capitalization, book value, total earnings, total dividends and gross sales of the 836 stocks comprising the S&P Emerging LM Index since January 1, 1996 are extracted to form the initial research database. To ensure that sufficient liquidity and partially to address the survivorship bias in the initial database, only stocks that are ranked in the top 300 based on market capitalization at the beginning of each month are employed as sample stocks. Large caps are generally more liquid and are less likely to be non-survivors in emerging markets.

Indexes are constructed to track the investment style that follows the performance of large blue chip companies in emerging markets. Firm-specific style attributes that represent the above-mentioned investment style include the market capitalization and the fundamental values of sample stocks. The four fundamental attributes employed to construct fundamental indexes include book value, total earnings, total dividends and gross sales of the sample stocks. At the beginning of each month, the top 100, 50 and 30 sample stocks in terms of the respective fundamental values are extracted to form fundamental indexes over the examination period from January 1, 1996 through December 31, 2010. Fundamental composite indexes of 100, 50 and 30 constituents are also constructed from sample stocks with the highest averages of the four fundamental values at the beginning of each month. Similarly, large cap indexes of 100, 50 and 30 constituents are constructed against which the fundamental indexes are evaluated.

The indexes are either equally-weighted (*EW*) or style-weighted (*SW*). The weight of the *i*th constituent in an equally-weighted index *x* for month *t* is computed using equation (1):

$$w_{x(EW)i,t} = \frac{1}{n_{x,t}}, \tag{1}$$

where $n_{x,t}$ refers to the number of constituents in index *x* at the beginning of month *t*. On the other hand, the weight of the *i* th constituents in a style-weighted index *x* for month *t* is computed using the following equation:

$$w_{x(SW)_{i,t}} = \frac{A_{i,t}}{\sum_{j=1}^{n_{X,t}} A_{j,t}}, \tag{2}$$

where $A_{i,t}$ is the log value of the style attribute for the *i*th constituent in the index.

The index weighting methodology, the number of constituents in the index, together with the frequency of rebalancing determines the style concentration of an index. Style-weighted indexes are more concentrated in their style orientation compared to equally-weighted indexes of the same style. On the other hand, the weight carried by a stock in an index comprised of only 30 stocks is greater compared to its weight in an otherwise identical index comprised of 50 or 100 stocks, applying the same weighting methodology. With regard to the frequency of rebalancing, cap-weighted indexes self-adjust to constituent price changes, incurring the least cost to maintain its investment style. For fundamental indexes, the costs incurred from rebalancing could have serious impact on the index performance. The monthly portfolio turnover, defined as the monthly percentage of the portfolio value being traded through rebalancing, is calculated for all indexes using equation (3):

$$Turnover_{x,t} = \sum_{i=1}^{K_t} \left| w_{x,i,t} - \left(w_{i,t-1} \times \frac{1+r_{i,t-1}}{1+r_{x,t-1}} \right) \right|, \tag{3}$$

where K_t is the total number of sample stocks; $w_{x,i,t}$ represents the weight of stock *i* in portfolio *x* for months *t*; $w_{i,t-1}$ is the weight of stock *i* at the end of month *t*; and $r_{i,t-1}$ and $r_{x,t-1}$ are the returns of stock *i* and portfolio *x* in month *t*-1.

The percentage monthly trading cost is computed as the percentage trading cost multiplied by the monthly portfolio turnover. The monthly cost-adjusted return for an index can then be derived by subtracting the percentage monthly trading cost from the monthly index return exclusive of trading cost. The percentage trading cost is assumed to be 2% of the transaction amount to reflect brokerage commission, tax and bid-ask spread. Overall, the degree of portfolio concentration determines the style orientation of an index in representing its designated investment style. However, an overly concentrated index might be poorly diversified. Thus, the maximum constituent holding is capped at 10% for all indexes throughout the examination period. In order to measure the relative degree of portfolio concentration amongst the indexes, the effective number of constituents, defined by Kruger and van Rensburg (2008) as "*the number of equally-weighted shares required to achieve the same share-specific risk as the portfolio*" is computed for all indexes using equation (4):

$$N_{x,t} = \frac{1}{\sum_{i=1}^{n_{X,t}} \left(w_{x,i,t} \right)^2}, \tag{4}$$

where $n_{x,t}$ is the number of constituents for index *x* in month *t*; and $w_{x,i,t}$ is the weight of the *i*th constituent in index *x* for month *t*.

4. Performance evaluation of the fundamental indexes

Basic performance evaluation measures including the arithmetic return, geometric return, standard deviation and cumulative return, as well as the selected risk-adjusted performance measures are computed for all indexes over the examination period from January 1, 1996 to December 31, 2010; and the two sub-periods from January 1, 1996 to June 30, 2003 and from July 1, 2003 to December 31, 2010. The selected risk-adjusted performance measures include the Sharpe ratio, Treynor measure, Jensen's alpha, *M*-square and the information ratio. The Sharpe ratio and Treynor measure both estimate the excess return of an index per unit of risk, where the Sharpe ratio uses standard deviation (σ) as the measure of total risk, while the Treynor measure usesthe beta coefficient (β) to measure the systematic risk of an index. The mathematical computations of the Sharpe ratio (*SR*) and Treynor measure (*TM*) for index *x* are represented by equation (5) and equation (6) respectively:

$$SR_x = \frac{r_x - r_f}{\sigma_x}, \tag{5}$$

$$TM_x = \frac{r_x - r_f}{\beta_{x,M}}, \tag{6}$$

where r_x is the return on index *x*; r_f is the return on the risk-free proxy; σ_x is the standard deviation of monthly returns for index *x*; and $\beta_{x,M}$ is the beta coefficient of index *x*, which measures the sensitivity of index *x*'s return to movements in the returns on the market proxy, r_M. The market proxy is represented by a monthly-rebalanced cap-weighted index consisting of all sample stocks; and the risk-free proxy is represented by the 90-day U.S. Treasury bill. The beta coefficient of index *x* over the examination period is obtained from the following monthly time-series regression:

$$r_{x,t} - r_{f,t} = \alpha_x + \beta_{x,M} \times \left(r_{M,t} - r_{f,t}\right) + \varepsilon_{x,t}. \tag{7}$$

The intercept of the regression, α_x, known as Jensen's alpha, represents excess returns earned above the risk-adjusted return depicted by the CAPM. The regression residuals, $\varepsilon_{x,t}$ are regarded as trading noises and are assumed to be negligible over time.

Similar to Jensen's alpha, *M*-square (M^2) and the information ratio (*IR*) measure the index performance against the risk-adjusted benchmark. Using the market proxy as the benchmark, the *M*-square and the information ratio for index *x* are computed using equation (8) and equation (9) respectively:

$$M^2{}_x = \sigma_M \times \left(\left(\frac{r_x - r_f}{\sigma_x}\right) - \left(\frac{r_M - r_f}{\sigma_f}\right)\right) = \tag{8}$$

$$= \sigma_M \times \left(SR_x - SR_M\right),$$

$$IR_x = \frac{r_x - r_{M.}}{\sigma_{x-M}}, \tag{9}$$

where $r_x - r_M$ is known as excess returns derived from active portfolio management (i.e. active returns); and $\sigma_{x\text{-}M}$, known as active risk, is the standard deviation of the active returns over the examination period.

The detailed reports on the performance of the large cap indexes, book value indexes, earnings indexes, dividend indexes, sales indexes and the fundamental composite indexes are demonstrated in Appendix (Tables 1A-6A). The report in each table documents index performance of the two sub-periods and the overall examination period. The four sections comprising the performance report include basic statistics, measure of representativeness, indication of transaction costs and risk-adjusted measures. The performance of the market proxy and the risk-free proxy is also included in each table for comparison purposes. The left panel in the report documents the performance of equally-weighted indexes of 100, 50 and 30 constituents; the style weighted indexes are reported in the right panel. The first sub-period is more bearish compared to the second sub-period. The market proxy earns 3.01% average annual return, which is substantially lower than the average annual return of 25.69% in the second sub-period. All indexes have negative risk-adjusted returns over the first sub-period with the exception of the sales indexes.

The sales indexes (equally-weighted and style-weighted) are also the only indexes that exhibit improvements in performance when the portfolio becomes more concentrated, as the number of the constituents in the portfolio declines. The portfolio concentration has a negative effect on the large cap indexes and the fundamental indexes for both sub-periods. It is also observed that fundamental indexes are less concentrated with substantially lower maximum constituent holding and higher effective number of constituents compared to the large cap indexes. As a result, the performance of the fundamental-weighted indexes and the otherwise identical equally-weighted fundamental indexes are not easily distinguishable. On the other hand, the equally-weighted large cap indexes outperform their cap-weighted counterparts on a risk-adjusted basis. Schoenfeld and Ginis (2006) suggest that the day-to-day price movements in an alternative weighting strategy creates significant tracking challenges, and

asset managers have a trade-off between allowing the constituent weights to drift away from their target weights; or incurring higher transaction costs due to frequent rebalancing. Although fundamental indexes incur higher transaction costs due to greater portfolio turnover, the cost-adjusted returns of the fundamental indexes are still higher than the cost-adjusted returns of the large cap indexes.

The summarized performance of the broader, more diversified, style-weighted indexes of 100 stocks over the complete examination period is reported in Table 1. Although all fundamental-weighted indexes outperform the market proxy and the cap-weighted index on a risk-adjusted basis, the sales-weighted index is the only index that has significant positive Jensen's alpha. Despite the fact that the sales-weighted index is the only fundamental-weighted index with higher standard deviation compared to the cap-weighted index, it has the highest risk-adjusted return amongst all indexes over the examination period. The sales-weighted index is also the only fundamental-weighted index that has below average systematic risk (beta coefficient less than 1.0). The high *R*-square of the regressions indicates that more than 90% of the return variations in the fundamental-weighted indexes are explained by movements in the market risk premium. The cap drag is evident in that the cap-weighted index of 100 stocks underperforms the "not so concentrated" cap-weighted market proxy with 300 constituents on a risk-adjusted basis.

The style-weighting methodology has negligible effect on the portfolio concentration of fundamental-weighted index in that the average effective number of constituents and the maximum constituent holding are close to that of an otherwise identical equally-weighted index (100 constituents with 1.00% capital allocated to each constituent). On the contrary, the average effective number of constituents for the cap-weighted index (65.43 stocks on average) is substantially lower than the actual number of constituents in the index; and the maximum constituent holding for the cap-weighted index of 5.56% is also much greater than 1.00%. Since none of the indexes has a weight greater than 10%, the original intention of placing the 10% ceiling on the largest constituent at all times becomes unnecessary.

Table 1. Performance statistics summary

	Market proxy	Large cap index	Book value index	Earnings index	Dividends index	Sales index	Fundamental composite
Basic statistics							
Arithmetic return	13.83%	11.43%	15.11%	15.39%	13.96%	20.39%	14.53%
Geometric return	10.22%	7.65%	11.40%	11.79%	10.78%	16.25%	11.17%
Cost adj. return	-	7.01%	9.39%	9.86%	8.89%	14.13%	9.26%
Cumulative return	4.306	3.021	5.052	5.324	4.644	9.566	4.896
Standard deviation	25.16%	25.99%	25.51%	25.08%	23.55%	26.33%	24.22%
Representativeness							
Effective constituents	-	65.43	99.81	99.72	99.65	99.83	99.77
Max. holding	-	5.56%	1.19%	1.26%	1.26%	1.13%	1.16%
Portfolio turnover							
Monthly rebalancing	-	2.46%	7.61%	7.30%	7.19%	7.72%	7.23%
Risk-adj. measures							
Sharpe ratio	0.281	0.173	0.323	0.344	0.324	0.497	0.331
M-square	0.000	-0.027	0.011	0.016	0.011	0.054	0.013
Information ratio	-	-0.945	0.195	0.255	0.081	0.987	0.145
Treynor ratio	0.071	0.045	0.087	0.096	0.088	0.138	0.092
Jensen's alpha	0.000	-0.027	0.013	0.018	0.012	0.059	0.014
[*p*-value]	-	[0.001]	[0.420]	[0.288]	[0.521]	[0.001]	[0.429]
R- square	100%	92.64%	94.41%	94.11%	92.55%	94.67%	93.27%
Beta	1.00	1.02	0.99	0.97	0.90	1.02	0.93

The cumulative U.S. dollar returns and historical drawdown of the market proxy and the fundamental-weighted indexes are illustrated in Figure 1 and Figure 2, respectively. Although the cumulative return of the sales-weighted index is noticeably higher than the rest of the indexes and the market proxy, it does not incur greater loss during turbulent times. It is also noted that the fundamental-weighted indexes rebound much faster than the market proxy after the financial market crisis at the end of 2008.

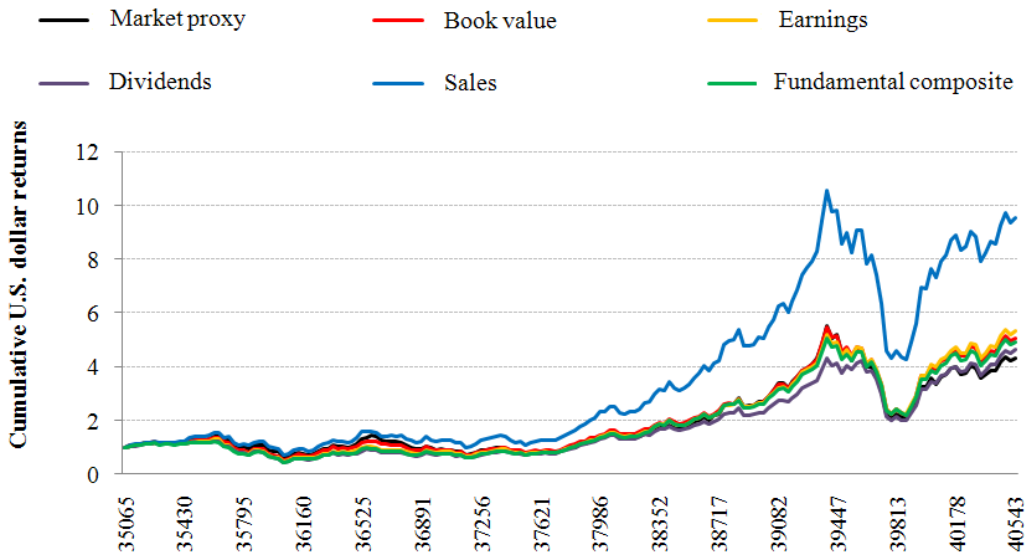

Fig. 1. Cumulative U.S. dollar returns

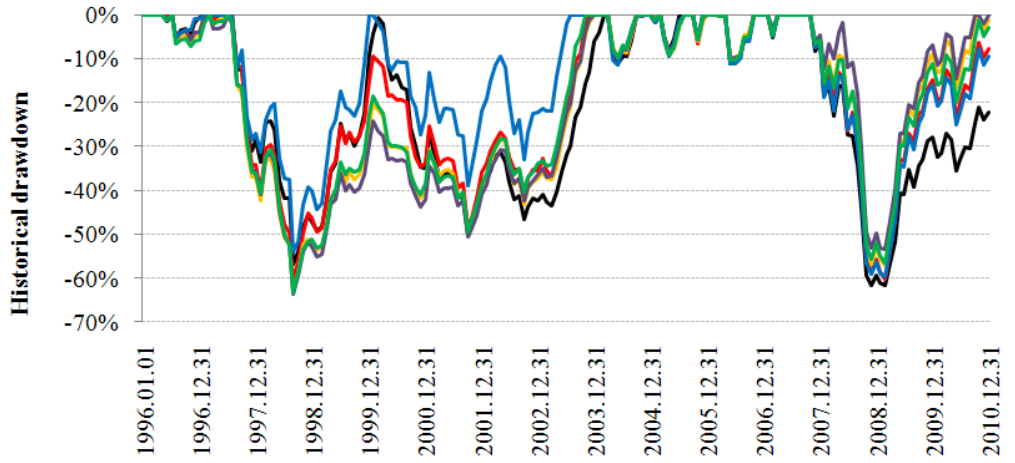

Fig. 2. Historical drawdown

5. Performance attribution analysis

To investigate whether the performance of fundamental indexes are due to the inherent size effect or value effect, performance attribution analysis is conducted by regressing the monthly excess returns of the fundamental-weighted indexes of 100 constituents on the movements of the risk proxies based on the Fama and French (1993) 3-factor model as shown in equation (10):

$$r_{x,t} - r_{f,t} = \alpha_x + \beta_{x,M} \times \left(r_{M,t} - r_{f,t}\right) + \\ + \beta_{x,S} SMB_t + \beta_{x,V} HML_t + \varepsilon_{x,t}, \quad (10)$$

where $\beta_{x,S}$ is the sensitivity of index x's return to movements in the size risk premium *SMB*; and $\beta_{x,V}$ is the sensitivity of portfolio x's return to movements in the value risk premium *HML*. The size risk factor, *SMB* (small-minus-big), is the return difference between the quintile of the smallest caps and the quintile of the largest caps in the sample. The value risk factor, *HML* (high-minus-low), is the return difference between the stocks in the highest value quintile (proxied by the book-to-market ratio) and the stocks in the lowest value quintile in the sample. Examining the sensitivities of the fundamental index returns to movements in the returns of the size and value proxies provides an indication as to whether fundamental indexation is a unique investment style on its own or an alternative approach to overweight value stocks and avoid large caps. The intercept α_x represents the abnormal returns of the index after the size effect and value effect are controlled for in the regression.

The results of the Fama and French (1993) 3-factor regressions are reported in Table 2. Regression coefficients with significant test statistics at a 5% level are highlighted in bold. Approximately 95% of the variations in the fundamental-weighted index returns are explained by the 3-factor model. The market risk premium remains as the most important variable in explaining the return variations of the fundamental-weighted indexes. With the exception of the sales-weighted index, the returns on the fundamental indexes respond significantly positively to movements in the size and value risk premiums. This finding suggests that the

return variations of most fundamental indexes are well explained by the size and value effect inherent in the indexes. After taking into account the risks related to the size and value effects, all fundamental-weighted indexes incur significantly negative abnormal returns, with the exception of the sales-weighted index. The market risk premium is the only variable in the model that is significant in explaining the return variations of the sales-weighted index as the regression intercept remains significantly positive after the size effect and the value effect are controlled for in the analysis.

Table 2. Fama and French (1993) 3-factor model regression results

	Book value index	Earnings index	Dividends index	Sales index	Fundamental composite
R-square Adj. *R*-square *F*-statistics [*p*-value]	96.08% 96.01% 1438.245 [0.000]	95.56% 95.48% 1262.407 [0.000]	94.05% 93.94% 926.576 [0.000]	94.72% 94.63% 1052.684 [0.000]	94.52% 94.43% 1012.340 [0.000]
Intercept *t*-statistics [*p*-value]	-0.004 -3.169 [0.002]	-0.003 -2.477 [0.014]	-0.003 -2.278 [0.024]	0.005 2.854 [0.005]	-0.003 -2.108 [0.036]
b_Market risk premium *t*-statistics [*p*-value]	0.989 64.249 [0.000]	0.971 60.263 [0.000]	0.903 51.497 [0.000]	1.015 55.087 [0.000]	0.933 53.947 [0.000]
b_SMB (Size effect) *t*-statistics [*p*-value]	0.144 6.146 [0.000]	0.134 5.441 [0.000]	0.115 4.298 [0.000]	-0.005 -0.191 [0.849]	0.114 4.326 [0.000]
b_HML (Value effect) *t*-statistics [*p*-value]	0.037 3.358 [0.001]	0.033 2.863 [0.005]	0.039 3.101 [0.002]	0.017 1.279 [0.203]	0.0336 2.698 [0.008]

Figure 3 plots the cumulative regression residuals of the fundamental-weighted indexes against the cumulative return of the market proxy over the examination period. The regression residuals represent the portion of the index returns that is not explained by the regression variables over time. A visual examination on the manner in which the regression residuals are accumulated throughout various phases of the economic cycle assists to explain the investment styles carried by the fundamental-weighted indexes. The major financial crises that result in major market drawdown over the examination period include the Asian financial market crisis in 1997, the crash of the dot.com bubble in 2000 and the global financial crisis towards the end of 2008. The declining cumulative residuals of the fundamental-weighted indexes during the Asian financial market crisis in 1997 suggest that fundamental indexation impose additional risks during the period. Although the cumulative residuals experience strong growth during the crash of the dot.com bubble and the subprime crisis, the fundamental-weighted indexes experience severe drawdown during these periods, which suggests that fundamental indexation might have abnormally large exposures to known risks in emerging markets during turbulent times.

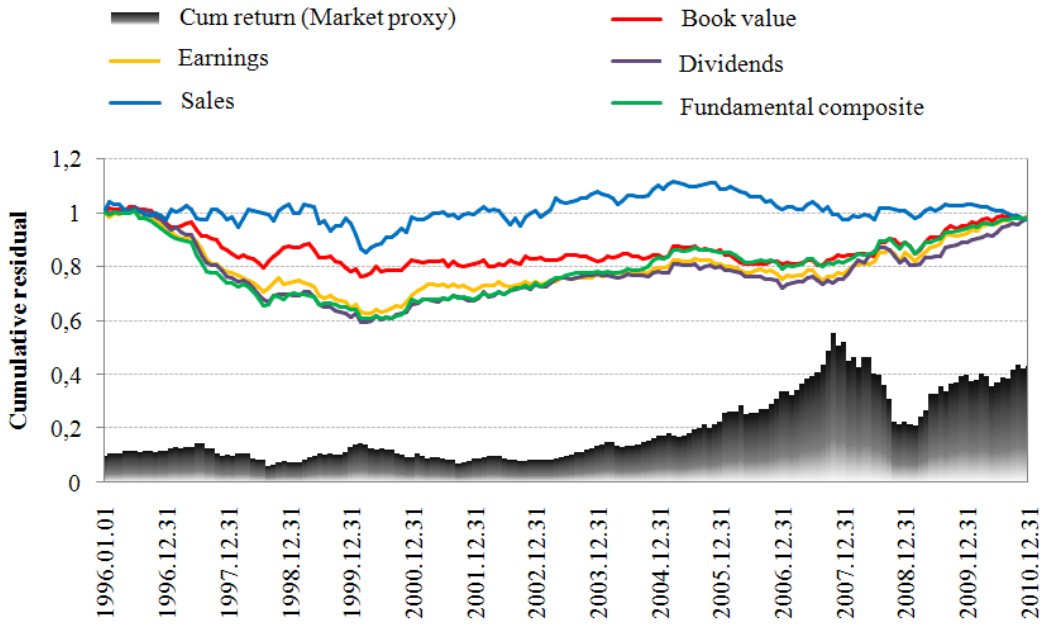

Fig. 3. Cumulative residuals

Conclusion

This paper investigates whether fundamental indexation represents a unique investment style, or an alternative approach to avoid large caps or investing in value stocks in emerging stock markets. Capital market theories imply that investors should invest in cap-weighted indexes since the market capitalization accurately reflects a stock's intrinsic worth. Arnott et al. (2005) argue that the cap-weighted indexes cease to be mean-variance efficient in the presence of investor overreaction, which results in systematic overshooting of stock prices. The fundamental-weighted indexes proposed by Arnott et al. (2005) outperform the cap-weighted benchmarks on a risk-adjusted basis in different markets; and over different time periods. This evidence is supported by the noisy market hypothesis of Siegel (2006) in that fundamental indexes are "price noise resistant" and hence are more mean-variance efficient compared to price-sensitive cap-weighted indexes under real economic conditions. On the other hand, studies conducted by Schoenfeld and Ginis (2006) and Chow et al. (2011) suggest that the outperformance of fundamental indexes are primarily attributed to sector allocations and exposures to known risk factors. Amenc et al. (2012) also argues that the noisy market hypothesis does not provide justification for any particular fundamental indexation, but rather justification for any alternative price-insensitive weighting method. Studies conducted by Estrada (2008) suggests that although fundamental-weighted indexes are generally found to outperform cap-weighted indexes, the fundamental indexes themselves could well be outperformed by other alternative indexing strategies, casting doubt on fundamental indexation as a mean-variance efficient "quasi-active" indexing strategy.

The emerging market fundamental indexes constructed in this paper only outperform the cap-weighted benchmarks when the size and value risks are not controlled for. Taking into account these two well-documented empirical anomalies, the fundamental-weighted indexes earn negative abnormal returns, with the exception of the sales-weighted index. The sales-weighted index is also the only fundamental-weighted index that is free of significant smaller cap and value biases. This result is in line with the study conducted by Arnott et al. (2005) in that the sales-weighted index shows superiority over other single matrix fundamental indexes in the U.S. stock markets. The company's sales revenue, being the first line of the income statement, is relatively more predictable by the investment society compared to profitability matrices in the financial statements. On the other hand, estimating the company's profits and earnings involves analysis of the company's operating efficiency in terms of various levels of costs and expenses, which cannot be directly inferred by the general economic condition like the sales estimate.

Examining the portfolio performance in conjunction with the portfolio concentration of the fundamental-weighted indexes reveals that there is a high resemblance between the fundamental-weighted indexes and the otherwise identical equally-weighted fundamental indexes. It is also found that during the crash of the dot.com bubble in 2000 and the global financial crisis in 2008, fundamental-weighted indexes accumulate significant residuals, yet experience severe drawdown during the periods. This observation suggests that fundamental indexation might have significant exposures to known risk factors in emerging markets during turbulent times.

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Appendix

Table 1A. Performance of large cap indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	0.94%	-0.90%	-0.69%	-0.29%	-1.31%	-1.31%
	07/'03~12/'10	25.69%	2.11%	26.28%	23.79%	22.59%	24.39%	23.04%	22.64%
	01/'96~12/'10	13.83%	3.16%	12.96%	10.82%	10.39%	11.43%	10.25%	10.07%
Geometric return	01/'96~06/'03	-0.19%	4.22%	-2.36%	-4.13%	-4.29%	-3.72%	-4.76%	-5.05%
	07/'03~12/'10	21.73%	2.11%	22.14%	19.58%	18.55%	20.35%	18.92%	18.54%
	01/'96~12/'10	10.22%	3.16%	9.20%	7.07%	6.52%	7.65%	6.43%	6.09%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	-4.28%	-5.90%	-6.00%	-4.31%	-5.42%	-5.80%
	07/'03~12/'10	N/A	N/A	20.32%	17.91%	16.94%	19.67%	18.11%	17.61%
	01/'96~12/'10	N/A	N/A	7.31%	5.33%	4.84%	7.01%	5.69%	5.25%
Cumulative return	01/'96~06/'03	0.985	1.363	0.836	0.729	0.720	0.753	0.694	0.678
	07/'03~12/'10	4.369	1.169	4.482	3.824	3.583	4.012	3.668	3.581
	01/'96~12/'10	4.306	1.594	3.746	2.786	2.579	3.021	2.545	2.428
Standard deviation	01/'96~06/'03	24.85%	0.46%	25.45%	25.41%	26.86%	23.54%	24.75%	25.46%
	07/'03~12/'10	25.27%	0.52%	25.81%	26.24%	25.79%	24.61%	24.91%	25.59%
	01/'96~12/'10	25.16%	0.57%	25.77%	25.96%	26.44%	24.22%	25.00%	25.69%
Measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	67.51	39.22	25.51
	07/'03~12/'10	N/A	N/A	100	50	30	63.36	37.43	24.86
	01/'96~12/'10	N/A	N/A	100	50	30	65.43	38.33	25.18
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	5.56%	7.30%	9.03%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	4.56%	5.89%	7.27%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	5.56%	7.30%	9.03%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.23%	7.71%	7.46%	2.54%	2.86%	3.25%
	07/'03~12/'10	N/A	N/A	6.32%	5.91%	5.73%	2.37%	2.87%	3.31%
	01/'96~12/'10	N/A	N/A	7.27%	6.81%	6.60%	2.46%	2.87%	3.28%
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	-0.259	-0.329	-0.317	-0.305	-0.342	-0.337
	07/'03~12/'10	0.776	0	0.776	0.666	0.638	0.711	0.645	0.631
	01/'96~12/'10	0.281	0	0.235	0.151	0.127	0.173	0.124	0.109
M-square	01/'96~06/'03	0.000	0.000	-0.020	-0.038	-0.035	-0.032	-0.041	-0.040
	07/'03~12/'10	0.000	0.000	0.000	-0.028	-0.035	-0.017	-0.033	-0.037
	01/'96~12/'10	0.000	0.000	-0.012	-0.033	-0.039	-0.027	-0.039	-0.043
Information ratio	01/'96~06/'03	N/A	N/A	-0.765	-0.968	-0.683	-1.248	-1.013	-0.733
	07/'03~12/'10	N/A	N/A	0.169	-0.696	-0.733	-0.528	-0.601	-0.527
	01/'96~12/'10	N/A	N/A	-0.382	-0.872	-0.710	-0.945	-0.829	-0.653

Table 1A (cont.). Performance of large cap indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
Treynor ratio	01/'96~06/'03	-0.044	N/A	-0.066	-0.084	-0.085	-0.079	-0.090	-0.093
	07/'03~12/'10	0.196	N/A	0.200	0.175	0.164	0.182	0.168	0.164
	01/'96~12/'10	0.071	N/A	0.060	0.039	0.034	0.045	0.033	0.029
Jensen's alpha	01/'96~06/'03	0.000	N/A	-0.020	-0.038	-0.038	-0.033	-0.044	-0.045
	07/'03~12/'10	0.000	N/A	0.004	-0.021	-0.024	-0.008	-0.021	-0.021
	01/'96~12/'10	0.000	N/A	-0.012	-0.033	-0.038	-0.027	-0.038	-0.042
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.000	0.001	0.008	0.001	0.003	0.012
	07/'03~12/'10	N/A	N/A	0.278	0.151	0.203	0.312	0.295	0.377
	01/'96~12/'10	N/A	N/A	0.000	0.001	0.003	0.001	0.003	0.009
R-square	01/'96~06/'03	100%	N/A	95.44%	91.61%	88.39%	92.78%	89.23%	85.82%
	07/'03~12/'10	100%	N/A	97.15%	93.27%	90.14%	92.71%	88.23%	84.72%
	01/'96~12/'10	100%	N/A	96.24%	92.51%	89.14%	92.64%	88.71%	85.13%
Beta	01/'96~06/'03	1.00	N/A	1.05	1.03	1.06	1.06	1.05	1.07
	07/'03~12/'10	1.00	N/A	1.00	1.00	0.96	0.97	0.96	0.94
	01/'96~12/'10	1.00	N/A	1.03	1.01	1.01	1.02	1.01	1.01

Table 2A. Performance of book value indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	4.30%	3.17%	4.19%	4.27%	3.14%	4.12%
	07/'03~12/'10	25.69%	2.11%	27.03%	27.08%	25.75%	26.98%	26.98%	25.67%
	01/'96~12/'10	13.83%	3.16%	15.15%	14.55%	14.51%	15.11%	14.49%	14.43%
Geometric return	01/'96~06/'03	-0.19%	4.22%	1.08%	-0.42%	0.15%	1.03%	-0.46%	0.04%
	07/'03~12/'10	21.73%	2.11%	22.88%	22.70%	21.49%	22.84%	22.63%	21.43%
	01/'96~12/'10	10.22%	3.16%	11.45%	10.54%	10.30%	11.40%	10.48%	10.22%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	-1.01%	-2.47%	-1.91%	-1.06%	-2.51%	-2.01%
	07/'03~12/'10	N/A	N/A	20.98%	20.87%	19.67%	20.95%	20.81%	19.62%
	01/'96~12/'10	N/A	N/A	9.43%	8.57%	8.35%	9.39%	8.52%	8.27%
Cumulative return	01/'96~06/'03	0.985	1.363	1.084	0.969	1.011	1.080	0.966	1.003
	07/'03~12/'10	4.369	1.169	4.690	4.639	4.305	4.679	4.618	4.290
	01/'96~12/'10	4.306	1.594	5.084	4.495	4.352	5.052	4.460	4.304
Standard deviation	01/'96~06/'03	24.85%	0.46%	24.93%	26.44%	28.00%	25.02%	26.52%	28.11%
	07/'03~12/'10	25.27%	0.52%	25.83%	26.62%	26.41%	25.80%	26.55%	26.34%
	01/'96~12/'10	25.16%	0.57%	25.48%	26.63%	27.28%	25.51%	26.64%	27.30%
Measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	99.79	49.91	29.96
	07/'03~12/'10	N/A	N/A	100	50	30	99.84	49.94	29.97
	01/'96~12/'10	N/A	N/A	100	50	30	99.81	49.93	29.97
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	1.19%	2.30%	3.75%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.13%	2.18%	3.55%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.19%	2.30%	3.75%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.69%	8.67%	8.64%	8.69%	8.67%	8.65%
	07/'03~12/'10	N/A	N/A	6.57%	6.33%	6.31%	6.53%	6.30%	6.28%
	01/'96~12/'10	N/A	N/A	7.63%	7.50%	7.47%	7.61%	7.48%	7.47%
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	-0.126	-0.175	-0.146	-0.128	-0.177	-0.149
	07/'03~12/'10	0.776	0	0.804	0.774	0.734	0.804	0.773	0.734
	01/'96~12/'10	0.281	0	0.325	0.277	0.262	0.323	0.275	0.259
M-square	01/'96~06/'03	0.000	0.000	0.013	0.001	0.008	0.012	0.000	0.007
	07/'03~12/'10	0.000	0.000	0.007	-0.001	-0.011	0.007	-0.001	-0.011
	01/'96~12/'10	0.000	0.000	0.011	-0.001	-0.005	0.011	-0.001	-0.006

Table 2A (cont.). Performance of book value indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
Information ratio	01/'96~06/'03	N/A	N/A	0.180	-0.027	0.036	0.174	-0.033	0.025
	07/'03~12/'10	N/A	N/A	0.228	0.175	-0.044	0.225	0.165	-0.054
	01/'96~12/'10	N/A	N/A	0.200	0.045	0.010	0.195	0.037	0.000
Treynor ratio	01/'96~06/'03	-0.044	N/A	-0.033	-0.049	-0.043	-0.034	-0.049	-0.044
	07/'03~12/'10	0.196	N/A	0.218	0.216	0.204	0.218	0.216	0.203
	01/'96~12/'10	0.071	N/A	0.087	0.078	0.075	0.087	0.077	0.074
Jensen's alpha	01/'96~06/'03	0.000	N/A	0.011	-0.002	0.006	0.011	-0.002	0.005
	07/'03~12/'10	0.000	N/A	0.011	0.004	-0.007	0.011	0.003	-0.007
	01/'96~12/'10	0.000	N/A	0.013	0.002	-0.002	0.013	0.001	-0.003
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.640	0.955	0.717	0.645	0.959	0.734
	07/'03~12/'10	N/A	N/A	0.598	0.828	0.836	0.603	0.838	0.830
	01/'96~12/'10	N/A	N/A	0.407	0.821	0.927	0.420	0.846	0.958
R-square	01/'96~06/'03	100%	N/A	92.10%	90.50%	89.30%	92.30%	90.67%	89.24%
	07/'03~12/'10	100%	N/A	96.15%	95.70%	95.69%	96.30%	95.84%	95.73%
	01/'96~12/'10	100%	N/A	94.24%	93.21%	92.34%	94.41%	93.35%	92.30%
Beta	01/'96~06/'03	1.00	N/A	0.96	1.01	1.07	0.97	1.02	1.07
	07/'03~12/'10	1.00	N/A	1.00	1.03	1.02	1.00	1.03	1.02
	01/'96~12/'10	1.00	N/A	0.98	1.02	1.04	0.99	1.02	1.04

Table 3A. Performance of earnings indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	3.23%	0.44%	1.60%	3.08%	0.46%	1.62%
	07/'03~12/'10	25.69%	2.11%	29.17%	27.06%	27.26%	29.04%	26.99%	27.13%
	01/'96~12/'10	13.83%	3.16%	15.53%	13.03%	13.77%	15.39%	13.02%	13.72%
Geometric return	01/'96~06/'03	-0.19%	4.22%	0.15%	-2.88%	-2.16%	-0.01%	-2.87%	-2.15%
	07/'03~12/'10	21.73%	2.11%	25.10%	23.10%	23.34%	24.99%	23.05%	23.22%
	01/'96~12/'10	10.22%	3.16%	11.93%	9.34%	9.85%	11.79%	9.32%	9.80%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	-1.82%	-4.78%	-4.04%	-1.97%	-4.77%	-4.03%
	07/'03~12/'10	N/A	N/A	23.23%	21.34%	21.56%	23.12%	21.28%	21.44%
	01/'96~12/'10	N/A	N/A	9.99%	7.49%	8.00%	9.86%	7.47%	7.95%
Cumulative Return	01/'96~06/'03	0.985	1.363	1.011	0.803	0.849	0.999	0.804	0.850
	07/'03~12/'10	4.369	1.169	5.365	4.753	4.822	5.328	4.739	4.787
	01/'96~12/'10	4.306	1.594	5.424	3.817	4.093	5.324	3.808	4.066
Standard deviation	01/'96~06/'03	24.85%	0.46%	24.46%	25.72%	27.31%	24.52%	25.77%	27.35%
	07/'03~12/'10	25.27%	0.52%	25.38%	25.16%	25.21%	25.33%	25.13%	25.16%
	01/'96~12/'10	25.16%	0.57%	25.07%	25.60%	26.41%	25.08%	25.61%	26.41%
Measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	99.67	49.89	29.95
	07/'03~12/'10	N/A	N/A	100	50	30	99.77	49.92	29.97
	01/'96~12/'10	N/A	N/A	100	50	30	99.72	49.90	29.96
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	1.26%	2.39%	3.84%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.14%	2.20%	3.57%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.26%	2.39%	3.84%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.24%	8.18%	8.07%	8.25%	8.19%	8.07%
	07/'03~12/'10	N/A	N/A	6.37%	6.07%	6.11%	6.36%	6.09%	6.12%
	01/'96~12/'10	N/A	N/A	7.31%	7.13%	7.09%	7.30%	7.14%	7.09%
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	-0.167	-0.276	-0.234	-0.173	-0.275	-0.233
	07/'03~12/'10	0.776	0	0.906	0.834	0.842	0.903	0.834	0.839
	01/'96~12/'10	0.281	0	0.350	0.241	0.253	0.344	0.241	0.252

Table 3A (cont.). Performance of earnings indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
M-square	01/'96~06/'03	0.000	0.000	0.003	-0.025	-0.014	0.001	-0.024	-0.014
	07/'03~12/'10	0.000	0.000	0.033	0.015	0.017	0.032	0.014	0.016
	01/'96~12/'10	0.000	0.000	0.017	-0.010	-0.007	0.016	-0.010	-0.007
Information ratio	01/'96~06/'03	N/A	N/A	0.048	-0.326	-0.189	0.026	-0.323	-0.188
	07/'03~12/'10	N/A	N/A	0.657	0.290	0.280	0.653	0.282	0.260
	01/'96~12/'10	N/A	N/A	0.275	-0.131	-0.044	0.255	-0.134	-0.050
Treynor ratio	01/'96~06/'03	-0.044	N/A	-0.045	-0.079	-0.071	-0.047	-0.079	-0.071
	07/'03~12/'10	0.196	N/A	0.255	0.233	0.236	0.254	0.232	0.234
	01/'96~12/'10	0.071	N/A	0.097	0.069	0.074	0.096	0.068	0.074
Jensen's alpha	01/'96~06/'03	0.000	N/A	0.001	-0.028	-0.019	-0.001	-0.028	-0.019
	07/'03~12/'10	0.000	N/A	0.037	0.018	0.022	0.036	0.018	0.021
	01/'96~12/'10	0.000	N/A	0.019	-0.008	-0.003	0.018	-0.008	-0.004
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.954	0.401	0.722	0.997	0.408	0.727
	07/'03~12/'10	N/A	N/A	0.112	0.387	0.393	0.112	0.390	0.411
	01/'96~12/'10	N/A	N/A	0.256	0.757	0.991	0.288	0.750	0.976
R-square	01/'96~06/'03	100%	N/A	91.85%	89.83%	85.66%	91.87%	89.75%	85.57%
	07/'03~12/'10	100%	N/A	95.92%	96.48%	94.86%	96.13%	96.54%	94.88%
	01/'96~12/'10	100%	N/A	93.99%	93.16%	89.99%	94.11%	93.14%	89.93%
Beta	01/'96~06/'03	1.00	N/A	0.94	0.98	1.02	0.95	0.98	1.02
	07/'03~12/'10	1.00	N/A	0.98	0.98	0.97	0.98	0.98	0.97
	01/'96~12/'10	1.00	N/A	0.97	0.98	1.00	0.97	0.98	1.00

Table 4A. Performance of dividend indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	2.67%	1.66%	-0.86%	2.55%	1.59%	-0.77%
	07/'03~12/'10	25.69%	2.11%	26.57%	26.54%	27.15%	26.51%	26.46%	27.01%
	01/'96~12/'10	13.83%	3.16%	14.04%	13.47%	12.35%	13.96%	13.40%	12.34%
Geometric return	01/'96~06/'03	-0.19%	4.22%	-0.18%	-1.63%	-4.38%	-0.31%	-1.71%	-4.29%
	07/'03~12/'10	21.73%	2.11%	23.14%	23.08%	23.76%	23.10%	23.02%	23.65%
	01/'96~12/'10	10.22%	3.16%	10.87%	10.03%	8.79%	10.78%	9.96%	8.79%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	-2.13%	-3.58%	-6.16%	-2.27%	-3.64%	-6.08%
	07/'03~12/'10	N/A	N/A	21.35%	21.37%	22.12%	21.32%	21.32%	22.01%
	01/'96~12/'10	N/A	N/A	8.98%	8.18%	7.05%	8.89%	8.12%	7.05%
Cumulative return	01/'96~06/'03	0.985	1.363	0.987	0.884	0.715	0.977	0.879	0.720
	07/'03~12/'10	4.369	1.169	4.763	4.747	4.948	4.753	4.731	4.915
	01/'96~12/'10	4.306	1.594	4.701	4.195	3.537	4.644	4.157	3.536
Standard deviation	01/'96~06/'03	24.85%	0.46%	23.45%	25.31%	26.41%	23.53%	25.33%	26.43%
	07/'03~12/'10	25.27%	0.52%	23.35%	23.58%	23.41%	23.30%	23.51%	23.32%
	01/'96~12/'10	25.16%	0.57%	23.53%	24.60%	25.15%	23.55%	24.58%	25.11%
Measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	99.54	49.86	29.94
	07/'03~12/'10	N/A	N/A	100	50	30	99.76	49.93	29.97
	01/'96~12/'10	N/A	N/A	100	50	30	99.65	49.90	29.96
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	1.26%	2.39%	3.86%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.19%	2.25%	3.63%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.26%	2.39%	3.86%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.24%	8.30%	7.84%	8.25%	8.25%	7.87%
	07/'03~12/'10	N/A	N/A	6.13%	5.87%	5.62%	6.12%	5.87%	5.62%
	01/'96~12/'10	N/A	N/A	7.18%	7.09%	6.73%	7.19%	7.06%	6.71%

Table 4A (cont.). Performance of dividend indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	-0.187	-0.231	-0.325	-0.193	-0.234	-0.322
	07/'03~12/'10	0.776	0	0.901	0.890	0.925	0.901	0.890	0.924
	01/'96~12/'10	0.281	0	0.328	0.279	0.224	0.324	0.277	0.224
M-square	01/'96~06/'03	0.000	0.000	-0.002	-0.013	-0.037	-0.004	-0.014	-0.036
	07/'03~12/'10	0.000	0.000	0.031	0.029	0.038	0.032	0.029	0.037
	01/'96~12/'10	0.000	0.000	0.012	0.000	-0.014	0.011	-0.001	-0.014
Information ratio	01/'96~06/'03	N/A	N/A	0.002	-0.152	-0.386	-0.015	-0.161	-0.381
	07/'03~12/'10	N/A	N/A	0.238	0.203	0.268	0.234	0.195	0.256
	01/'96~12/'10	N/A	N/A	0.093	-0.023	-0.153	0.081	-0.032	-0.155
Treynor ratio	01/'96~06/'03	-0.044	N/A	-0.051	-0.067	-0.099	-0.052	-0.068	-0.098
	07/'03~12/'10	0.196	N/A	0.242	0.241	0.249	0.241	0.240	0.248
	01/'96~12/'10	0.071	N/A	0.089	0.079	0.065	0.088	0.078	0.065
Jensen's alpha	01/'96~06/'03	0.000	N/A	-0.004	-0.017	-0.043	-0.006	-0.017	-0.042
	07/'03~12/'10	0.000	N/A	0.034	0.033	0.043	0.034	0.033	0.042
	01/'96~12/'10	0.000	N/A	0.013	0.003	-0.010	0.012	0.003	-0.010
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.868	0.689	0.334	0.837	0.672	0.342
	07/'03~12/'10	N/A	N/A	0.170	0.242	0.177	0.167	0.240	0.178
	01/'96~12/'10	N/A	N/A	0.489	0.845	0.787	0.521	0.869	0.783
R-square	01/'96~06/'03	100%	N/A	89.99%	86.33%	83.33%	90.13%	86.63%	83.56%
	07/'03~12/'10	100%	N/A	94.72%	93.08%	91.01%	94.81%	93.16%	91.18%
	01/'96~12/'10	100%	N/A	92.45%	89.56%	86.69%	92.55%	89.73%	86.85%
Beta	01/'96~06/'03	1.00	N/A	0.90	0.95	0.97	0.90	0.95	0.97
	07/'03~12/'10	1.00	N/A	0.90	0.90	0.88	0.90	0.90	0.88
	01/'96~12/'10	1.00	N/A	0.90	0.93	0.93	0.90	0.93	0.93

Table 5A. Performance of sales indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	9.71%	12.20%	13.63%	9.86%	12.42%	13.95%
	07/'03~12/'10	25.69%	2.11%	31.78%	33.60%	33.77%	31.83%	33.68%	33.80%
	01/'96~12/'10	13.83%	3.16%	20.28%	22.50%	23.33%	20.39%	22.63%	23.51%
Geometric return	01/'96~06/'03	-0.19%	4.22%	6.02%	7.78%	8.64%	6.16%	7.96%	8.91%
	07/'03~12/'10	21.73%	2.11%	27.27%	28.83%	28.55%	27.30%	28.84%	28.57%
	01/'96~12/'10	10.22%	3.16%	16.16%	17.83%	18.18%	16.25%	17.94%	18.33%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	3.78%	5.59%	6.50%	3.92%	5.79%	6.77%
	07/'03~12/'10	N/A	N/A	25.30%	26.91%	26.71%	25.33%	26.91%	26.72%
	01/'96~12/'10	N/A	N/A	14.04%	15.76%	16.16%	14.13%	15.87%	16.32%
Cumulative return	01/'96~06/'03	0.985	1.363	1.551	1.753	1.861	1.565	1.777	1.896
	07/'03~12/'10	4.369	1.169	6.101	6.686	6.578	6.111	6.688	6.585
	01/'96~12/'10	4.306	1.594	9.460	11.724	12.244	9.566	11.881	12.487
Standard deviation	01/'96~06/'03	24.85%	0.46%	25.93%	28.20%	29.98%	26.01%	28.27%	30.09%
	07/'03~12/'10	25.27%	0.52%	26.47%	27.33%	28.47%	26.52%	27.36%	28.50%
	01/'96~12/'10	25.16%	0.57%	26.27%	27.81%	29.26%	26.33%	27.86%	29.32%
measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	99.83	49.94	29.97
	07/'03~12/'10	N/A	N/A	100	50	30	99.83	49.95	29.98
	01/'96~12/'10	N/A	N/A	100	50	30	99.83	49.94	29.97
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	1.13%	2.19%	3.58%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.11%	2.15%	3.52%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.13%	2.19%	3.58%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.92%	8.54%	8.32%	8.88%	8.51%	8.28%
	07/'03~12/'10	N/A	N/A	6.57%	6.35%	6.10%	6.55%	6.34%	6.10%
	01/'96~12/'10	N/A	N/A	7.74%	7.45%	7.21%	7.72%	7.42%	7.19%

Table 5A (cont.). Performance of sales indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	0.070	0.126	0.147	0.074	0.132	0.156
	07/'03~12/'10	0.776	0	0.950	0.978	0.929	0.950	0.977	0.928
	01/'96~12/'10	0.281	0	0.495	0.528	0.513	0.497	0.531	0.517
M-square	01/'96~06/'03	0.000	0.000	0.061	0.075	0.081	0.063	0.077	0.083
	07/'03~12/'10	0.000	0.000	0.044	0.051	0.039	0.044	0.051	0.038
	01/'96~12/'10	0.000	0.000	0.054	0.062	0.059	0.054	0.063	0.060
Information ratio	01/'96~06/'03	N/A	N/A	0.822	0.708	0.597	0.828	0.715	0.608
	07/'03~12/'10	N/A	N/A	1.381	1.290	0.933	1.395	1.286	0.934
	01/'96~12/'10	N/A	N/A	0.983	0.861	0.683	0.987	0.862	0.689
Treynor ratio	01/'96~06/'03	-0.044	N/A	0.019	0.037	0.047	0.020	0.039	0.049
	07/'03~12/'10	0.196	N/A	0.265	0.281	0.278	0.265	0.281	0.279
	01/'96~12/'10	0.071	N/A	0.137	0.155	0.158	0.138	0.156	0.160
Jensen's alpha	01/'96~06/'03	0.000	N/A	0.062	0.082	0.091	0.064	0.083	0.093
	07/'03~12/'10	0.000	N/A	0.048	0.059	0.050	0.048	0.059	0.050
	01/'96~12/'10	0.000	N/A	0.058	0.073	0.075	0.059	0.074	0.076
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.025	0.038	0.070	0.024	0.037	0.065
	07/'03~12/'10	N/A	N/A	0.007	0.014	0.095	0.007	0.015	0.095
	01/'96~12/'10	N/A	N/A	0.001	0.003	0.014	0.001	0.003	0.013
R-square	01/'96~06/'03	100%	N/A	91.53%	84.26%	75.92%	91.33%	83.89%	75.48%
	07/'03~12/'10	100%	N/A	97.82%	96.24%	94.05%	97.86%	96.24%	94.06%
	01/'96~12/'10	100%	N/A	94.75%	90.10%	84.52%	94.67%	89.90%	84.26%
Beta	01/'96~06/'03	1.00	N/A	1.00	1.04	1.05	1.00	1.04	1.05
	07/'03~12/'10	1.00	N/A	1.04	1.06	1.09	1.04	1.06	1.09
	01/'96~12/'10	1.00	N/A	1.02	1.05	1.07	1.02	1.05	1.07

Table 6A. Performance of fundamental composite indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Basic statistics									
Arithmetic return	01/'96~06/'03	3.01%	4.22%	2.83%	0.95%	-0.50%	2.76%	0.96%	-0.39%
	07/'03~12/'10	25.69%	2.11%	27.58%	27.68%	26.83%	27.53%	27.60%	26.75%
	01/'96~12/'10	13.83%	3.16%	14.59%	13.60%	12.41%	14.53%	13.56%	12.43%
Geometric return	01/'96~06/'03	-0.19%	4.22%	-0.03%	-2.16%	-3.75%	-0.11%	-2.16%	-3.65%
	07/'03~12/'10	21.73%	2.11%	23.77%	23.80%	22.79%	23.73%	23.72%	22.72%
	01/'96~12/'10	10.22%	3.16%	11.24%	10.06%	8.71%	11.17%	10.02%	8.74%
Cost adj. geometric return	01/'96~06/'03	N/A	N/A	-2.00%	-4.08%	-5.55%	-2.07%	-4.07%	-5.45%
	07/'03~12/'10	N/A	N/A	21.95%	22.08%	21.13%	21.91%	22.01%	21.07%
	01/'96~12/'10	N/A	N/A	9.32%	8.21%	6.96%	9.26%	8.19%	6.99%
Cumulative return	01/'96~06/'03	0.985	1.363	0.998	0.849	0.751	0.992	0.849	0.757
	07/'03~12/'10	4.369	1.169	4.951	4.960	4.662	4.937	4.937	4.642
	01/'96~12/'10	4.306	1.594	4.940	4.212	3.501	4.896	4.191	3.512
Standard deviation	01/'96~06/'03	24.85%	0.46%	23.50%	24.73%	25.41%	23.54%	24.75%	25.46%
	07/'03~12/'10	25.27%	0.52%	24.62%	24.92%	25.62%	24.61%	24.91%	25.59%
	01/'96~12/'10	25.16%	0.57%	24.20%	24.99%	25.69%	24.22%	25.00%	25.69%
Measure of representativeness									
Effective no. constituents	01/'96~06/'03	N/A	N/A	100	50	30	99.74	49.93	29.97
	07/'03~12/'10	N/A	N/A	100	50	30	99.81	49.93	29.97
	01/'96~12/'10	N/A	N/A	100	50	30	99.77	49.93	29.97
Max. constituent holding	01/'96~06/'03	N/A	N/A	1.00%	2.00%	3.33%	1.16%	2.22%	3.61%
	07/'03~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.14%	2.19%	3.58%
	01/'96~12/'10	N/A	N/A	1.00%	2.00%	3.33%	1.16%	2.22%	3.61%
Indication of transaction costs									
Avg. monthly rebalancing	01/'96~06/'03	N/A	N/A	8.28%	8.24%	7.84%	8.25%	8.20%	7.81%
	07/'03~12/'10	N/A	N/A	6.26%	5.89%	5.71%	6.22%	5.87%	5.69%
	01/'96~12/'10	N/A	N/A	7.27%	7.07%	6.77%	7.23%	7.03%	6.75%

Table 6A (cont.). Performance of fundamental composite indexes

		Weighting: EW/SW; No. constituents: 100/50/30							
		Market	Rf	EW100	EW50	EW30	SW100	SW50	SW30
Risk-adjusted measures									
Sharpe ratio	01/'96~06/'03	-0.178	0	-0.181	-0.258	-0.314	-0.184	-0.258	-0.309
	07/'03~12/'10	0.776	0	0.880	0.871	0.807	0.879	0.868	0.806
	01/'96~12/'10	0.281	0	0.334	0.276	0.216	0.331	0.275	0.217
M-square	01/'96~06/'03	0.000	0.000	-0.001	-0.020	-0.034	-0.002	-0.020	-0.033
	07/'03~12/'10	0.000	0.000	0.026	0.024	0.008	0.026	0.023	0.007
	01/'96~12/'10	0.000	0.000	0.013	-0.001	-0.016	0.013	-0.002	-0.016
Information ratio	01/'96~06/'03	N/A	N/A	0.021	-0.205	-0.326	0.010	-0.206	-0.317
	07/'03~12/'10	N/A	N/A	0.411	0.468	0.194	0.414	0.454	0.181
	01/'96~12/'10	N/A	N/A	0.154	-0.022	-0.175	0.145	-0.027	-0.172
Treynor ratio	01/'96~06/'03	-0.044	N/A	-0.049	-0.073	-0.092	-0.050	-0.073	-0.091
	07/'03~12/'10	0.196	N/A	0.249	0.250	0.238	0.249	0.249	0.237
	01/'96~12/'10	0.071	N/A	0.093	0.079	0.064	0.092	0.079	0.064
Jensen's alpha	01/'96~06/'03	0.000	N/A	-0.003	-0.023	-0.039	-0.004	-0.023	-0.038
	07/'03~12/'10	0.000	N/A	0.029	0.026	0.012	0.028	0.026	0.012
	01/'96~12/'10	0.000	N/A	0.015	0.002	-0.013	0.014	0.001	-0.012
p-value (alpha)	01/'96~06/'03	N/A	N/A	0.915	0.542	0.372	0.896	0.542	0.388
	07/'03~12/'10	N/A	N/A	0.185	0.187	0.593	0.182	0.196	0.605
	01/'96~12/'10	N/A	N/A	0.409	0.884	0.683	0.429	0.899	0.690
R-square	01/'96~06/'03	100%	N/A	89.93%	85.78%	82.18%	89.92%	85.83%	82.22%
	07/'03~12/'10	100%	N/A	96.11%	96.90%	95.44%	96.34%	96.95%	95.45%
	01/'96~12/'10	100%	N/A	93.16%	91.41%	88.90%	93.27%	91.46%	88.91%
Beta	01/'96~06/'03	1.00	N/A	0.90	0.92	0.93	0.90	0.92	0.93
	07/'03~12/'10	1.00	N/A	0.96	0.97	0.99	0.96	0.97	0.99
	01/'96~12/'10	1.00	N/A	0.93	0.95	0.96	0.93	0.95	0.96