In search of firms' economic footprint: incorporating debt information to enhance fundamental indexation

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Abstract

It is important to integrate debt information when measuring firms' economic footprint, since firms usually have different financial leverages. This paper is the first to discuss how, by constructing an enterprise-multiple-weighted metric which integrates debt information, a new approach can be used to enhance performance of fundamental indexation. We find that enterprise-multiple-weighted index has the lowest tracking error and the highest information ratio compared with other six traditional fundamental-weighted indexation during 1972-2010, including book-equity weighted, earnings-weighted, sales-weighted, dividends-weighted, cash-flow-weighted and EBITDA-weighted indexation. It has an information ratio of 0.56, 55% larger than average of the six fundamental indexes. Furthermore, this approach has the added advantage of generating alpha for 3-factor model directly over other six traditional weighting schemes in fundamental indexation.

JEL Classification: G11

Keywords: Portfolio Weighting, Fundamental indexation

I. Introduction

Motivated by its capacity to compare firms with different leverages, this paper is the first to introduce enterprise multiple as a metrics in fundamental indexation. Although Arnott et al. (2005) propose an alternative weighting scheme based on firm's fundamental data such as book value, cash flows, dividends and sales, the paper does not integrate debt information into measuring fundamentals of firms, which is also missed by other research in the field (Walkshaul and Lobe 2009, Arya and Kaplan 2008, Basu Forbes 2013). Loughran & Wellman (2011) provide an excellent example of the merits of integrating debt into stock valuation. For example, General Motors had debt of $287 billion in 2005, but with market capitalization of only $17 billion. Without integrating debt information in fundamental indexation, it is hard to accurately capture real economic footprint of general Motors in this case and also difficult to compare values of firms with different leverages.

Comparisons of risks and returns for different indexation in this paper shows that enterprise-multiple-weighted (EM-weighted) scheme has the highest information ratio when compared with other traditional fundamental-weighted schemes, including book-equity weighted, earnings-weighted, sales-weighted, dividends-weighted, cash-flow-weighted and EBITDA-weighted. It has an information ratio of 0.56, which is 55% larger than average of above six fundamental indexation and 25% larger than that of sales-weighted indexation (the highest in the above six fundamental indexation).

Further tests show that there is alpha for enterprise-multiple-weighted indexation when using the 3- factor model. At the same time, the paper finds that there is no alpha for other six fundamental indexation when using 3-factor model, which is consistent with other research (Jun and Malkiel 2008, Amenc, Goultz and Le Sourd 2009). Results also show that alphas for both 3-factor model and 4-factor model are quite stable during 1972-2010 when using historical average information about earnings, market value of book and debt within different rolling years. Alphas are around 10 basis points and 17 basis points per month, respectively, for the 3-factor model and the 4-factor model. Further research shows that there is a better chance to harvest alpha for growth stocks than for value stocks when we integrate debt information into the weighting scheme.

The paper is structured as follows. Section II is for literature review and section III describes the data and methodology to construct indexes weighted by different methods, then empirical analyses of different fundamental indexes in US market is followed in section IV, which also includes the risk analysis of the fundamental indexes. Robustness checks and the conclusion are followed in section V and VI, respectively.

II. Literature review

The capitalization-weighted scheme is rooted in the finance industry due to theoretical foundation of capital asset pricing model (CAPM) proposed by Sharpe (1964) and Lintner (1965), who suggest that investors can earn extra return only from taking more risks. However, the correction of the CAPM is based on the assumption that prices can

reflect a firm's intrinsic value correctly. Shiller (1981) demonstrates that stock prices are too volatile compared with their dividends, which implies that stock prices can temporarily deviate from their intrinsic value. If stock prices cannot reflect the intrinsic value, then capitalization-weighted scheme is no longer the best weighting strategy to allocate stocks weightings. On the contrary, cap-weighted index will automatically overweight overvalued stocks and underweight undervalued stocks. Siegel (2006) indicates that cap-weighted index would be inferior to that of the fundamental index if there is noise for stock prices. Treynor (2005) and Hsu (2006, 2008) demonstrates that market-cap-weighted index has a return drag if there is a mispricing, and show that a diversified capitalisation-weighted portfolio is suboptimal to any diversified non-price-weighted portfolio in the noise-in-price model.

An alternative weighting scheme based on firm's fundamental data such as book value, cash flows, dividends, sales or employee has been proposed by Arnott et al. (2005). Since fundamental data anchors to the economic footprint of a firm, it will be more accurate in estimating intrinsic value when stock prices revert to their intrinsic value. Arnott et al. (2005) showed that fundamental-weighted schemes can outperform the corresponding market-cap-weighted scheme by about two percentage points per year during 1962-2004. Further analyses from these authors show that there are positive Jensen alphas for fundamental indexation and their volatilities of returns are similar to or lower than that of the corresponding market-cap-weighted index. Also, Hemminki and Puttonen (2008) show that fundamental indexation has higher risk-adjusted returns compared with corresponding capitalization-weighted index for European stock markets. The same

conclusion is confirmed further by Stotz, Wanzenried and Döhnert (2010). Tamura and Shimizu (2005) use the same metrics as those from Arnott to compose a global fundamental index, and find that the fundamental index outperforms the cap-weighted benchmark of MSCI World and FTSE developed between 1988 and 2005. Walkshaul and Lobe (2009) use net payout, which is equal to dividends paid plus cash used for repurchases minus cash received from issuances. Estrada (2008) also applies the dividends-weighted scheme to an international index and finds that it outperforms the corresponding cap-weighted index when using risk-adjusted returns during 1974-2005.

Since none of above research integrates debt information, a critical dimension of firms' economic footprint, we use enterprise multiple as a metrics to capture debt information. Enterprise multiple is calculated as enterprise value (EV) (equity value + debt + preferred stock - cash) divided by operating income before depreciation (EBITDA). The introduction of this metric is motivated by its capacity to compare firms with different leverages. Damodaran (2006) shows that enterprise multiple, price-to-earnings and price-to-sales are the most popular metrics of valuation. Loughran & Wellman (2011) demonstrate that enterprise multiple is a strong determinant of stock returns.

Using enterprise multiple as a metrics is a "blended" approach which actually integrates both fundamental indexation and capitalization-weighted index directly. This is implied in the calculation of enterprise multiple. As Kaplan (2007) points out, a combination of fundamental indexation and capitalization-weighted index has potential to produce better

results than using either of them. Our approach is different from the "collared" approach in Arya and Kaplan (2006 2008), which uses fundamental weights to set boundaries for weights. The "collared" approach is to help investor avoid concentrating on overvalued growth stocks when there is a bubble, such as tech bubble happened in the late 90s. When index weights fall within the boundary, they are kept in the market capital weights; when stocks' weight in the portfolio falls outside the boundaries, the stocks are held based on the boundary set by fundamental weights. Our approach is also different from the method of using a smoothed average of cap weights to measure fundamental weights in Chen et al. (2007). Their idea is to use the average historical stock prices to represent the fundamental accounting information.

Our results show that there is alpha for enterprise-multiple-weighted indexation when using the 3- factor model. This is different from former research using other metrics where alpha is not observed in the 3-factor model (Jun and Malkiel 2008, Amenc, Goultz and Le Sourd 2009). The potential merits of fundamental indexation raise a fierce debate across the financial community (Perold 2007). The main critique of fundamental indexation indicates that it is in disguise of value premium investigated by Fama and French (1992). Estrada (2008) recognizes that the fundamental indexation underperforms a pure value strategy based on dividend yield during 1974-2005. Jun and Malkiel (2008) shows that the fundamental indexation does not add additional value if using the Fama and French three-factor model to measure the risks. This is also supported by Blitz and Swinkels (2009), who consider the fundamental indexation as nothing more than active value strategies. Walkshaul and Lobe (2009) show that fundamental indexation can

outperform their corresponding capitalization-weighted indexes for 44 countries based on a sample of 28 developed and 22 emerging markets during 1982 – 2008, but this outperformance can be due to their exposure to value stocks. Based on the studies of Amenc, Goultz and Le Sourd (2009), the fundamental index of RAFI 1000 does not outperform the corresponding benchmark of cap-weighted index if the value bias is adjusted accordingly. They also find that fundamental indexation does not outperform equal-weighted indexes. Goltz (2014) points out that fundamental indexation may be exposed to extra systematic risks such as value and size. Mar, Bird, Casavecchia and Yeung (2009) find that fundamental indexation outperforms cap-weighted index by an average of 193 basis points per year when using metrics of book-equity, cash flows and revenue over the period of 1995-2006, and also find that fundamental indexation tilts into the value factor when using Carhart 4-factor model. In addition, the outperformance of fundamental indexation is also criticized by Perold (2007) who shows that fundamental indexation can underperform in environments of persistent mispricing or under-reacting stock prices. Moreover, he argues that fundamental indexation can only outperform the cap-weighted index by knowing more information about intrinsic value from the strategy. Graham (2012) indicates that results depend on the critical assumption that stock prices revert to fair value consistently. Further research (Chen, Dempsey, and Lajbcygier 2014, De Moor, Liu, Sercuand Vinaimont 2013) indicates that value added by the fundamental value index disappears when considering the time-varying exposure to various risk factors.

On the contrary, Arnott (2005) suggests that the noise-in-price maybe a key driver for value and size premiums based on "noisy market" proposed by Jeremy Siegel (2006). Arnott, Hsu, Liu, and Markowitz (2007) mathematically demonstrate that a modest amount of noise in prices can create size and value effects. This is also consistent with mispricing proposed by Lakonishok, Shleifer, and Vishny (1994). Arnott, Hsu, Kalesnik and Tindall (2013) also empirically show that value and size can arise naturally in non-price-weighted strategies. They test two inverse portfolios – an inverse ratio formed by normalizing the weight 1/w, a complement portfolio formed by normalizing the weight (max(w)-w), and a monkey-managed portfolio. Surprisingly all these three portfolios outperform the corresponding capitalization-weighted portfolio when using three-factor model. This suggests that all insensible investments designed as inverse portfolios are not originally based on value and size but have unintended and almost unavoidable value tilt. Except for applied in equity market, fundamental indexation approach is also applied in other asset classes such as fixed income (Jong and Wu 2014, Arnott, Hsu, Li and Shepherd 2010) and real estate investment trust (Hsu, Li and Kalesnik 2010).

III Methodology and data

Data and Index Construction

We use top 1000 largest cap stocks in the US stock markets each year as "market" index during January 1972 and December 2010 (begins at 1972 because before the year there are less than 1000 stocks based on standard of stock-screening we use in this paper). Monthly stock prices are obtained from Center for Research on Security Prices (CRSP) database at the University of Chicago. Stock splits and stock dividends have been

adjusted so that all returns and earnings are aligned on a comparable basis. The company's shares are traded on the New York Stock Exchange, American Stock Exchange, or NASDAQ. We also use different fundamental metrics, including book value (BE), sales (S), dividends (D), earnings (E), cash flow (CF), earnings before the deduction of interest expenses, taxes, depreciation, and amortization (EBITDA), and enterprise multiple (EM) to construct the fundamental indexation. All accounting information is from Compustat database in Wharton Research Data Services (WRDS).

Fundamental Metrics

Cash flow is treated as a metric for measuring the short-term sustainability of a company without considering the cost of depreciation of plant and equipment. We use the unit cash flow item in Compustat, which is equal to the gross income after the reduction of all cash expense but before the payments for common and (or) preferred dividends.

Sales revenue is usually at the top of the income statement to measure the expansion of products to the markets. It is closely tied to the companies' growth and profitability and it is harder to manipulate compared with earnings. However, the portfolio may tilt into mature firms full of competition and/or with low profit margin when using this weighting scheme.

Net earnings is one of the most important metrics for the companies and shareholder. Earnings could be volatile due to business cycle and it is relatively easier for manager to manipulate during the short term with aggressive accounting practices.

Dividends is a metric considered as the most objective and transparent metric, and it is not easy to be manipulated by managers based on Siegel's view (2006). The dividend policy can vary a lot among different industries and companies, and it depends on the growth phase of a company. Usually a firm with high growth opportunities pays less dividends. The portfolio is likely to tilt into value stocks when employing this weighting scheme.

Book value is calculated as book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit, and minus the book value of preferred stock.

EBITDA is a metric to measure a firm's operating cash flow. EBITDA is more useful for large firms with significant assets, including intangible assets, and/or debt financing, because these firms have large amounts of fixed (intangible) assets subject to heavy cost of depreciation (amortization). The portfolio tilts into large stocks when applying this weighting scheme. On the other hand, using EBITDA is not affected by nonoperating gains or losses. It is usually considered as a better metric to measure firm's profitability

compared with net income, because it is less easily manipulated. These properties make it very useful to compare firm within or across different industries by using EBITDA.

Enterprise multiple (EM) is a valuation metric, which is calculated as enterprise value (EV) (equity value + debt + preferred stock - cash) divided by operating income before depreciation (EBITDA). Value firms usually have low EM ratios while growth firms have high EM ratios. When using this metric in constructing the portfolio, we use the reverse of this ratio as the weighting scheme.

The portfolio weights at the beginning of each year were calculated by using information available at the end of the prior year. The company's most recent annual financial statement was used to calculate the following year's weightings. Rebalance happens on the last trading day of each year. Then the portfolio is held until the end of the next year. With this dynamic rebalance, selection and survivorship bias are avoided. Since the details of trading cost are hard to measure, we do not adjust for trading costs in the index construction.

Different methods of weighting in this paper include capital weighting and fundamental weighting. The detail weighting process is as following: we use market capitalization of a stock at the end of last December as the weighting factor, which is equal to the multiplication of closing stock prices and the number of its shares outstanding. For the fundamental index the weight of a stock is based on the fundamental metrics, such as

sales, from the newest fiscal year report before each portfolio rebalance. Each stock in the portfolio is given a weight according to its relative size against the whole portfolio. As for enterprise-multiple (EM)–weighted scheme, we define this as the weighting scheme based on the reverse of the enterprise multiple ratio. Always, the sum of index weights is equal to one. The rebalance takes place at the end of the last trading day of previous calendar year. While market capitalization is available at that time, fundamental metrics are from the latest fiscal annual report. Since fundamental indexation uses the fundamental metrics as scales to measure economic weight of a firm, we force the data to be equal to zero when the value of a metric is negative, such as negative earnings and negative cash flows. This implies that there are no short positions in the construction of portfolios. This method is in line with Arnett (2005). Different from Arnott (2005) using the last 5-year-average accounting information, we use the latest available annual information as the main weighting scheme. We also use historical average metrics to check whether there is a change of loadings on risk factors when using different data set.

Performance Evaluation

The annualized Sharpe ratio is calculated by multiplying square root of twelve to a monthly Sharpe ratio, which is the average monthly excess return of a portfolio divided by the monthly standard deviation of excess returns. The information ratio is calculated via dividing excess return by tracking error which is equal to the standard deviation of the excess returns. The excess return is calculated as subtracting the return of cap-weighted scheme from those of fundamental-weighted scheme or EM-weighted scheme. Sortino ratio is defined as the average period return subtracted by the required rate of return,

which is equal to three month T-bill risk free rate, and then divided by the target downside deviation, which is calculated as the root-mean-square of the deviations of the realized returns where returns above the required rate of return are treated as zero.

Measurement of risk with different asset pricing models

The one-factor CAPM model is estimated by the following time-series regressions

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}(R_{mt} - R_{ft})_i + \varepsilon_{it} \quad (1)$$

Where R_{it} is the return for common stock of firm i on day t. Three-month T-bill is used as a proxy for risk free rate of return, R_{ft} on day t. R_{mt} is the return on day t for the market. In the regressions, monthly excess returns of a portfolio weighted by different schemes, $R_{it} - R_{ft}$, are regressed on monthly excess market returns, $R_{mt} - R_{ft}$. $R_{it} - R_{ft}$ is assumed to be jointly multivariate normal, independently and identically distributed through time. It is also assumed that ε_{it}, the error term for firm i at time t, is normal distributed around zero and is uncorrelated with R_{mt}. The β_{1t} and α_i both can be derived based on the above regressions, where β_{1t} measures the sensitivity of the average monthly excess returns to the variation of market premium and α_i measures the intercept of the regression measured by ordinary least squares method and measures the abnormal return on the pricing model,

We also estimate the risks and returns based on Fama-French's three-factor model:

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}(R_{mt} - R_{ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_i + \varepsilon_{it} \quad (2)$$

Where SMB_t is the difference between the average monthly return on three small market-capitalization portfolios, including S/L, S/M, and S/H, and the average monthly

return on three large market-capitalization portfolios, including B/L, B/M, and B/H; HML_t is the difference between the average monthly return on two high book-to-market equity portfolios, including S/H and B/H, and the average monthly return on low book-to-market equity portfolios, including S/L and B/L. The return difference due to size and B/M is free of the effect of each other based on above construction. The coefficients of the three risk factors, β_{1i}, β_{2i}, β_{3i}, are the loadings of the monthly excess returns on the factors.

The 4-factor model (Carhart 1997) is also employed, which includes three factors in fama-french's model and also the momentum factor developed by Jegadeesh and Titman (1993) on returns to momentum strategies.The model has the form of

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}(R_{mt} - R_{ft}) + \beta_{2i} SMB_t + \beta_{3i} HML_i + \beta_{4i} UMD_i + \varepsilon_{it} \qquad (3)$$

UMD_t is momentum factor based on 12-month momentum in returns, which is equal to difference of average return on high prior 12-month return portfolios and that of the average return on low prior 12-month return portfolios (exclude month t-1). β_{4i} is the coefficient to measure the sensitivity of R_{it} to corresponding momentum factor. The data source for the above factor models is provided from the Center for Research on Security Prices (CRSP) at the University of Chicago.

IV. Results and discussion

Cumulative returns and weightings on different sectors

Figure 1 shows cumulative returns for fundamental-weighted portfolios and the benchmark of capitalization-weighted portfolio from January of 1972 to December of 2010. All these cumulative returns are not adjusted by the allocation costs to maintain the different weighting strategies. Without considering the trading cost, it is obvious that fundamental indexes outperform the capitalization-weighted benchmark in the long run. Panel A illustrates that if one dollar was invested at the beginning of 1972, it grows into $39.54 when using capitalization-weighted scheme, but it grows into $75.27and $67.07, respectively, when applying sales-weighted index and EM-weighted index. When using capitalization-weighted index as a benchmark, it is intuitively to know that fundamental indexes underperform the capitalization-weighted indexes during late 90's technology/media/telecommunications bubble and the recent mortgage bubble around 2005-2007. The pattern of the cumulative returns is consistent with those from Arnott et al. (2005), although we do not use exactly the same time period.

Figure 2 provides sector weightings based on capitalization-weighted scheme, sales-weighted scheme and EM-weighted scheme. Compared with Figure 2B, Figure 2A shows a tech bubble in the late 90s. Figure 2C shows that capitalization-weighted strategy put more weightings on technology sector, such as computers, software, and electronic equipment, and more on healthcare industries, such as medical equipment and drugs. On the contrary, sales-weighted scheme weights more on sectors of wholesale, manufacturing and energy. During the late 90's tech bubble, the sales-weighted index

diversifies its portfolio more on different sectors of the wholesale, manufacturing and energy, compared with capitalization-weighted index which concentrates 19.42% more on tech sectors such as computer, software and electronic equipment. This is consistent with results from Hsu (2014), which suggests that fundamental-weighted schemes are well diversified from an industry-concentration perspective. During 2009 the sales-weighted index weights 12.12% more, compared with capitalization-weighted index, on Wholesale, Retail, and Services such as Laundries & Repair Shops, and 4.86% more on sector of consumer durables such as cars, furniture and household. On the other hand, capitalization-weighted index has an additional 5.15% on healthcare sector and extra 8.23% on energy sector during the same period, compared with sales-weighted index. As for EM-weighted scheme, it weighs more on Energy and finance sectors. For example, it holds 5.21% more on finance sector and 5.83% more on energy sector in 2009, compared with the corresponding capitalization-weighted scheme.

Table 1 provides information of top 20 holdings for different index strategies. Although sales-weighted index holds 3.29% on Walmart on October 2007, which is 1.78% larger than the corresponding weighting from capitalization-weighted scheme, EBITDA-weighted index only holds 1.15% on Walmart. If information of debt, EBITDA and market capitalization are integrated as an EM-weighted scheme, the weighting on Walmart based on this scheme is equal to 1.30% in October 2007. Another example is Microsoft. In March 2009, the cap-weighted scheme holds 2.08% but sales-weighted scheme only holds 0.80% (out of Top 20 holdings) on this stock. Integrating additional

information from the debt and adjusted earnings, ME-weighted scheme holds 2.13% on Microsoft in the same period.

Returns and Sharpe ratio analysis

Table 2 shows the return characteristics for different fundamental indexation and the capitalization-weighted benchmark of the top USA 1000 stocks during 1972-2010.

It shows that all fundamental indexes outperform the capitalization-weighted indexes during this period. The sales-weighted portfolio has a mean annual geometric return of 10.70% and dividend-weighted portfolio has a mean annual geometric return of 10.71%, while capitalization-weighted index only has an annual geometric return of 8.06%. The annual geometric returns of these two fundamental-weighted indexes are higher than that of the capitalization-weighted index by 274 and 275 basis points per year, respectively. Even integrating a conservative transaction cost of 30 basis points per year (the transaction cost for block traders is usually less than 10 basis points at current market), the sales -weighted index still outperforms the capitalization-weighted index. On the other hand, EM-weighted scheme has a mean annual geometric return of 10.37%, outperforming the capitalization-weighted scheme by 231 basis points per year. At the same time, all fundamental indexes except for sales-weighted index with a volatility of 16.78% have lower volatilities compared with that of a capitalization-weighted index. All the above results are consistent with those from former research findings such as Arnott (2005), and Basu and Forbes (2013). The dividends-weighted scheme has the lowest volatility of 14.92% and EM-weighted scheme has a volatility of 15.75%.

Compared with capitalization-weighted indexes, all fundamental indexes have positive excess returns, ranging from 1.07 for dividends-weighted index to 2.04 for sales-weighted index, and most of them are statistically significant. When using a "blended" approach of EM-weighted scheme, it provides an excess return of 1.49 with a t-value of 3.48. The annualized Sharpe ratio, which measures the excess return to risk free rate per unit of risk, is larger for all fundamental indexes compared with that of capitalization-weighted index. The Sharpe ratios varies from 0.45 to 0.50 for different fundamental indexation, and EM-weighted scheme has a Sharpe ratio of 0.48, 26% higher than that of a capitalization-weighted scheme. This implies that compared with investing on a capitalization-weighted index, betting on these fundamental indexes with smart betas does have extra rewards without taking additional risks. Since investors concern more about downside deviation than standard deviation, using Sortino ratio to measure risk provides more information about risks compared with using standard deviation. Table 2 also shows that capitalization-weighted index has a Sortino ratio of 0.54, which is lower than those of fundamental indexes ranging from 0.59 (sales-weighted) to 0.76 (earnings-weighted). This implies that betting on smart beta does also have an extra advantage from the aspect of risk of large losses, compared with the capitalization-weighted strategy. When using EM-weighted scheme, it also has a Sortino ratio of 0.67, which is larger than that of a capitalization-weighted scheme.

Another important metric in portfolio performance measurement is tracking error, which measures the closeness of a portfolio following a benchmark. The tracking errors for fundamental indexes range from 2.78% (book-equity-weighted) to 5.11% (dividends-weighted). When we consider the tracking error and excess return together, sales-

weighted index has the highest information ratio of 0.48 among all six common fundamental indexes in Table 2, which include book-equity weighted, earnings-weighted, sales-weighted, dividends-weighted, and cash-flow-weighted and EBITDA weighted. Based on information ratio, the "blended" approach of EM-weighted scheme introduced in this paper is even more competitive. It has an information ratio of 0.56, which is 25% larger than that of sales-weighted index and 55% larger than the average of the above six fundamental indexes with a ratio of 36%.

All other fundamental indexes have similar skewness of -0.38, compared with that of capitalization-weighted index. In addition, EM-weighted index has a negative skewness of -0.46, which is close to that of the capitalization-weighted scheme. This implies that EM-weighted index has a similar asymmetric tail in returns tilting into negative values. At the same time, all fundamental indexes also have a litter higher kurtosis, ranging from 2.15 for earnings-weighted index to 2.70 for sales-weighted index, compared to 2.00 for the capitalization-weighted index. This indicates that fundamental indexes have relatively concentrated distributions for returns compared with that of capitalization-weighted index. And the EM-weighted index also has a higher negative skewness of 2.31. Combining this information, we infer that EM-weighted index has a little higher frequencies of outcomes at the extreme negative end of the distribution curve compared with that of capitalization-weighted index. This may be due to underperformance of the fundamental index during market mispricings such as the tech bubble (Hsu and Campollo 2006). We are cautious that indexes with high kurtosis are more likely to overestimate the probability of getting

the mean return. This implies that the lower volatility of fundamental indexes and EM-weighted schemes may not capture the true riskiness in a full extent.

Table 2 shows that twelve-month maximum loss of the capitalization-weighted index is equal to -42.24%, which is less than those of fundamental indexes ranging from -42.94% (cash- flow-weighted) to -50.49% (EBITDA-weighted) . One explanation is that capitalization-weighted index can automatically allocates less weight to stocks in the portfolio when their prices drop. On the other hand, the capitalization-weighted index has a relative small twelve-month maximum profit, 64.72%, compared with most of fundamental indexes ranging from 64.82% (EBITDA-weighted index) to 72.80% (sales-weighted index) --except for earnings-weighted index with a value of 63.79%. This may be due to ineffectiveness of capitalization-weighted index to capture the value premium. For example, when a stock's price drops sharply from a growth stock to an value stock compared with other stocks in the portfolio, the capitalization-weighted index puts less weight on the stock; when a stock's price increase from an value stock to a growth stock compared with other stocks in the portfolio, the capitalization-weighted index puts more weights on the growth stocks which usually have lower returns. Comparing with fundamental indexes, the capitalization-weighted index automatically tilts into growth stocks. The effectiveness of capturing the value premium is illuminated by Hsu (2014), who suggests that a non-price weighting scheme can effectively profit from the mean reversion of both stock prices and value premium via rebalancing embedded a mechanism of dollar cost averaging.

Table 3 and Table 4 show return volatilities and tracking errors are larger during economy contraction compared with those in economy expansion for all fundamental indexes and EM-weighted index. For example, the tracking error increases to 6.33% during periods of economy contraction and decreases to 3.66% during periods of economy expansion for sales-weighted index, while it increases to 3.65% during periods of economy contraction and decreases to 2.41% during periods of economy contraction for EM-weighted index. All information ratios for fundamental indexes are larger in periods of economy expansion compared with those in periods of economy contraction. It increases to 0.54 during expansion and decreases to 0.48 during contraction for sales-weighted index, while increases to 0.69 during expansion and decreases to 0.17 during contraction for EM-weighted index. It is interesting to know that although sales-weighted index has higher excess return than that of EM-weighted index during expansion, it has lower information ratio than that of EM-weighted index due to its higher tracking errors. In summary, EM-weighted index has the highest information ratio during periods of economy expansion but not in contraction periods.

Table 5 shows the Spearson correlation matrix of monthly index returns based on different weighting schemes. Table 5B and Table 5C indicate that return correlations based on different weighting schemes are on average higher during contraction compared with those in expansion. As time moves from the 1970's to the 2000's, the correlation decreases (Table 5D). For example, the correlation of returns between fundamental index of sales and index of capitalization-weighted index decreases from 0.96 to 0.90 during

decades from 1970 to 2000. Compared with other fundamental indexes, the indexes of dividends and sales have relatively low correlations with the capitalization-weighted index in all separate sub-periods. Both these two indexes have relatively high cumulative returns compared with other indexes in Figure 1. On the other hand, earnings-weighted index, cash-flows weighted index have relatively high correlations with the capitalization-weighted index. This is consistent with information delivered in Figure 1, which shows that indexes of earnings and cash flow have relatively low cumulative returns compared with other fundamental indexes. The low performance of the indexes of earnings and cash flow may be due to their relatively easy manipulation compared with other fundamental metrics, which affect their effectiveness of providing high value-added information for measuring intrinsic values. EBITDA, which is hard to manipulate compared with earnings, has a better performance in cumulative return. This comparison suggests that EBITDA provides better information in measuring the intrinsic value compared with earnings, which is helpful for us to compose more effective EM-weighted index.

Risk analyses based on different asset pricing models

Table 6 shows alphas and loadings of risk factors on three asset pricing models for using different weighting schemes. Autocorrelation and hetereoscedasticity in the returns are adjusted by Newey-West (1987) standard errors when estimating parameters in the table. CAPM model in Table 6A shows that monthly alphas from fundamental indexes are significantly larger than zero, ranging from 18 basis points for the earnings-weighted

index to 25 points for the sales-weighted index. EM-weighted scheme has a monthly alpha of 22 basis points. These results demonstrate that fundamental indexes and EM-weighted have positive Jensen's alphas compared with capitalization-weighted index. On the other hand, except for sales-weighted index which has a beta coefficient of 0.9600, all other beta coefficients of fundamental indexes are less than that of the market-weighted index (0.9590). The beta for dividends-weighted index is equal to 0.8033, the lowest among all fundamental indexes in the table.

The Fama-French 3-factor model and the Carhar 4-factor model are further applied to evaluate the performance of fundamental indexes. Loadings on the value factor (HML) in the 3-factor model in Table 6A are significantly positive for all fundamental indexes compared with that from the capitalization-weighted index. The loadings vary from 0.2305 (earnings-weighted) to 0.4024 (sales-weighted) in the fundamental indexes. Loading on the size factor (SML) in 3-factor model of Table 6A are the most negative with statistical significance, except for sales-weighted index with a loading of 0.0038. EM-weighted scheme has a loading of 0.2429 on value factor and at the same time has a loading of -0.1352 on size factor, implying that it bets more on value and larger firms. Compared with corresponding betas in CAPM model, market betas in the three-factor are closer to 1. Carhart 4-factor model in Table 6A shows similar results to the three-factor, but provides more information about the momentum. The loadings on the momentum factor (UMD) are all statistical significant for the fundamental indexes, and EM-weighted scheme has a loading of -0.0667 on the momentum factor.

Based on above analysis, Jensen alphas in CAPM model for fundamental indexes mainly come from high loadings of value stocks, i.e., stocks with high book-to-mark values. The alphas disappear when using 3-factor, and this is consistent with most of other research (Jun and Malkiel 2008, Amenc, Goultz and Le Sourd 2009).

When using the 4-factor model, there are positive alphas for most of the fundamental indexations. And EM-weighted scheme has an alpha of 17 basis points with *t*-value of 4.13. As for the adjust R^2, it gets larger when the employed asset price model changes from CAPM, to the 3-factor model and the 4-factor model. This implies that there are extra returns which could not be explained by the 4-factor model when integrating momentum factor.

In order to see whether there is a difference for the fundamental index in different states of the economy. We divide states of economy into two parts, contraction and expansion, based on definition from The National Bureau of Economic Research (NBER). We run regressions of different asset pricing models conditional on the economy states to see whether there is any difference for alpha generation and loadings on betas. Table 6B and Table 6C present the corresponding results. Table 6B shows the intercepts and coefficients in economy contraction and Table 6C is for economy expansion. The Jensen alphas for most fundamental indexes and EM-weighted index during economy contraction are quite similar to those during expansion. For example, book-equity-

weighted index has an average Jensen alpha of 23 basis points while having an average Jensen alpha of 22 basis points in expansion. However, the Jensen alphas for capitalization-weighted index and equal-weighted index both shrink from 17 basis points and 58 basis points to 7 and 23 basis points, respectively, when economy state changes from contraction to expansion. As for betas, we do not see any significant difference for the loadings on value factor (HML), size factor and momentum factor during the two sub-periods. This test demonstrates that alpha for the 4-factor model also exists in the sub-period of the economy expansion during 1972-2010.

V Robustness Checks

Using historical average of fundamental weightings

Compared with sales-weighted scheme which does not have statistical significance in Table 8, EM-weighted scheme in Table 7 has consistent alphas with statistical significance for 3-factor model. Table 7 shows that when using historical fundamental data within last five years, there are consistent alphas with statistical significance when using CAPM, the 3-factor model and the 4-factor model. The alpha for CAPM model increases from 22 points to 27 points when using historical information measured by Enterprise Multiples years before. The increase of CAPM alpha is due to heavier loadings on value stocks when using older historical information, which is demonstrated both in the 3-factor and the 4-factor models. Alphas for both the 3-factor model and the 4-factor model are quite stable, around 10 basis points and 17 basis points, respectively. These

tests show that alphas do exist for EM-weighted scheme, and they are not very sensitive for using historical average information about the earnings, market value of book and debt together.

Test alphas for stocks with different market-to-book ratios when using EM-weighted scheme

Table 9 shows alphas on different asset pricing models when using EM-weighted scheme for different level of market-to-book ratios. CAPM model shows that Jensen alpha is the highest, 40 basis points, for decile 1 with highest market-to-book ratio. And it decreases to 25 basis points for decile 4. As for decile 5, it becomes negative but is not statistically significant. The 4-factor model shows that loadings on value factor decrease from 0.5841 to -0.1901 as market-to-book ratio increases from decile 1 to the decile 5, implying that loadings for value factor are higher for value stocks. It is the same for using sales-weighted scheme whose loadings on HML change from 0.7555 to -0.1210. Compared with the sales-weighted scheme, the EM-weighted scheme can capture alphas with statistical significance for growth stocks (in deciles of 3,4 and 5) when using the 4-factor model, but also fail in capturing alphas for value stocks (in deciles of 1 and 2). This suggests that there is a better chance to get extra returns for growth stocks than for value stocks when integrated debt information into the weighting scheme.

VI Conclusion

Although there is still a debate on whether market noise can result in value and size premium, fundamental indexation gets more attention and application in both industry and academia. One dimension missed by previous research on fundamental indexation is to integrate debt information in measuring firms' economic footprint. Without information pertaining to debt, it is hard to compare values of firms with different leverage.

This paper is the first to incorporate debt information into fundamental indexation by using enterprise-multiple-weighted scheme. This weighting scheme not only incorporate debt information when measuring fundamentals of the firms but also integrate methods of fundamental-weighted and capitalization-weighted directly. It has the highest information ratio of 0.56 during 1972–2010, compared with other six fundamental indexation weighted by different schemes, including book-equity weighted, earnings-weighted, sales-weighted, dividends-weighted, cash-flow-weighted and EBITDA-weighted schemes. The information ratio is 55% larger than the average of above six fundamental indexation, and 25% larger than that of the highest in the above six fundamental indexation (sales-weighted indexation). Further tests show that there is alpha for enterprise-multiple-weighted indexation when using 3- factor model. This also distinguishes the enterprise-multiple-weighted scheme from other traditional weighted scheme in fundamental indexation.

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Figure 1 Cumulative returns of fundamental Indexes compared with capitalization-weighted index during 1972–2010. The capitalization-weighted benchmark is based on the 1000 largest US stocks. All indexes are rebalanced on the last trading day of the year. ME is for the weighting scheme based on market value; BE is for the weighting scheme based on book value; E is for the weighting scheme based on earnings; S is for the weighting scheme based on sales; D is for the weighting scheme based on dividends; CF is for the weighting scheme based on cash flows; EBITDA is the weighting scheme based on EBITDA; EM is the weighting scheme based on enterprise multiple.

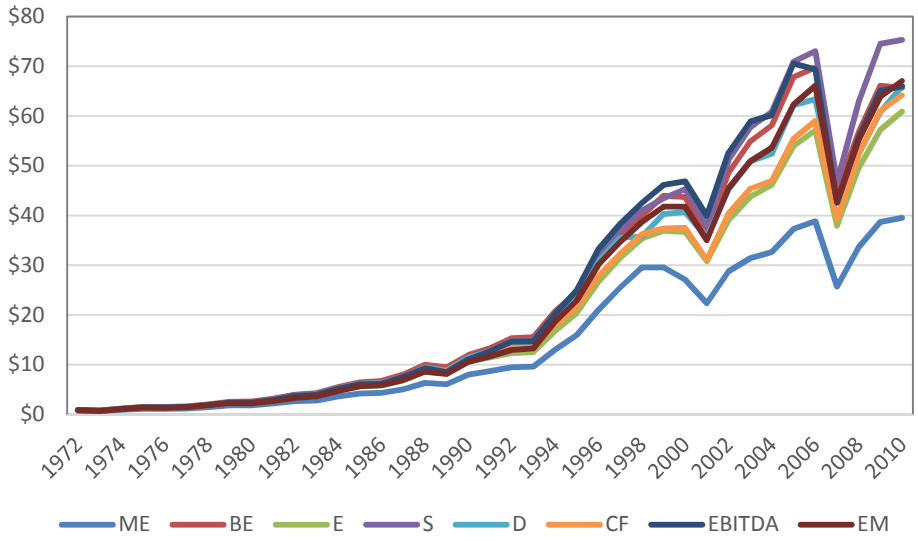

Figure2 Sector weightings based on capitalization-weighted scheme, sales-weighted scheme and EM-weighted scheme. The portfolio is divided into twelve industries based on Kenneth French's Website.

Figure 2A. Sector weightings based on capitalization-weighted scheme

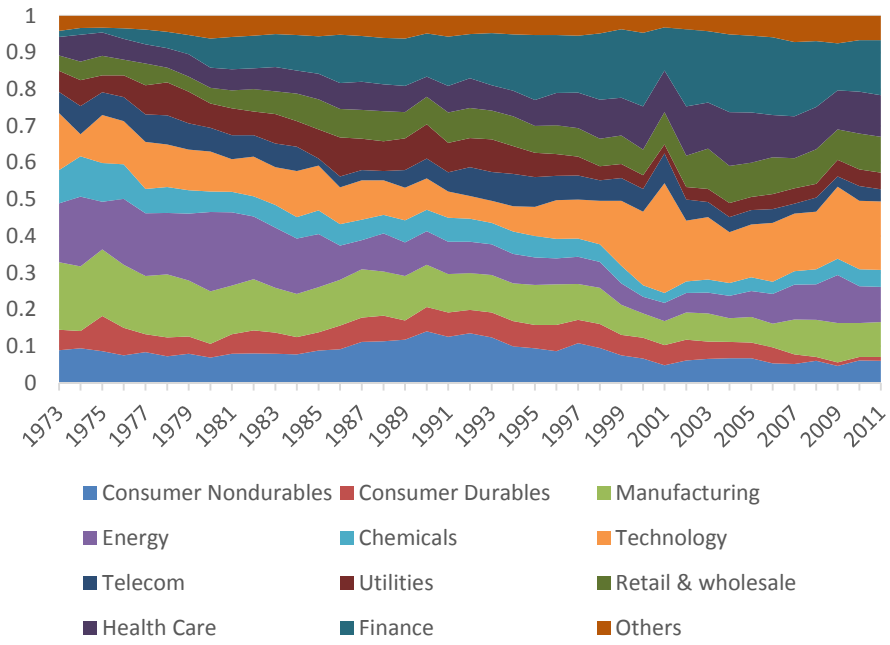

Figure 2B. Sector weightings based on sales-weighted scheme

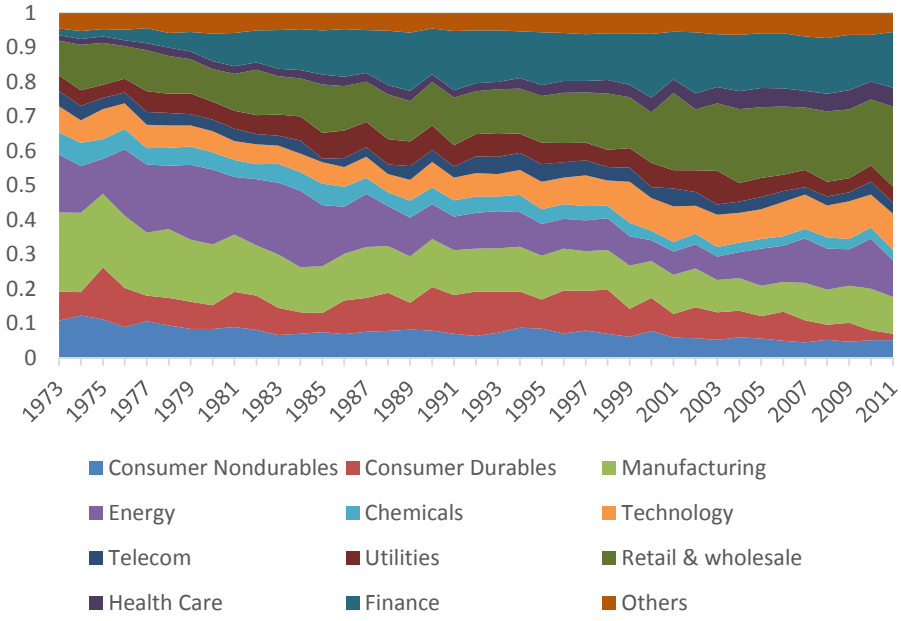

Figure 2C Thedifference of sector weightings between sales-weighted scheme and capitalization-weighted scheme, i.e. sector weights of sales-weighted index minus sector weights of capitalization-weighted index

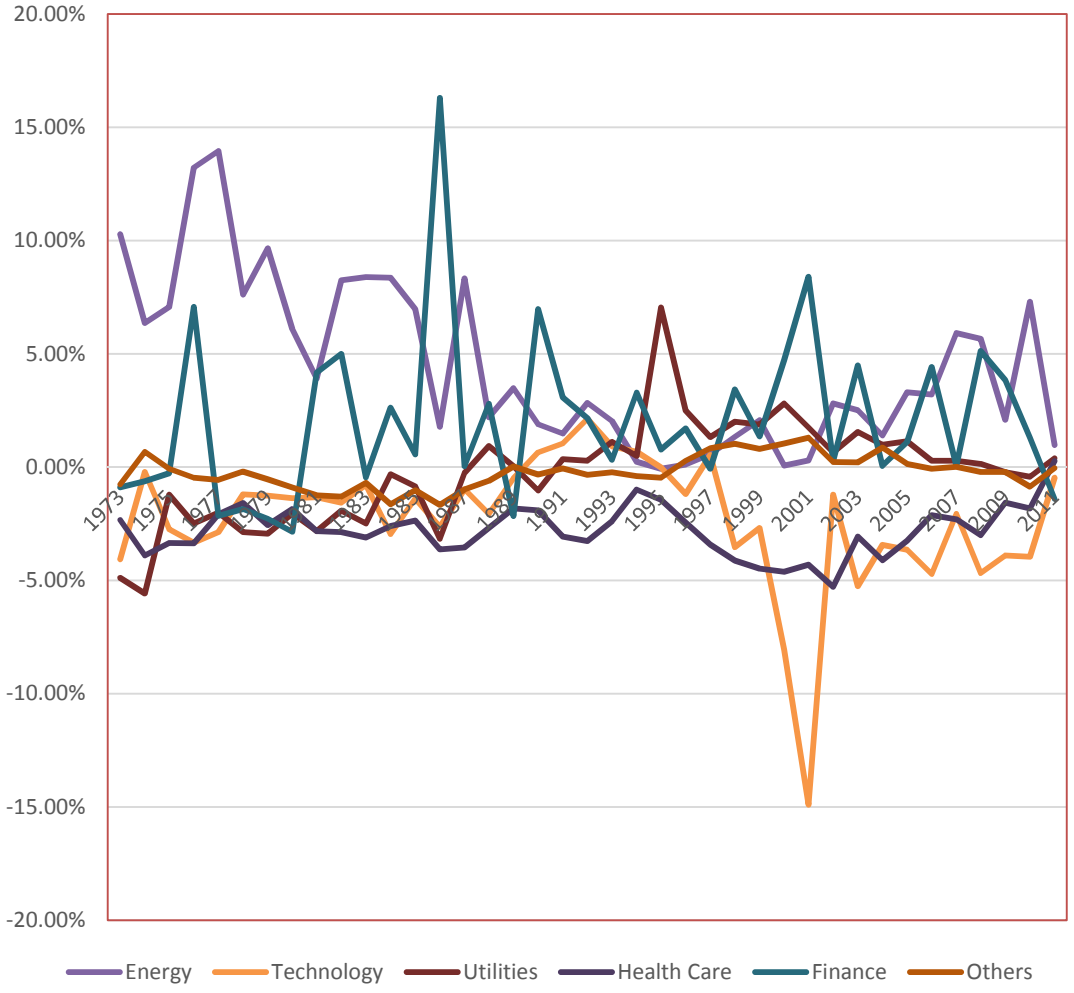

Figure 2D. Sector weightings based on EM-weighted scheme

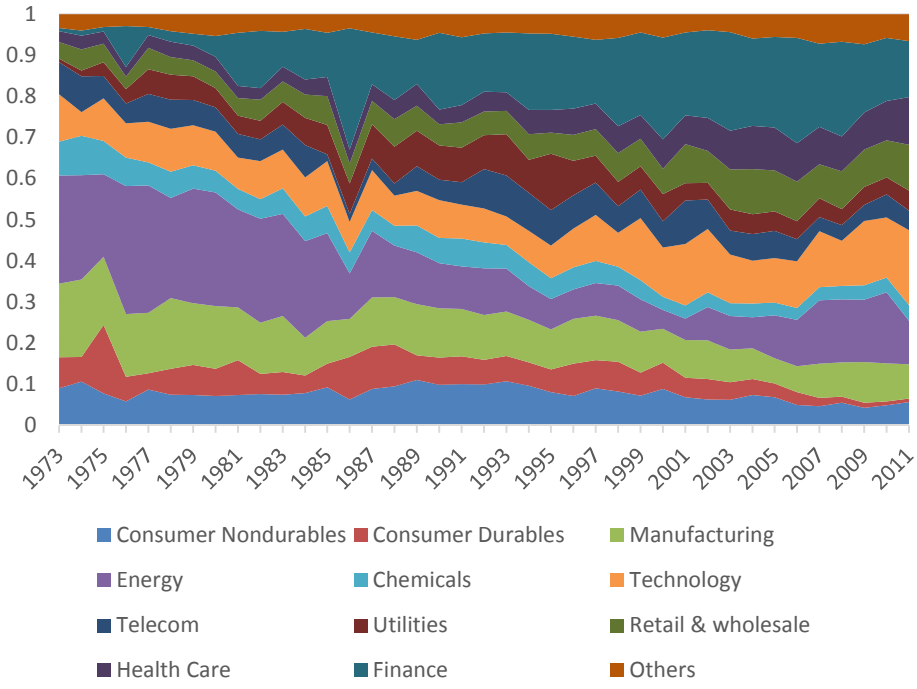

Figure 2E The difference of sector weightings between EM-weighted scheme and capitalization-weighted scheme, i.e. sector weights of EM-weighted index minus sector weights of capitalization-weighted index

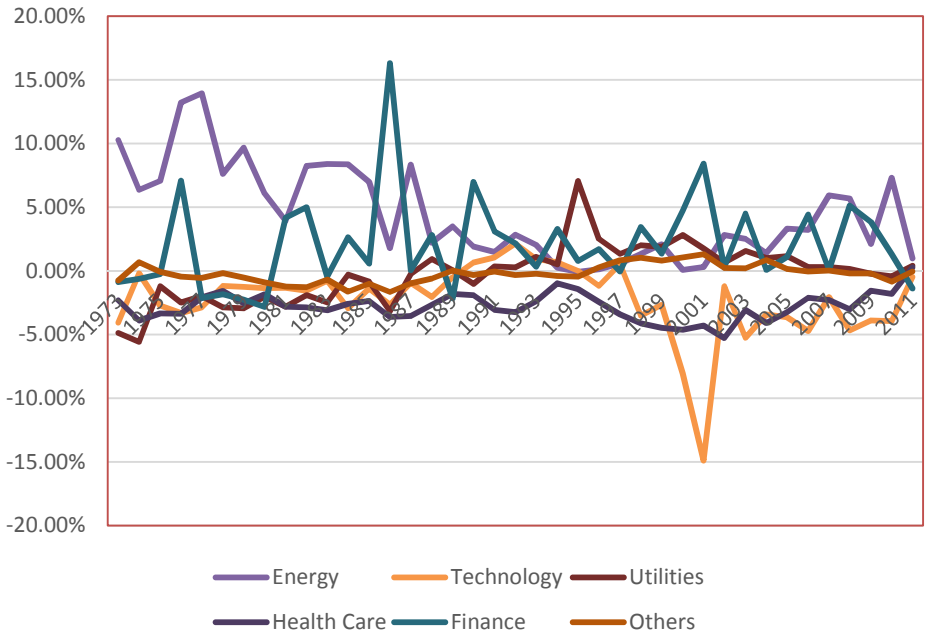

Table 1A Top 20 holdings for different weighting schemes (at peak, Oct 2007). ME is for the weighting scheme based on market value; S is for the weighting scheme based on sales; EBITDA is for the weighting scheme based on EBITDA; EM is for the weighting scheme based on enterprise multiple

Year	Month	ME	S	EBITDA	EM
2007	10	3.56% EXXON MOBIL CORP	4.40% EXXON MOBIL CORP	4.15% EXXON MOBIL CORP	5.86% EXXON MOBIL CORP
2007	10	3.03% GENERAL ELECTRIC CO	3.29% WAL MART STORES INC	3.04% GENERAL ELECTRIC CO	2.60% CHEVRON CORP NEW
2007	10	1.84% MICROSOFT CORP	2.61% CHEVRON CORP NEW	2.72% FEDERAL NATIONAL MORTGAGE ASSN	2.08% CONOCOPHILLIPS
2007	10	1.64% BANK OF AMERICA CORP	2.52% GENERAL MOTORS CORP	2.70% CITIGROUP INC	1.95% GENERAL ELECTRIC CO
2007	10	1.60% CITIGROUP INC	2.22% FORD MOTOR CO DEL	2.00% CHEVRON CORP NEW	1.90% VERIZON COMMUNICATIONS INC
2007	10	1.59% PROCTER & GAMBLE CO	2.20% CONOCOPHILLIPS	1.97% VERIZON COMMUNICATIONS INC	1.80% INTEL CORP
2007	10	1.51% WAL MART STORES INC	1.84% GENERAL ELECTRIC CO	1.88% BANK OF AMERICA CORP	1.70% BERKSHIRE HATHAWAY INC DEL
2007	10	1.40% JOHNSON & JOHNSON	1.23% INTERNATIONAL BUSINESS MACHS COR	1.77% MORGAN STANLEY DEAN WITTER & CO	1.64% MICROSOFT CORP
2007	10	1.39% CHEVRON CORP NEW	1.19% VALERO ENERGY CORP NEW	1.73% CONOCOPHILLIPS	1.54% PFIZER INC
2007	10	1.30% ALTRIA GROUP INC	1.16% HEWLETT PACKARD CO	1.71% GOLDMAN SACHS GROUP INC	1.48% CITIGROUP INC
2007	10	1.29% PFIZER INC	1.14% AMERICAN INTERNATIONAL GROUP INC	1.68% JPMORGAN CHASE & CO	1.46% INTERNATIONAL BUSINESS MACHS COR
2007	10	1.15% AMERICAN INTERNATIONAL GROUP INC	1.13% MCKESSON H B O C INC	1.67% FEDERAL HOME LOAN MORTGAGE CORP	1.44% JPMORGAN CHASE & CO
2007	10	1.15% CISCO SYSTEMS INC	1.11% CITIGROUP INC	1.37% FORD MOTOR CO DEL	1.37% ALTRIA GROUP INC
2007	10	1.15% INTERNATIONAL BUSINESS MACHS COR	0.99% VERIZON COMMUNICATIONS INC	1.32% AMERICAN INTERNATIONAL GROUP INC	1.30% WAL MART STORES INC
2007	10	1.11% INTEL CORP	0.98% BERKSHIRE HATHAWAY INC DEL	1.31% MERRILL LYNCH & CO INC	1.26% JOHNSON & JOHNSON
2007	10	1.10% JPMORGAN CHASE & CO	0.89% BANK OF AMERICA CORP	1.24% INTEL CORP	1.15% PROCTER & GAMBLE CO
2007	10	1.05% CONOCOPHILLIPS	0.88% CARDINAL HEALTH INC	1.19% INTERNATIONAL BUSINESS MACHS COR	1.13% BANK OF AMERICA CORP
2007	10	1.02% A T & T INC	0.84% JPMORGAN CHASE & CO	1.16% ALTRIA GROUP INC	1.09% AMERICAN INTERNATIONAL GROUP INC
2007	10	0.99% BERKSHIRE HATHAWAY INC DEL	0.83% KROGER COMPANY	1.15% WAL MART STORES INC	1.00% A T & T INC
2007	10	0.96% COCA COLA CO	0.83% PROCTER & GAMBLE CO	1.14% PFIZER INC	0.86% CISCO SYSTEMS INC

Table 1B Top 20 holdings for different weighting schemes (at through, Mar 2009). BE is for the weighting scheme based on book value; S is for the weighting scheme based on sales; EBITDA is for the weighting scheme based on EBITDA; EM is for the weighting scheme based on enterprise multiple

Year	Month	ME	S	EBITDA	EM
2009	3	4.13% EXXON MOBIL CORP	4.19% WAL MART STORES INC	4.95% MORGAN STANLEY DEAN WITTER & CO	5.65% EXXON MOBIL CORP
2009	3	2.18% MICROSOFT CORP	3.88% EXXON MOBIL CORP	4.36% GOLDMAN SACHS GROUP INC	2.54% CHEVRON CORP NEW
2009	3	2.03% WAL MART STORES INC	2.13% CHEVRON CORP NEW	3.97% EXXON MOBIL CORP	2.40% A T & T INC
2009	3	1.86% INTERNATIONAL BUSINESS MACHS COR	1.92% FORD MOTOR CO DEL	2.34% A T & T INC	2.13% MICROSOFT CORP
2009	3	1.75% CHEVRON CORP NEW	1.62% GENERAL MOTORS CORP	2.20% GENERAL ELECTRIC CO	2.06% BERKSHIRE HATHAWAY INC DEL
2009	3	1.74% A T & T INC	1.57% CONOCOPHILLIPS	1.90% JPMORGAN CHASE & CO	1.72% INTERNATIONAL BUSINESS MACHS COR
2009	3	1.62% APPLE INC	1.37% INTERNATIONAL BUSINESS MACHS COR	1.88% CHEVRON CORP NEW	1.69% CONOCOPHILLIPS
2009	3	1.58% JOHNSON & JOHNSON	1.37% MCKESSON H B O C INC	1.49% CONOCOPHILLIPS	1.66% WAL MART STORES INC
2009	3	1.51% PROCTER & GAMBLE CO	1.32% MORGAN STANLEY DEAN WITTER & CO	1.45% WAL MART STORES INC	1.38% PFIZER INC
2009	3	1.46% GENERAL ELECTRIC CO	1.26% A T & T INC	1.45% FEDERAL NATIONAL MORTGAGE ASSN	1.34% JOHNSON & JOHNSON
2009	3	1.28% CISCO SYSTEMS INC	1.22% BERKSHIRE HATHAWAY INC DEL	1.44% MICROSOFT CORP	1.20% INTEL CORP
2009	3	1.14% COCA COLA CO	1.21% GOLDMAN SACHS GROUP INC	1.43% INTERNATIONAL BUSINESS MACHS COR	1.20% PROCTER & GAMBLE CO
2009	3	1.11% BERKSHIRE HATHAWAY INC DEL	1.13% GENERAL ELECTRIC CO	1.32% BERKSHIRE HATHAWAY INC DEL	1.09% BANK OF NEW YORK MELLON CORP
2009	3	1.10% INTEL CORP	1.09% CARDINAL HEALTH INC	1.30% SPRINT NEXTEL CORP	1.05% CISCO SYSTEMS INC
2009	3	1.09% CONOCOPHILLIPS	1.08% VALERO ENERGY CORP NEW	1.27% FEDERAL HOME LOAN MORTGAGE CORP	1.03% GENERAL ELECTRIC CO
2009	3	0.99% ORACLE CORP	1.07% JPMORGAN CHASE & CO	1.24% FORD MOTOR CO DEL	1.00% SPRINT NEXTEL CORP
2009	3	0.92% PEPSICO INC	1.06% HEWLETT PACKARD CO	1.05% PROCTER & GAMBLE CO	0.92% JPMORGAN CHASE & CO
2009	3	0.91% HEWLETT PACKARD CO	0.92% SPRINT NEXTEL CORP	1.00% JOHNSON & JOHNSON	0.85% HEWLETT PACKARD CO
2009	3	0.89% JPMORGAN CHASE & CO	0.89% HOME DEPOT INC	0.92% PFIZER INC	0.78% OCCIDENTAL PETROLEUM CORP
2009	3	0.86% GENENTECH INC	0.87% C V S CAREMARK CORP	0.80% CITIGROUP INC	0.76% MORGAN STANLEY DEAN WITTER & CO

Table 2. Measurement of return characteristics (1972-2010). All statistics are annualized and monthly total returns from January of 1972 to December of 2010 are used for the analysis. ME is for the weighting scheme based on market value; BE is for the weighting scheme based on book value; E is for the weighting scheme based on earnings; S is for the weighting scheme based on sales; D is for the weighting scheme based on dividends; CF is for the weighting scheme based on cash flows; EBITDA is for the weighting scheme based on EBITDA; EM is for the weighting scheme based on enterprise multiples. The cap-weighted benchmark is based on the 1000 largest market cap US stocks.

Weighting Scheme	Skewness	Excess Kurtosis	Minimum Monthly Return	Minimum 3-Month Return	Minimum 12-Month Return	Maxmum Monthly Return	Maxmum3-Month Return	Maxmum 12-Month Return
ME	-0.38	2.00	-22.09%	-29.68%	-42.24%	17.33%	30.21%	64.72%
BE	-0.37	2.35	-21.60%	-29.45%	-47.54%	18.45%	33.77%	66.83%
E	-0.39	2.15	-21.02%	-29.42%	-43.27%	17.26%	29.36%	63.79%
S	-0.37	2.70	-23.49%	-31.04%	-46.60%	21.78%	35.23%	72.80%
D	-0.38	2.40	-19.58%	-27.20%	-48.39%	17.13%	35.46%	67.42%
CF	-0.39	2.32	-21.76%	-29.70%	-42.94%	17.51%	30.56%	64.82%
EBITDA	-0.35	2.20	-21.69%	-30.68%	-50.49%	18.60%	38.91%	72.10%
EM	-0.46	2.31	-21.69%	-30.86%	-44.23%	17.14%	29.93%	64.77%

Weighting Scheme	Annual Geometric Return	Annual Volatility	Sharpe Ratio (vs. rf)	Excess Return (vs. Ref)	t-Value of Excess Return	Tracking Error (vs. Ref)	Information Ratio	Sortino Ratio
ME	8.06%	15.99%	0.38	\	\	\	\	0.54
BE	11.06%	15.73%	0.48	1.14	2	3.55%	0.32	0.66
E	10.02%	15.50%	0.50	1.04	2.33	2.78%	0.37	0.76
S	10.70%	16.78%	0.47	2.04	2.99	4.22%	0.48	0.59
D	10.71%	14.92%	0.45	1.07	1.3	5.11%	0.21	0.65
CF	10.45%	15.62%	0.47	1.28	2.46	3.23%	0.40	0.66
EBITDA	10.74%	16.19%	0.47	1.43	2.39	3.72%	0.39	0.67
EM	10.37%	15.75%	0.48	1.49	3.48	2.65%	0.56	0.67

Table 3. Measurement of returns under economy contraction and expansion during 1972-2010, based on definition of NBER.

Table 3A. During Contraction (78 months)

Weighting Scheme	Skewness	Excess Kurtosis	Minimum Monthly Return	Minimum 3-Month Return	Minimum 12-Month Return	Maxmum Monthly Return	Maxmum3-Month Return	Maxmum 12-Month Return
ME	0.18	-0.05	-16.50%	-29.14%	-42.24%	17.33%	30.21%	49.85%
BE	0.14	0.41	-17.36%	-29.45%	-47.54%	18.45%	33.77%	50.29%
E	0.12	0.28	-17.41%	-29.42%	-43.27%	17.26%	29.36%	49.30%
S	0.25	0.71	-18.79%	-30.31%	-46.60%	21.78%	35.23%	52.37%
D	0.12	0.61	-15.12%	-26.48%	-48.39%	17.13%	35.46%	49.38%
CF	0.15	0.38	-17.34%	-29.33%	-42.94%	17.51%	30.56%	49.09%
EBITDA	0.23	0.36	-17.88%	-30.68%	-50.49%	18.60%	38.91%	50.64%
EM	0.10	0.33	-18.56%	-30.86%	-44.23%	17.14%	29.93%	49.49%

Table 3B. During Expansion (390 Months)

Weighting Scheme	Skewness	Excess Kurtosis	Minimum Monthly Return	Minimum 3-Month Return	Minimum 12-Month Return	Maxmum Monthly Return	Maxmum3-Month Return	Maxmum 12-Month Return
ME	-0.58	2.94	-22.09%	-29.68%	-29.05%	12.84%	21.24%	48.97%
BE	-0.51	2.93	-21.60%	-28.60%	-27.36%	14.16%	20.53%	48.50%
E	-0.51	2.76	-21.02%	-29.33%	-25.26%	13.74%	20.35%	48.33%
S	-0.63	3.27	-23.49%	-31.04%	-27.79%	14.89%	22.34%	50.33%
D	-0.50	2.64	-19.58%	-27.20%	-22.75%	12.50%	22.18%	45.93%
CF	-0.54	3.03	-21.76%	-29.70%	-26.65%	14.18%	21.52%	45.23%
EBITDA	-0.55	2.81	-21.69%	-29.66%	-25.08%	13.53%	23.59%	49.29%
EM	-0.61	3.02	-21.69%	-29.62%	-26.04%	12.51%	20.88%	49.21%

Table 4. Measurement of return characteristics during 1972-2010 economy contraction and expansion , based on NBER definition

Table 4A. During Contraction (78 months)

Weighting Scheme	Annual Geometric Return	Annual Volatility	Sharpe Ratio (vs. rf)	Excess Return (vs. Ref)	t-Value of Excess Return	Tracking Error (vs. Ref)	Information Ratio	Sortino Ratio
ME	-9.54%	23.09%	-0.32	\	\	\	\	-0.55
BE	-4.38%	22.85%	-0.29	0.81	0.42	4.89%	0.17	-0.47
E	-6.48%	22.32%	-0.21	0.70	0.46	3.86%	0.18	-0.38
S	-5.19%	24.58%	-0.30	2.40	0.96	6.33%	0.38	-0.45
D	-4.29%	21.93%	-0.30	0.90	0.33	7.01%	0.13	-0.48
CF	-6.18%	22.37%	-0.30	0.76	0.43	4.45%	0.17	-0.50
EBITDA	-5.49%	23.51%	-0.30	0.28	0.14	5.27%	0.05	-0.52
EM	-6.64%	22.65%	-0.30	0.61	0.42	3.65%	0.17	-0.50

Table 4B. During Expansion (390 Months)

Weighting Scheme	Annual Geometric Return	Annual Volatility	Sharpe Ratio (vs. rf)	Excess Return (vs. Ref)	t-Value of Excess Return	Tracking Error (vs. Ref)	Information Ratio	Sortino Ratio
ME	11.92%	14.09%	0.65	\	\	\	\	0.91
BE	14.37%	13.80%	0.79	1.21	2.13	3.22%	0.38	1.10
E	13.70%	13.66%	0.79	1.11	2.5	2.52%	0.44	1.19
S	13.97%	14.69%	0.79	1.97	3.03	3.66%	0.54	0.96
D	13.93%	13.00%	0.75	1.11	1.35	4.65%	0.24	1.10
CF	14.16%	13.81%	0.77	1.39	2.68	2.93%	0.47	1.08
EBITDA	14.23%	14.21%	0.78	1.66	2.83	3.33%	0.50	1.08
EM	14.22%	13.88%	0.79	1.66	3.91	2.41%	0.69	1.10

Table 5 Spearson Correlation matrix of monthly index returns based on different weighting schemes. ME is for the weighting scheme based on market value; BE is for the weighting scheme based on book value; E is for the weighting scheme based on earnings; S is for the weighting scheme based on sales; D is for the weighting scheme based on dividends; CF is for the weighting scheme based on cash flows; EBITDA is for the weighting scheme based on EBITDA; EM is for the weighting scheme based on enterprise multiple

Table 5A. During 1972-2010

	ME	BE	E	S	D	CF	EBITDA	EM
ME	1							
BE	0.9764	1						
	<.0001							
E	0.9845	0.9871	1					
	<.0001	<.0001						
S	0.9702	0.9854	0.9778	1				
	<.0001	<.0001	<.0001					
D	0.9469	0.9704	0.9627	0.9552	1			
	<.0001	<.0001	<.0001	<.0001				
CF	0.9785	0.9903	0.9955	0.9825	0.9614	1		
	<.0001	<.0001	<.0001	<.0001	<.0001			
EBITDA	0.9757	0.9892	0.9841	0.9864	0.9739	0.9850	1	
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
EM	0.9860	0.9863	0.9895	0.9800	0.9656	0.9881	0.9874	1
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	

Table 5B. During expansion in 1972-2010, based on NBER definition

	ME	BE	E	S	D	CF	EBITDA	EM
ME	1							
BE	0.9751	1						
	<.0001							
E	0.9838	0.9849	1					
	<.0001	<.0001						
S	0.9704	0.9837	0.9756	1				
	<.0001	<.0001	<.0001					
D	0.9409	0.9644	0.9590	0.9470	1			
	<.0001	<.0001	<.0001	<.0001				
CF	0.9780	0.9888	0.9947	0.9824	0.9567	1		
	<.0001	<.0001	<.0001	<.0001	<.0001			
EBITDA	0.9761	0.9875	0.9824	0.9852	0.9682	0.9838	1	
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
EM	0.9861	0.9849	0.9878	0.9790	0.9602	0.9866	0.9869	1
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	

Table 5C. During contraction in 1972-2010, based on NBER definition

	ME	BE	E	S	D	CF	EBITDA	EM
ME	1							
BE	0.9835	1						
	<.0001							
E	0.9873	0.9900	1					
	<.0001	<.0001						
S	0.9759	0.9875	0.9816	1				
	<.0001	<.0001	<.0001					
D	0.9664	0.9848	0.9678	0.9687	1			
	<.0001	<.0001	<.0001	<.0001				
CF	0.9817	0.9901	0.9977	0.9802	0.9691	1		
	<.0001	<.0001	<.0001	<.0001	<.0001			
EBITDA	0.9790	0.9922	0.9872	0.9866	0.9832	0.9872	1	
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
EM	0.9898	0.9894	0.9933	0.9831	0.9755	0.9921	0.9884	1
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	

Table 5D. During different periods in 1972-2010. Spearson correlation matrix of returns between capitalization-weighted index and other fundamental indexes

	ME						
	1972-2010	Contraction	Expansion	00s	90s	80s	70s
BE	0.9764	0.9835	0.9751	0.9821	0.9868	0.9720	0.9595
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
E	0.9845	0.9873	0.9838	0.9897	0.9855	0.9901	0.9692
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
S	0.9702	0.9759	0.9704	0.9672	0.9870	0.9602	0.9540
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
D	0.9469	0.9664	0.9409	0.9834	0.9771	0.9397	0.8719
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CF	0.9785	0.9817	0.9780	0.9890	0.9817	0.9819	0.9599
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
EBITDA	0.9757	0.9790	0.9761	0.9856	0.9874	0.9747	0.9445
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
EM	0.9860	0.9898	0.9861	0.9879	0.9863	0.9857	0.9730
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Table 6 Alphas and loadings of factors on asset pricing models, based on different weighting schemes. BE is for the weighting scheme based on book value; E is for the weighting scheme based on earnings; S is for the weighting scheme based on sales; D is for the weighting scheme based on dividends; CF is for the weighting scheme based on cash flows; EBITDA is for the weighting scheme based on EBITDA; EM is for the weighting scheme based on enterprise multiples. The cap-weighted benchmark is based on the 1000 largest market cap US stocks. Market factor, Small size (SMB), Value (HML), Momentum (MOM) factors, risk-free rate are obtained from WRDS Data Library.

Table 6A. During 1972-2010

		CAPM			3-factor					4-factor					
DEPVAR	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
BE		0.0021	0.8948	0.9051	0.0003	1.0051	-0.0823	0.3401	0.9593	0.0012	0.9926	-0.0822	0.3189	-0.0793	0.9650
BE	T	*3.28*	*64.11*		*0.74*	*97.99*	*-5.95*	*21.69*		*2.82*	*103.11*	*-6.41*	*21.61*	*-8.41*	
E		0.0018	0.9097	0.9230	0.0007	0.9990	-0.1336	0.2305	0.9579	0.0014	0.9878	-0.1335	0.2115	-0.0710	0.9624
E	T	*3.01*	*71.90*		*1.48*	*95.20*	*-9.45*	*14.36*		*3.28*	*98.41*	*-9.99*	*13.74*	*-7.22*	
D		0.0023	0.8033	0.8314	0.0003	0.9466	-0.1846	0.3897	0.9340	0.0009	0.9380	-0.1846	0.3751	-0.0547	0.9370
D	T	*2.78*	*46.10*		*0.60*	*77.41*	*-11.21*	*20.85*		*1.72*	*77.57*	*-11.47*	*20.23*	*-4.61*	
S		0.0025	0.9600	0.8964	0.0002	1.0717	0.0038	0.4024	0.9515	0.0011	1.0575	0.0039	0.3783	-0.0901	0.9579
S	T	*3.36*	*61.06*		*0.34*	*88.85*	*0.23*	*21.82*		*2.32*	*92.89*	*0.26*	*21.68*	*-8.08*	
CF		0.0019	0.9092	0.9151	0.0006	1.0048	-0.1074	0.2704	0.9541	0.0013	0.9945	-0.1074	0.2529	-0.0653	0.9579
CF	T	*3.13*	*68.18*		*1.20*	*91.33*	*-7.25*	*16.08*		*2.74*	*93.19*	*-7.56*	*15.46*	*-6.25*	
EBITDA		0.0021	0.9217	0.9058	0.0003	1.0389	-0.1171	0.3413	0.9625	0.0010	1.0283	-0.1170	0.3234	-0.0669	0.9663
EBITDA	T	*3.09*	*64.37*		*0.68*	*102.48*	*-8.58*	*22.02*		*2.41*	*105.72*	*-9.04*	*21.69*	*-7.02*	
EM		0.0022	0.9243	0.9266	0.0010	1.0174	-0.1352	0.2429	0.9634	0.0017	1.0069	-0.1351	0.2251	-0.0667	0.9673
EM	T	*3.71*	*73.79*		*2.32*	*102.52*	*-10.12*	*16.01*		*4.13*	*105.98*	*-10.69*	*15.45*	*-7.17*	

Table 6B During contraction in 1972-2010, based on NBER definition

		CAPM			3-factor					4-factor					
DEPVAR	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
BE		0.0023	0.9225	0.9547	0.0010	0.9824	-0.0018	0.3154	0.9794	0.0015	0.9716	-0.0216	0.3133	-0.0417	0.9801
BE	T	*1.47*	*38.72*		*0.96*	*50.30*	*-0.05*	*9.13*		*1.38*	*48.35*	*-0.62*	*9.22*	*-1.83*	
E		0.0021	0.9376	0.9735	0.0015	0.9707	-0.0089	0.1647	0.9797	0.0017	0.9670	-0.0157	0.1640	-0.0143	0.9795
E	T	*1.75*	*51.12*		*1.39*	*49.67*	*-0.26*	*4.76*		*1.49*	*47.08*	*-0.44*	*4.72*	*-0.61*	
D		0.0020	0.8311	0.9109	0.0010	0.9132	-0.0774	0.3395	0.9428	0.0015	0.9015	-0.0988	0.3373	-0.0453	0.9434
D	T	*0.99*	*26.97*		*0.62*	*30.44*	*-1.49*	*6.40*		*0.91*	*28.85*	*-1.82*	*6.38*	*-1.27*	
S		0.0038	0.9930	0.9267	0.0014	1.0201	0.1793	0.3661	0.9665	0.0025	0.9972	0.1376	0.3618	-0.0884	0.9697
S	T	*1.77*	*29.97*		*0.97*	*37.48*	*3.81*	*7.60*		*1.67*	*36.84*	*2.92*	*7.90*	*-2.87*	
CF		0.0020	0.9308	0.9664	0.0013	0.9729	-0.0197	0.1991	0.9755	0.0012	0.9754	-0.0151	0.1995	0.0096	0.9752
CF	T	*1.47*	*45.23*		*1.09*	*45.54*	*-0.53*	*5.27*		*0.96*	*43.36*	*-0.39*	*5.24*	*0.38*	
EBITDA		0.0014	0.9394	0.9452	0.0002	0.9995	-0.0123	0.3037	0.9663	0.0009	0.9827	-0.0431	0.3005	-0.0652	0.9681
EBITDA	T	*0.77*	*35.00*		*0.13*	*39.10*	*-0.28*	*6.72*		*0.66*	*37.76*	*-0.95*	*6.83*	*-2.20*	
EM		0.0022	0.9529	0.9721	0.0016	0.9948	-0.0280	0.1873	0.9797	0.0018	0.9886	-0.0393	0.1861	-0.0240	0.9797
EM	T	*1.72*	*49.72*		*1.42*	*50.15*	*-0.82*	*5.34*		*1.62*	*47.64*	*-1.09*	*5.30*	*-1.02*	

Table 6C During expansion in 1972-2010, based on NBER definition

		CAPM			3-factor					4-factor					
DEPVAR	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
BE		0.0022	0.8807	0.8781	0.0001	1.0090	-0.0989	0.3384	0.9489	0.0010	1.0060	-0.0886	0.3182	-0.0909	0.9574
BE	T	*3.11*	*50.87*		*0.28*	*79.94*	*-6.42*	*18.75*		*2.16*	*87.22*	*-6.27*	*19.11*	*-8.47*	
E		0.0018	0.8959	0.8962	0.0005	0.9994	-0.1575	0.2332	0.9485	0.0012	0.9968	-0.1483	0.2153	-0.0806	0.9550
E	T	*2.76*	*55.68*		*0.97*	*78.31*	*-10.10*	*12.78*		*2.62*	*83.55*	*-10.14*	*12.50*	*-7.26*	
D		0.0025	0.7885	0.7894	0.0001	0.9524	-0.2049	0.3923	0.9295	0.0006	0.9507	-0.1987	0.3803	-0.0543	0.9327
D	T	*2.75*	*36.69*		*0.17*	*68.04*	*-11.98*	*19.60*		*1.11*	*69.50*	*-11.85*	*19.26*	*-4.27*	
S		0.0023	0.9456	0.8789	-0.0002	1.0813	-0.0338	0.3943	0.9469	0.0006	1.0784	-0.0238	0.3748	-0.0878	0.9537
S	T	*3.03*	*51.04*		*-0.36*	*78.31*	*-2.00*	*19.97*		*1.23*	*83.63*	*-1.51*	*20.13*	*-7.31*	
CF		0.0020	0.8981	0.8879	0.0003	1.0113	-0.1209	0.2814	0.9436	0.0011	1.0086	-0.1114	0.2627	-0.0841	0.9506
CF	T	*2.92*	*53.34*		*0.63*	*75.23*	*-7.36*	*14.64*		*2.24*	*80.13*	*-7.22*	*14.46*	*-7.18*	
EBITDA		0.0023	0.9111	0.8837	0.0002	1.0468	-0.1368	0.3416	0.9606	0.0008	1.0446	-0.1291	0.3266	-0.0675	0.9649
EBITDA	T	*3.17*	*52.24*		*0.47*	*91.58*	*-9.80*	*20.90*		*1.97*	*96.86*	*-9.77*	*20.97*	*-6.73*	
EM		0.0023	0.9095	0.9022	0.0009	1.0164	-0.1559	0.2445	0.9558	0.0015	1.0141	-0.1476	0.2282	-0.0735	0.9611
EM	T	*3.51*	*57.55*		*1.89*	*85.03*	*-10.68*	*14.30*		*3.51*	*90.40*	*-10.73*	*14.09*	*-7.05*	

Table 7 Alphas, and loadings of different factors for EM-weighted portfolio in different asset pricing models. Market factor, Small size (SMB), Value (HML), Momentum (MOM) factors, risk-free rate are obtained from Wrds Data Library. Monthly total returns from January of 1972 to December of 2010 are used for the analysis. EM_AVE_1 is the EM-weighted scheme based on last fiscal year EM ratio; EM_AVE_12 is based on average of EM ratios in last 2 fiscal years; EM_AVE_321 is based on average of EM ratios in last 3 fiscal years; EM_AVE_5 is based on average of EM ratios in last 5 fiscal years; EM_AVE_432 is based on three-year average of EM ratios beginning at the last 4th fiscal year; EM_AVE_543 is based on three-year average of EM ratios beginning at the last 5th fiscal year.

		CAPM			3-factor					4-factor					
DEPVAR	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
EM_AVE_1		0.0022	0.9243	0.9266	0.0010	1.0174	-0.1352	0.2429	0.9634	0.0017	1.0069	-0.1351	0.2251	-0.0667	0.9673
EM_AVE_1	T	*3.71*	*73.79*		*2.32*	*102.52*	*-10.12*	*16.01*		*4.13*	*105.98*	*-10.69*	*15.45*	*-7.17*	
EM_AVE_12		0.0024	0.9082	0.9147	0.0009	1.0093	-0.1033	0.2927	0.9584	0.0017	0.9974	-0.1032	0.2726	-0.0751	0.9634
EM_AVE_12	T	*3.84*	*67.98*		*1.97*	*96.45*	*-7.33*	*18.30*		*3.92*	*100.41*	*-7.81*	*17.91*	*-7.72*	
EM_AVE_321		0.0024	0.9052	0.9138	0.0009	1.0072	-0.0971	0.3002	0.9587	0.0017	0.9955	-0.0970	0.2804	-0.0743	0.9637
EM_AVE_321	T	*3.93*	*67.60*		*2.00*	*96.92*	*-6.94*	*18.90*		*3.95*	*100.86*	*-7.38*	*18.53*	*-7.69*	
EM_AVE_432		0.0026	0.8994	0.9059	0.0010	1.0048	-0.0887	0.3181	0.9545	0.0017	0.9937	-0.0886	0.2992	-0.0709	0.9589
EM_AVE_432	T	*4.07*	*64.43*		*2.09*	*92.21*	*-6.04*	*19.10*		*3.82*	*94.88*	*-6.36*	*18.64*	*-6.91*	
EM_AVE_5		0.0025	0.8969	0.9096	0.0009	1.0009	-0.0965	0.3077	0.9570	0.0017	0.9899	-0.0964	0.2890	-0.0698	0.9614
EM_AVE_5	T	*4.02*	*65.87*		*2.10*	*95.04*	*-6.80*	*19.11*		*3.87*	*98.02*	*-7.18*	*18.67*	*-7.06*	
EM_AVE_543		0.0027	0.8917	0.9007	0.0009	0.9989	-0.0877	0.3251	0.9516	0.0017	0.9881	-0.0876	0.3068	-0.0684	0.9558
EM_AVE_543	T	*4.02*	*62.54*		*2.00*	*89.39*	*-5.83*	*19.03*		*3.61*	*91.43*	*-6.09*	*18.52*	*-6.46*	

Table 8 Alphas, and loadings of different factorsfor EM-weighted portfolio in different asset pricing models. Market factor, Small size (SMB), Value (HML), Momentum (MOM) factors, risk-free rate are obtained from Wrds Data Library. Monthly total returns from January of 1972 to December of 2010 are used for the analysis. S_AVE_1 is the Sales-weighted scheme based on last fiscal year sales; S_AVE_12 is based on average of sales in last 2 fiscal years; S_AVE_321 is based on average of sales in last 3 fiscal years; S_AVE_5 is based on average of sales in last 5 fiscal years; S_AVE_432 is based on three-year average of sales beginning at the last 4th fiscal year; S_AVE_543 is based on three-year average of sales beginning at the last 5th fiscal year.

		CAPM			3-factor					4-factor					
DEPVAR	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
S_AVE_1		0.0025	0.9600	0.8964	0.0002	1.0717	0.0038	0.4024	0.9515	0.0011	1.0575	0.0039	0.3783	-0.0901	0.9579
S_AVE_1	T	*3.36*	*61.06*		*0.34*	*88.85*	*0.23*	*21.82*		*2.32*	*92.89*	*0.26*	*21.68*	*-8.08*	
S_AVE_12		0.0027	0.9567	0.8881	0.0003	1.0711	0.0234	0.4250	0.9485	0.0013	1.0564	0.0235	0.4001	-0.0934	0.9553
S_AVE_12	T	*3.54*	*58.49*		*0.48*	*86.08*	*1.40*	*22.34*		*2.48*	*90.02*	*1.51*	*22.24*	*-8.12*	
S_AVE_321		0.0027	0.9555	0.8865	0.0002	1.0704	0.0268	0.4292	0.9481	0.0012	1.0555	0.0269	0.4038	-0.0950	0.9551
S_AVE_321	T	*3.49*	*58.03*		*0.38*	*85.68*	*1.59*	*22.47*		*2.41*	*89.76*	*1.72*	*22.40*	*-8.24*	
S_AVE_432		0.0027	0.9517	0.8818	0.0001	1.0692	0.0282	0.4392	0.9464	0.0012	1.0541	0.0283	0.4136	-0.0958	0.9535
S_AVE_432	T	*3.41*	*56.70*		*0.25*	*84.30*	*1.65*	*22.65*		*2.26*	*88.22*	*1.78*	*22.58*	*-8.18*	
S_AVE_5		0.0026	0.9510	0.8823	0.0001	1.0692	0.0217	0.4373	0.9468	0.0012	1.0540	0.0218	0.4117	-0.0958	0.9540
S_AVE_5	T	*3.40*	*56.86*		*0.26*	*84.75*	*1.28*	*22.67*		*2.28*	*88.76*	*1.38*	*22.62*	*-8.24*	
S_AVE_543		0.0026	0.9466	0.8766	0.0000	1.0671	0.0251	0.4482	0.9444	0.0011	1.0517	0.0252	0.4221	-0.0978	0.9519
S_AVE_543	T	*3.29*	*55.35*		*0.08*	*82.85*	*1.45*	*22.76*		*2.10*	*86.75*	*1.56*	*22.71*	*-8.24*	

Table 9 Alpha of EM-weighted scheme in different asset pricing models for stocks with different levels of market-to-book ratio. The top 1000 stocks are divided into five deciles based on market-to-book ratio. Risk-free rate, market factor, size factor (SMB), value factor (HML), and momentum factor (MOM) are all obtained from WRDS Data Library. Monthly total returns from January of 1972 to December of 2010 are used for the analysis

EM-weighted scheme															
		CAPM			3-factor					4-factor					
MTB Rank	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
1		0.0040	0.9534	0.7437	0.0005	-0.0037	-0.0166	0.1017	0.8496	0.0017	1.0991	0.0438	0.5841	-0.1139	0.8579
1	T	*3.17*	*35.38*		*0.78*	*-0.22*	*-0.75*	*4.02*		*1.69*	*48.23*	*1.44*	*16.72*	-5.10	
2		0.0030	0.8699	0.7603	0.0004	0.0158	0.0155	0.0031	0.8719	0.0007	1.0177	-0.0190	0.5381	-0.0740	0.8760
2	T	*2.78*	*36.98*		*1.01*	*1.52*	*1.11*	*0.19*		*0.85*	*52.99*	*-0.74*	*18.28*	*-3.93*	
3		0.0029	0.8808	0.7980	0.0004	-0.0058	-0.0071	0.0426	0.8381	0.0019	0.9742	-0.0997	0.2821	-0.0487	0.8397
3	T	*2.89*	*41.28*		*1.21*	*-0.84*	*-0.77*	*4.04*		*2.00*	*45.14*	*-3.47*	*8.53*	*-2.30*	
4		0.0025	0.9402	0.8493	0.0007	-0.0181	-0.0074	0.0207	0.8619	0.0026	0.9868	-0.1317	0.0921	-0.0446	0.8632
4	T	*2.85*	*49.30*		*2.51*	*-2.80*	*-0.85*	*2.09*		*2.92*	*47.82*	*-4.80*	*2.91*	*-2.20*	
5		-0.0008	0.9729	0.8708	0.0000	-0.0103	0.0114	0.1138	0.8960	0.0015	0.9543	-0.2306	-0.1901	-0.1032	0.9037
5	T	*-0.98*	*53.90*		*-0.02*	*-1.51*	*1.24*	*10.91*		*2.01*	*53.94*	*-9.80*	*-7.01*	*-5.95*	

Table 10 Alpha of Sales-weighted scheme in different asset pricing models for stocks with different levels of market-to-book ratio. The top 1000 stocks are divided into five deciles based on market-to-book ratio. Risk-free rate , market factor, size factor (SMB), value factor (HML), and momentum factor (MOM) are all obtained from WRDS Data Library. Monthly total returns from January of 1972 to December of 2010 are used for the analysis

Sales-weighted scheme															
		CAPM			3-factor					4-factor					
MTB Rank	TYPE	Intercept	mktrf	ADJRSQ	Intercept	mktrf	smb	hml	ADJRSQ	Intercept	mktrf	smb	hml	umd	ADJRSQ
1		0.0042	1.0164	0.7123	-0.0007	1.1966	0.2319	0.7993	0.8651	0.0011	1.1708	0.2321	0.7555	-0.1642	0.8800
1	T	*2.89*	*32.68*		*-0.67*	*50.09*	*7.21*	*21.88*		*1.10*	*51.32*	*7.65*	*21.60*	-7.35	
2		0.0028	0.9226	0.7875	-0.0005	1.0712	0.0478	0.5638	0.8881	0.0003	1.0590	0.0479	0.5432	-0.0774	0.8924
2	T	*2.58*	*39.98*		*-0.62*	*57.03*	*1.89*	*19.64*		*0.42*	*56.80*	*1.93*	*19.00*	*-4.24*	
3		0.0028	0.9110	0.8184	0.0009	1.0155	-0.0301	0.3538	0.8633	0.0015	1.0062	-0.0300	0.3380	-0.0592	0.8658
3	T	*2.93*	*44.09*		*1.00*	*50.49*	*-1.11*	*11.51*		*1.71*	*49.89*	*-1.12*	*10.93*	*-2.99*	
4		0.0021	0.9662	0.8724	0.0013	1.0212	-0.0706	0.1499	0.8828	0.0019	1.0134	-0.0705	0.1366	-0.0499	0.8844
4	T	*2.50*	*54.28*		*1.62*	*53.38*	*-2.74*	*5.12*		*2.23*	*52.70*	*-2.76*	*4.63*	*-2.65*	
5		-0.0009	0.9916	0.8840	-0.0001	0.9992	-0.1814	-0.0937	0.8975	0.0010	0.9831	-0.1813	-0.1210	-0.1021	0.9049
5	T	*-1.07*	*57.32*		*-0.09*	*54.77*	*-7.38*	*-3.36*		*1.34*	*55.28*	*-7.66*	*-4.44*	*-5.86*	