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Fundamental Indexation[i,ii]

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Abstract

The insights from the celebrated Capital Asset Pricing Model have led many to champion capitalization-weighted "equity market portfolios" as mean-variance optimal. Armed with these insights, investment managers and consultants have created a trillion dollar industry, based on investing in passive capitalization-weighted indexes, such as the S&P 500 and other indexes constructed by Russell, MSCI, The Financial Times, Wilshire, Forbes and Fortune to name a few. Trillions more in actively managed equity portfolios are benchmarked against these same capitalization-weighted indexes. But, the CAPM literature already rejects the mean-variance efficiency of capitalization-weighted equity market indexes. This suggests that it should be possible to construct stock market indexes that are more mean-variance efficient than those based on market capitalization.

In this paper, we examine a series of equity market indexes weighted by fundamental metrics of size, rather than market capitalization. We find that these indexes deliver consistent and significant benefits relative to standard capitalization-weighted market indexes. These indexes exhibit similar beta, liquidity and capacity compared to capitalization-weighted equity market indexes and have very low turnover. They show annual returns that are on average **213** basis points higher than equivalent capitalization-weighted indexes over the 42 years of the study. They contain most of the same stocks found in the traditional equity market indexes, but the weights of the stocks in these new indexes differ materially from their weights in capitalization-weighted indexes. Selection of companies and their weights in the indexes are based on simple measures of firm size such as book value, income, gross dividends, revenues, sales, and total company employment.

While price inefficiency could lead to the observed alpha, as capitalization weighting assuredly overweights the overvalued stocks and underweights undervalued stocks, the superior performance may also be attributable to superior mean-variance portfolio construction or to hidden risk factors (in an APT or Fama-French framework), none of which violates the assumption of price efficiency. Regardless of the exact reason, these Fundamental Indexation indexes appear to provide long-term performance superior to that of comparable capitalization-weighted equity indexes. We offer them not as substitutes for capitalization-weighted indexes, but as simple alternatives, that may offer superior return and risk characteristics.

Is the S&P500 mean-variance efficient?

The CAPM says that the "*market portfolio*" is mean-variance optimal. While this model is predicated on an array of assumptions, most of which are arguably not quite accurate, it leads to the conclusion that a passive investor/manager can do no better than holding a market portfolio. The finance industry, with considerable inspiration and perspiration from Harry Markowitz, Bill Sharpe, Jack Bogle, Burton Malkiel, Bill Fouse, Dean LeBaron and many others, has translated that investment advice into trillions of dollars invested in or benchmarked to capitalization-weighted market indexes such as the S&P500 and the Russell 1000.

Many academic papers reject the idea that capitalization-weighted indexes are good *CAPM market* proxies.[iii] This is equivalent to rejecting the mean-variance efficiency of these indexes.[iv] The rejection of capitalization-weighted equity market indexes as mean-variance efficient suggests that more efficient indexes exist. However, the exercise to identify a better index may be moot if *ex ante* identification is impossible or if capitalization-weighted equity market indexes are *almost optimal*.[v]

The ex ante construction of a mean-variance efficient portfolio is a difficult problem; forecasting expected stock returns and their covariance matrix for thousands of stocks, which is necessary for applying Markowitz's mean-variance portfolio construction, is intellectually challenging and resource intensive. This is precisely why CAPM remains so powerful: if one can find the "market" portfolio, one simultaneously identifies a mean-variance optimal portfolio.

Our industry and MBA programs have promoted the belief that capitalization-weighted equity market indexes is *sufficiently* representative of the CAPM "market portfolio" to be very nearly mean variance efficient. This assumption reduces the complicated problem of optimal portfolio construction to essentially buying and holding a capitalization-weighted index such as the S&P500 or Russell 1000. We demonstrate in this paper that investors can do much better than capitalization-weighted market indexes; and we provide fundamental equity market indexes, that deliver superior mean-variance performance.

In this study we construct indexes using gross revenue, book equity, gross sales, gross dividend, gross earnings and total employment as weights. If capitalization is a "Wall Street" definition of

the size of an enterprise, these are clearly "Main Street" measures. When a merger is announced, the Wall Street Journal may cite the combined capitalization, but the New York Post will focus on the combined sales and total employment. We show that these non-capitalization-based indexes consistently provide higher returns and lower risks than the traditional capitalization-weighted equity market indexes. In a sense, our work suggests that indexes constructed using "Main Street" measures of company size are measurably better than the capitalization-weighted "Wall Street" indexes.

Additionally, we show that these "Fundamental Indexes" deliver better risk-adjusted performance than traditional capitalization-weighted equity market indexes in various macroeconomic regimes, such as in rising and falling rate environments, in bull and bear markets and in expansions and recessions. We believe these results are not mere accidents of history but are likely to persist into the future. We offer our interpretations of the results and explain why the results should not be dismissed as active management anomalies or the product of data mining or data snooping. Ultimately, we hope to persuade the reader that our proposed Fundamental Indexes improve upon the capitalization-weighted indexes like S&P500 and Russell 1000.

Merits of capitalization-weighted equity market portfolios

Before introducing the methods we use to construct the fundamentals weighted equity market indexes, it is important to review the merits of capitalization weighting. Certainly, pension funds and endowments are indexed to S&P500 and Russell 1000 for many reasons other than the presumed mean-variance efficiency of these indexes. Whatever its shortcomings, capitalization weighting has many benefits. Any alternative should largely preserve these benefits.

- Capitalization weighting is a passive strategy requiring little trading; it therefore incurs lower trading costs and fees than active management. Capitalization-weighted portfolios automatically rebalance as security prices fluctuate. Apart from the impact of stock buybacks and secondary equity offerings, there is no rebalancing cost associated with executing this strategy, except for replacing a constituent security in the portfolio. The capitalization-weighted indexes require material adjustment only when new companies become large enough to merit inclusion in an index or when others disappear through merger,

failure or relative reduction of capitalization, collectively referred to as reconstitution. Such changes are not insignificant, however. A study of changes in the composition of the S&P 500 by Marshall Blume found that 235 companies had been changed between 1995 and 2000.[x]

- A capitalization-weighted index provides a convenient way to participate in the broad equity market. Capitalization-weighting seeks to assign the greatest weights to the largest companies. These companies are also typically among the largest as measured by other metrics of size as well, including sales, book value, earnings, normalized earnings, or total employment.

- Since market capitalization is highly correlated with trading liquidity, capitalization-weighting tends to emphasize the more liquidly traded stocks, thus reducing expected portfolio transaction costs.

- Since market capitalization is highly correlated with investment capacity, capitalization-weighting tends to emphasize the stocks with the greater investment capacities, thus allowing the use of passive indexing on an immense scale by large pension funds and institutions.

The aim of this paper is to offer indexes that are more mean-variance efficient than the usual capitalization-weighted market indexes, while retaining the many benefits of capitalization-weighting for the passive investor. Fortunately, the alternative size measures we use allow us to construct passive portfolios that retain the above-listed benefits of capitalization-weighted indexing.

We find most alternative measures of firm size such as book value, income, sales, revenues, gross dividends or total employment are highly correlated with capitalization and liquidity, which means these Fundamental Indexes are also primarily concentrated in the large capitalization stocks, preserving the liquidity and capacity benefits of traditional capitalization-weighted indexes. In addition, as compared with conventional capitalization-weighted indexes, these Fundamental Indexes typically have substantially identical volatilities, and CAPM betas and correlations exceeding **0.95**. The *market* characteristics that investors have traditionally

gained exposure to, through holding capitalization-weighted market indexes, are equally accessible through these Fundamental Indexes.

Maintaining low turnover is the most challenging aspect in the construction of Fundamental Indexes. In addition to the usual reconstitution, a certain amount of rebalancing is also needed for the Fundamental Indexes. If a stock price goes up 10%, its capitalization also goes up 10%. The weight of that stock in the Fundamental Index will at some interval need to be rebalanced to its its Fundamental weight in that index. If the rebalancing periods are too long, the difference between the policy weights and actual portfolio weights become so large that some of the suspected negative attributes associated with capitalization weighting may be reintroduced.

We base the Fundamental Index strategies described in this paper on annual rebalancing as of January 1st. The resulting turnover only modestly exceeds the turnover for capitalization-weighted indexes. Since the Fundamental Indexes are concentrated in large, liquid companies, the relatively low rebalancing turnovers translate into rebalancing costs that are nearly as low as for a capitalization-weighted strategy.[vi]

The genesis of our non-capitalization-weighted market indexes stems from a concern that market capitalization is a *particularly* volatile way to measure a company's size or true fair value. If so, capitalization weighting may lead to sub-optimal portfolio return characteristics because prices are too noisy relative to fundamentals. Mathematically, capitalization weighting assuredly gives additional weight to stocks that are currently overpriced relative to their (unknowable) true fair values, and reduces weights in stocks that are currently undervalued. This leads to a natural performance drag in capitalization-weighted and other price weighted portfolios.

Equal weighting, which is obviously not price weighted, is a much-studied alternative, but it does not preserve all of the benefits of capitalization weighting enumerated in the previous section. It lacks the liquidity and capacity found in traditional market indexes and its return characteristics are not representative of the *aggregate equity market*. Furthermore, equal weighting has logical inconsistencies: for instance, the equal-weighted Russell 1000 gives as much weight to the 1000th-largest company as to the largest, but gives no weight whatsoever to the 1001st-largest company.

Fundamental Indexes: Construction

Adopting Fundamental Indexation is more than just changing the basis for weighting the stocks in an index. For instance, if we simply re-weight the stocks in the S&P 500 or the Russell 1000 by book value, we miss a large number of companies with substantial book value but that are trading at a low price-to-book-value ratio. We end up with a double-metric portfolio, concentrated most heavily in stocks that are large in *both* capitalization *and* book value.

Instead we rank *all* companies by each metric, then select the 1000 largest. Each of these 1000 largest is included in the index, *at its relative metric weight*, to create the Fundamental Index for that metric. The measures of firm size we use in this study are:

- *book value (designated by the shorthand "book" later in this paper),*
- *trailing five-year average operating income ("income"),*
- *trailing five-year average revenues ("revenue"),*
- *trailing five-year average sales ("sales"),*
- *trailing five-year average gross dividend ("dividend"),*
- *total employment*[vii] *("employment"),*

We also examine a composite, equally weighting four of the above fundamental metrics of size ("composite"). This composite excludes the total employment because that is not always available, and sales because sales and revenues are so very similar. The four metrics used in the composite are widely available in most countries, so that the Composite Fundamental Index could easily be applied internationally, globally and even in the emerging markets.

Financial statement data are taken from the Compustat database. Stock price information is collected from the CRSP database and linked to the corresponding Compustat entries using the CRSP/Compustat merged list. The roster of selected stocks and the portfolio weights for January 1 of any year are generated using only data available on the last trading day of the prior year. In most cases this means using data lagged by at least one quarter. The index is rebalanced on the

last trading day of each year, using the end of day prices. We hold this portfolio until the end of the next year, at which point we use the most recent company financial information to calculate the following year's index weights.

We rebalance the index only once a year, on the last trading day of the year, for two reasons. First, the financial data available through Compustat are available only on an annual basis in the earliest years of our study. Second, when we try monthly, quarterly, and semi-annual rebalancing, we increase index turnover but find no appreciable return advantage over annual rebalancing.

Note that we do not adjust for trading costs in the index construction, which is consistent with the practice used by the commercial capitalization-weighted indexes and in most academic research. It would be difficult to know the actual trading cost with any precision, but we do examine the impact of a 1% trading cost (each way). Reciprocally, we measure how large the trading cost must be, in order to completely eliminate the alpha generated by the Fundamental Indexes relative to capitalization-weighted indexes.

We offer the results from six Fundamental Indexes, as well as a composite index combining four of the six. The construction of the 'composite' index requires some explanation. We combine in equal proportions the weights each company would have in four of the six Fundamental Indexes (book, income, revenue and gross dividends) to get the composite weight. We then select the top 1000 companies by composite weight, then we weight each by this composite weight to get the composite index.

For our Fundamental Indexes, we use trailing five-year averages wherever excessive volatility in the index weights would result from using year-to-year data; only book value and employment are single year metrics. This reduces index rebalancing turnover. Whenever fewer than five years of data are available, we average the years of data that are available. When we examine the mean return, volatility, and equity market beta for similar indexes constructed with single year income or revenue, we find the results are not materially different from those of their trailing five-year counterparts, but the portfolio turnover is substantially higher.

Because none of these measures of size relies on price, none will capture the current market valuation of perceived growth opportunity of the firms. So, young firms and fast-growing firms tend to be under-represented in the Fundamental Indexes, relative to their weights in capitalization-weighted market indexes. The gross dividend metric excludes all companies electing to not distribute dividends. Empirical studies have shown that zero-yield stocks outpace low-yield stocks with some regularity.[viii] Even though zero-yield stocks are excluded from the gross dividend index while low-yield stocks are not, the index (to our surprise) still outpaces the traditional capitalization-weighted indexes in the long run and does so with markedly lower risk.

Ex ante, it might seem that these indexes, which de-emphasize growth characteristics, would produce lower absolute returns and lower risk. This is because growth firms are usually firms with higher market beta risk and correspondingly (in theory) higher expected returns. We show later that this does not occur; the Fundamental Indexes constructed from book, income, revenues, sales and employment in fact have betas ranging from **0.95** to **0.99**, but have significantly higher realized returns with surprising consistency, over the 42 years.

For benchmarking purposes, we also construct a 1000-stock capitalization-weighted equity market index using the same construction method. While it bears close resemblance to the highly regarded Russell 1000, it is not identical.[ix] The construction of this Reference Capitalization index allows us to make direct comparisons with the Fundamental Indexes uncomplicated by questions of float, market impact, subjective selections, and so forth.

The Relative Performance of Fundamental Indexation

Table 1 shows the return attributes of the Fundamental Indexes against the Reference Capitalization-weighted equity market portfolio and the S&P500 for the 42 years from Jan. 1, 1962 to Dec. 31, 2003. The sample period is selected to cover as long a history as possible with data from the Compustat Database. While Compustat has data extending back to the 1950's, the number of firms prior to 1962, with sufficient data for our purposes, is far less than 1000. The sample period was not selected to maximize the outperformance of the Fundamental Indexes; indeed, we show results decade-by-decade and for different economic and market environments within the 42 years. The historical portfolio results *are not* adjusted for any transaction costs

associated with maintaining the strategy. We examine the issue of turnover and trading costs separately.

All of the Fundamental Indexes exhibit similar volatility and beta as the capitalization-weighted index except for the Gross Dividend index, which has, as might be expected, significantly lower return volatility and CAPM beta. This index is dominated by mature companies with less risk and lower perceived growth prospects. Even so, perhaps surprisingly, it outpaces the higher-risk conventional capitalization-weighted indexes.

The returns produced by the Fundamental Indexes are, on average, **1.91%** higher than the S&P500 and **2.13%** higher than the Reference Capitalization index. The best of the Fundamental Indexes outpaces the Reference Capitalization index by **2.50%** per annum. Surprisingly, the composite rivals the performance of the average, even though it excludes two of the three best Fundamental Indexes! Most of these indexes outpace the equal-weighted index of the top 1000 by capitalization, with lower risk, lower beta. The excess returns are significant and have an average t-statistic around **2.92**, with the composite coming in even higher, with a t-statistic of **3.20**.

As we can see in Table 2, once we adjust for the slightly lower beta and risk of the Fundamental Indexes, the average CAPM alpha rises to **2.36%** with a t-statistic of **3.21**; the composite (again, despite excluding two of the best single-metric indexes) delivers an even more impressive alpha of **2.43%** with a t-statistic of **3.80**. The information ratio[x] is above **0.50** for the best of these indexes, with the composite information ratio rising to **0.59** on a beta-adjusted basis. Given that Warren Buffett's lifetime information ratio is about 0.7, we find this to be a very satisfactory result for a process that isn't even seeking alpha!

Over the investment period of 42 years, the return advantages compound to ending values which are typically well above twice that of the ending value for the Reference Capitalization index. Only the Book Index and Gross Dividend Index fail to double the cumulative return of the capitalization-weighted indexes.

Portfolio Liquidity

In Table 3, we examine index characteristics that can help us assess the liquidity and capacity of the Fundamental Indexes. In conjunction with the information on annual portfolio turnover, this allows us to assess the impact of transaction costs on the excess returns of the Fundamental Indexes. There are several useful ways to gauge liquidity.

We measure the relative capacity of each Fundamental Index by dividing the fundamentally-weighted average capitalization of that index by the capitalization-weighted average capitalization of the Reference Capitalization index. This "CAP Ratio" measure helps us assess the investment capacity of each index. A CAP Ratio of 0.50 suggests that the weighted average capitalization of the companies in the index is half as large as that of the "Reference Capitalization" index. The inference is that the aggregate amount of money that can be benchmarked to or invested in the index is approximately half as much as what could be benchmarked to or invested in our CAP index**.**

In addition, we examine the average dollar trading volume of the Fundamental Index portfolios, as well as the average number of trading days required to trade a billion-dollar portfolio. For these two measures we use only the data from 1993 through 2003 to report numbers that are relevant to the current environment. These two metrics suggest that, apart from the Employment index, the Fundamental Index portfolios have liquidity that is over half that of the Reference Capitalization portfolio. Given that over $1 trillion is passively managed in some variant of capitalization-weighted index portfolios, this does not seem a serious constraint. Notably, the Fundamental Index portfolios generally have roughly twice the liquidity and half the turnover of an equally weighted portfolio of the Reference Capitalization holdings.

We also measure the concentration of the portfolio in the large capitalization stocks by examining the fraction of the total index capitalization that belongs to the top 100 stocks by metric weight in each Fundamental Index. These concentration ratios are similar for all the indexes, including the Reference Capitalization index, and range from **43%** to **62%.** Most are within **4%** of the **55%** concentration ratio for the capitalization-weighted index.

This table also shows the average annual index turnovers. Recall that the indexes are reconstituted and rebalanced once a year at the end of the year. Observe that the "Reference Capitalization" index has somewhat lower turnover than the others. This is expected since virtually the entire turnover, apart from the modest impact of stock buybacks and secondary equity offerings, arises only from reconstitution (the addition of new stocks to, and removal of existing stocks from, the 1000 stocks in the index). The Fundamental Indexes, on the other hand, must further adjust the index weights to reflect the deviation in the index weights from the beginning of the year policy weights due to price changes.

This increases the turnover from **6.3%** for the Reference Capitalization index to an average of **13.1%** for the Fundamental Indexes, and a surprisingly modest average of **10.6%** for the Composite index. The pertinent issue is the erosion of the excess return relative to the capitalization-weighted index due to transactions costs. Assuming a 2% round-trip transaction cost (or 1% each way, including both transaction fees and price impact), the average excess return falls from an average of **2.13%** to **1.99%.** To completely erode the excess return would require a *one-way* transaction cost of almost **16%** each trade, and it would take an implausible **24.7%** transaction cost *each way* to eliminate the alpha of the lower-turnover Composite Fundamental Index!

Stress-Testing the Results: Outliers and Market Environment

From a mean-variance perspective, the Fundamental Indexes appear to be superior to capitalization-weighted market indexes. Table 4 suggests that, on average, skewness is similar to the capitalization-weighted indexes, and kurtosis is slightly higher, suggesting modestly more outliers in the historical returns. This is evident with the Fundamental Indexes very slightly more exposed to extreme one-month and three-month events than a capitalization-weighted market index.

The pattern is interesting. For the Gross Dividends index compared with the capitalization-weighted index, the worst month is sharply improved but the best month is not degraded. However, for the Employment index and, to a lesser extent, the Revenue and Sales indexes, the range is wider than for any of the other indexes. Neither of these exceptions is a surprise. The observed extreme events across all of the indexes does not appear to be large enough to account

for the high excess return for the Fundamental Index portfolios. Indeed, the extremes are dampened in the Composite Index, so that the Composite outperforms the Reference Capitalization *and* the S&P 500 for both best and worst month and quarter.

Furthermore, they do not carry through to spans longer than a quarter. The annual results favor *all* of the Fundamental Indexes over the Reference Capitalization index, with a better best outcome *and* a better worst outcome, with the sole exception of the low-beta Gross Dividends index, which lags the best 12-month span for the capitalization-weighted indexes. None of the Fundamental Indexes fails to better the best *and* worst calendar years for the capitalization-weighted indexes.

If the goal of earning higher returns with lower risk is the raison d'etre for the finance community, we find convincing evidence for indexing to these Fundamental Indexes, as Figures 1A and 1B rather vividly suggest. Figure 1A shows the cumulative growth of a $1 investment in each index; the bold lines correspond to the Reference Capitalization 1000 and the Composite 1000. Figure 1B shows the relative wealth of each Fundamental Index, as compared with the Reference Capitalization 1000 index; the bold lines again correspond to Reference Capitalization 1000 and the Composite 1000, as well as the S&P 500, which tracks very close to the Reference Capitalization 1000 except during the bubble.

It is worth noting, in Figure 1B, that the Fundamental Indexes do not keep pace in large-capitalization high-multiple bull markets (the "nifty fifty" of 1972, the "TMT bubble" of 1998-1999, and, to a lesser extent, the tech-dominated rallies of 1980 and 1989-1991). These markets are characterized by narrow high-multiple leadership, which leave the "average stock" far behind. However, as we shall see, the Fundamental Indexes keep pace with the capitalization-weighted indexes in the average bull market. Since they lag in these "bubbles", we can infer that they perform very well in the more conventional bull markets with broad leadership. We return to this point later after we examine the consistency of the relative performance across time and across market environments.

- In Table 5, we show the performance of the indexes in the various decades. In four of the five spans, the Fundamental Indexes beat the capitalization-weighted indexes, often by a wide margin. The only shortfall was in the 1990s, and even during the 1990s the Composite

Fundamental Index was ahead of the Reference Capitalization until the end of May, 1999, just ten months before the bubble burst. This decade was characterized by a "mega-cap" dominated decade, fueled in part by a massive flow of investment assets into index funds, in which anything outside of the largest companies lagged. Comparing any of the 1000-stock indexes with the S&P 500 in that decade is something of an apples-to-oranges comparison. In an apples-to-apples comparison, relative to the Reference Capitalization index, the FIM indexes held a lead until the last 20 months of the decade! As the tech bubble of the late-1990s burst, the FIM indexes pull ahead by an average of **10.87%** per annum, from January 2000 through December 2003.

- In Table 6, we show the performance of the indexes in the recessionary and the expansionary phases of the business cycle as defined by the National Bureau of Economic Research (NBER). The excess returns are particularly strong in the recessionary phase of the business cycle, averaging **3.38%** per annum versus **1.32%** per annum during expansions. *Still, value was added during expansions as well as recessions*.

- In Table 7, we show the performance in bear and bull markets, where a bull market is defined simplistically (and ex post) by a 20% rally from the previous low and a bear market by 20% decline from the previous high. In Table 7, we find the Fundamental Indexes outperforming by **6.73%** per annum in bear markets versus only **0.34%** per annum in bull markets. Given the value bias of these indexes, the superior performance in bear markets is not surprising. *But, the Fundamental Indexes fully match the capitalization-weighted indexes in the typical bull market, despite the growth bias of the capitalization-weighted indexes*.

- In Table 8, we show the performance in rising interest rate and falling interest rate regimes, where a rising rate regime is defined (simplistically, and ex post) by the 10-year Treasury Note yield rising more than 20% from the previous low and a falling rate regime is defined by the Treasury Note yield falling more than 20% since the previous high. The Fundamental Indexes outperform by an average of **3.20%** per annum in falling interest rate environments versus **1.34%** per annum in rising interest rate environments.

Tables 4 through 8 are important in addressing the possibility that the excess returns of the Fundamental Indexes are driven by exposures to macroeconomic risks that are not captured fully

by the CAPM model. These exhibits suggest that weighting by the "Main Street" definitions of the size of a company is surprisingly robust, improving on the mean-variance efficiency of the ubiquitous capitalization-weighted indexes.

Table 9 compares the correlations of the Fundamental Indexes and the capitalization-weighted indexes with an array of asset class returns. The results are, for the most part, surprisingly bland: the Fundamental Indexes have largely the same correlations as we find for the capitalization-weighted indexes, with a wide assortment of asset classes. The notable exception is that the Fundamental Indexes are more strongly correlated with the Wilshire REIT index than the capitalization-weighted indexes. All correlations larger than 0.11 are statistically significant at the 90% (two-tail) level; 99% significance requires a correlation of 0.18.[xi] Accordingly, most of these correlations are highly significant.

The second panel of Table 9 goes one step further. It examines the correlation of the *value added* for the various indexes, net of the return for the Reference Capitalization index, with an array of asset classes. Here, we find differences that are more interesting, though often lacking in statistical significance. The S&P 500 would seem to outpace the Reference Capitalization index when the stock market is rising, the broad US bond market is rising (i.e., interest rates are falling), and high-yield bonds, emerging markets bonds and REITS are performing badly. The Fundamental Indexes have mostly the opposite characteristics, performing best when US and non-US stocks are falling and REITS are rising. Curiously, they mostly perform well when High Yield bonds are rising but Emerging Markets bonds are falling. Also, they tend to perform well when TIPS are rising (i.e., *real* interest rates are falling). Most of these results are unsurprising; but, apart from the S&P and REIT correlations, most are also not statistically significant.

The Intuition for Fundamental Indexes

Each of the indexes we construct contains 1000 companies. The rosters are generally similar, though not identical, to the stocks in conventional indexes like the Russell 1000. Our innovation in portfolio construction comes from the selection and weighting scheme applied. Instead of selecting and weighting the stocks in the index by capitalization, we use other metrics of firm size, such as book value of assets, income, sales, gross dividend distributions, or even total employment as the basis for both selection and weighting of the 1000 largest companies.

The two forms of indexing might can be characterized as "Wall Street indexing" and "Main Street indexing." The general public of "Main Street" does not typically think of market capitalization when considering the size of a company. For most of the population, other measures such as sales, income, employment, book value, and so forth, are the intuitive measures of the true size of a company. It is refreshing, even to us, to find Main Street indexing outperforming Wall Street indexing! Indeed, when the popular press describes mergers and other corporate actions, the size of the companies is generally described in these "Main Street" measures. The true significance of the different between these two forms of viewing the stock market may have been best stated by Ben Graham; "*In the short run, the market is a voting machine but in the long run, it is a weighing machine".*

We believe the performance of these Fundamental Indexes are largely free of data mining. Our selection of size metrics were intuitive and were not selected ex post, based upon results. We use no subjective stock selection or weighting decisions in their construction, and the portfolios are not fine-tuned in any way. Even so, we acknowledge that our research may be subject to the following – largely unavoidable – criticisms:

- we lived through the period covered by this research (1/1962-12/2003); we experienced bubble periods where cap-weighting caused severe destruction of investor wealth, contributing to our concern about the efficacy of capitalization-weighted indexation (the "nifty fifty" of 1971-72, the bubble of 1999-2000) and

- our Fundamental metrics of size, such as book value, revenues, smoothed earnings, total employment, and so forth, all implicitly introduce a value bias, amply documented as possible market inefficiencies or as priced risk factors. (Reciprocally, it can be argued that capitalization-weighted indexes have a growth bias, whereas the *Fundamental Index*es do not.)

Table 10 compares the 20 largest companies in the capitalization-weighted index with the 20 largest in the Composite Fundamental Index. With few exceptions, it would be reasonable to suggest that the stocks on these lists are intuitive and unsurprising. It is also evident that the capitalization-weighted list has a marked bias in favor of high-multiple stocks with strong *perceived* growth opportunities, relative to the composite Fundamental Index. Whether this

growth bias proves more profitable in the future we cannot say; it has not proven profitable in the past.

Few aspects of the Fundamental Indexes more starkly highlights the difference with capitalization-weighted indexes than the single largest company in the index. The largest-capitalization company, Microsoft, at a 3% weight in the Reference Capitalization index, is unequivocally an important part of today's economy – and tomorrow's. From the perspective of "Main Street," the Composite Fundamental Index suggests that Microsoft occupies seventh place, with a more modest 1% of the economy. But, for the average citizen, Wal-Mart occupies a larger share of our consumption basket (revenues), consumes more of our nation's capital stock (book value) and is more likely to be our employer (employment), than Microsoft. Accordingly, the Fundamental Indexes weight Wal-Mart as the top company in today's economy, with a 3% weight, though it ranks fourth in capitalization. "Wall Street" is making the judgment that Wal-Mart will be 20% smaller in the *future* economy than Microsoft, but Fundamental Indexing pegs Microsoft as one-third as large in the *current* economy as Wal-Mart. That's a big gap.

Figures 2A and 2B illustrate another interesting attribute of the Fundamental Indexes, the stability of the sector allocations over time. The capitalization-weighted index reacts strongly to shifting investor preferences, with a huge spike and collapse in the allocation to energy in the early 1980s and to the technology bubble and collapse from 1998-2001. By contrast, the Fundamental Indexes more closely reflect the steady evolution of the economy at large, with a gradual change in sector allocations in response to the shifting composition of the economy.

Performance Attribution

As mention before, the observed excess return of the Fundamental Indexes is consistent with the hypothesis that stock prices are inefficient, in that they are noisy relative to their true values. The incremental performance is also consistent with other explanations, not based on price inefficiency. We explore the possible reasons behind the performance of the Fundamental Indexes and show evidence supporting both views. Ultimately we remain agnostic as to the true driver of the excess return over the capitalization-weighted indexes; we simply recognize that they have outperformed significantly and with some consistency, across diverse market and

economic environments. Our research suggests little reason to believe that this pattern will not continue.[xii]

In Table 2, we saw that most of the CAPM betas and correlations exceed **0.95** for the Fundamental Indexes; the notable outlier Gross Dividend which has an average beta of **0.87**. Adjusted for beta risk, the average excess performance increases from **2.13% to 2.36%** per annum. The t-statistics are significant for all the Fundamental Indexes, approaching four for the Composite index. How do we explain these alphas? Much of this work builds on existing knowledge: alphas have been used repeatedly in the academic literature to reject (1) the S&P 500 as a good market proxy, (2) price efficiency, and (3) CAPM's single risk factor framework.

There are many theoretical reasons why the S&P500 index and other capitalization-weighted indexes do not proxy well for the "true" equity market portfolio,[xiii] so our identification of a better equity market index is unsurprising. This is a very defensible interpretation of our empirical results though it is not particularly confidence-inspiring. That said, there is no ex ante reason to believe these Fundamental Indexes are a better proxy for the "true" CAPM "market portfolio," that must include all assets that are in positive net supply (such as commodities, real estate and human capital).

As portfolio managers, we like to believe that the observed performance is alpha and is driven by price inefficiency. We understand that the assumption of price inefficiency is significantly more difficult to defend. We understand this point and do not wish to overstate our case. Many practitioners *and academics* do believe, however, that the extraordinary run-up in share valuations and the subsequent crash from 1998-2002 was a bubble; this adds support to the contention that price fluctuations sometimes do not reflect changes in firm fundamentals.

Suppose the assumption of price inefficiency is true. After all, even Fischer Black famously remarked, "The markets are far more efficient when viewed from the banks of the Charles than from the banks of the Hudson." It need not immediately suggest easy money. Suppose we merely know that some firms are overvalued while others are undervalued; there are no simple ways to trade away this idiosyncratic noise in prices, because one cannot know which stock is currently overvalued and which stock is undervalued.

However, any price deviation from "fair valuation" implies that capitalization weighting will overweight *all* currently overpriced stocks and underweight *all* undervalued ones. This overreliance on low-IRR stocks and underreliance on high-IRR stocks leads to lower risk adjusted performance relative to hypothetical fair-value-weighted strategies.[xiv] The size metrics that we explore are valuation-indifferent, and therefore will not be subject to this bias, or the corresponding performance drag in capitalization-weighted indexes. Admittedly they could introduce other potentially more costly biases; however, we find no evidence of that in the data.

The literature on stock return predictability, where price related ratios such as dividend yield and earnings yield appear to forecast next period stock returns is also consistent with our price inefficiency hypothesis.[xv,xvi] This is a stronger form of price inefficiency since the pattern of price deviation is systematic (e.g. high P/E stocks have a greater tendency to underperform), and there are obvious strategies to profit from the inefficiency.[xvii] This return predictability suggests a systematic inefficiency that can be exploited by using firms' financial ratios as trading signals. The Fundamental Indexes implicitly condition on firm financial ratios in its annual reconstitution and reweighting, that allows these indexes to benefit from the documented predictive relationships between dividend yields and earnings yield on future stock returns.

The construction of the Fundamental Indexes systematically underweights growth stocks relative to a capitalization-weighted portfolio. We would argue that a better way to state this is that the capitalization-weighted "Wall Street" indexes systematically overweight growth stocks relative to a "Main Street" Fundamental Index. A Fama-French 3 factor regression shows that the Fundamental Indexes have factor exposure to the value factor and thereby earn a value premium relative to a capitalization-weighted equity market index. We can adopt the interpretation that value premium is an anomaly and is a pure alpha due to a systematic price inefficiency.

This is not as controversial a stance as might be expected. The finance academic literature has still not reached a consensus on the source of the value premium and journals continue to publish general equilibrium models demonstrating how the Fama-French value factor could be a proxy for an underlying risk factor. There has been, however, little convincing evidence on the value factor proxying for a macroeconomic risk factor. The most popular interpretation of the value factor as a systematic distress risk factor fails to identify economy-wide distress scenarios, that

coincided with price collapses in value stocks. The finance literature on return anomalies and on systematic market inefficiencies, driven by behavioral biases, certainly lend support to the interpretation of our capturing of the value premium as pure alpha.

Note that the capitalization-weighted index underperformance is positively related to the size of the price deviation, whether that deviation is idiosyncratic or systematic.[xviii] This is illustrated powerfully in Table 5, where the capitalization-weighted market portfolio underperforms by an average of **10.87%** relative to the Fundamental Indexes in the current decade, after high tech share prices begin to revert to a level of normalcy relative to their fundamentals.

Certainly, we readily concede that the observed excess returns could also be attributed to hidden risk exposures rather than return anomalies from price inefficiency. As we mentioned before, the Fundamental Indexes underweight growth stocks relative to a capitalization-weighted index. This index characteristic may exposure the Fundamental Indexes to additional risks, such as economy-wide liquidity or distress risk when compared to a capitalization-weighted index. While the history of stock returns to which we have access does not provide support for this view (except, weakly, in the worst single month for a few of the Fundamental Indexes), it is impossible to eliminate the hidden risk factor proposition.

Whether the better mean-variance performance is driven by better market index construction, by pure alpha (perhaps driven by a structural negative alpha in capitalization-weighted portfolio) or by beta exposure to additional risk, historically these Fundamental Indexes are materially more mean-variance efficient than standard capitalization-weighted indexes. To the extent that an investor wants a more mean-variance efficient market portfolio, the data suggests that the Fundamental Indexes are superior alternatives to traditional capitalization-weighted equity market indexes.

Continuing Research

We are pursuing additional research, beyond the scope of this paper, in areas that include the following:

- This method compares more handsomely, and with greater consistency, on the "next 2000 stocks," (roughly equivalent to the Russell 2000). It does so with higher average

capitalization, broader diversification, less concentration, greater liquidity, and essentially the same turnover, when measured relative to the next 2000 capitalization-weighted stocks.

- This method should perform well outside of the US. Preliminary results in Japan are even better than in the US, with an average of **2.4%** of incremental return over the past 25 years.

- For international and global portfolios, it's noteworthy that Fundamental Indexing introduces a more stable country allocation than capitalization weighting. Just as the Fundamental Indexes smooth the movement of sector and industry allocations to mirror the evolution of each sector or industry's scale in the overall economy, a global Fundamental Indexes index will smooth the movement of country allocations, mirroring the relative size of each country's scale in the global economy. In other words, a global Fundamental Indexes index should offer the same advantages as GDP-weighted global indexing, with the same rebalancing "alpha" enjoyed by GDP-weighting. We would argue that the "alpha" from GDP-weighting in international portfolios is perhaps attributable to the elimination of the same capitalization-weighted return drag (from overweighting the overvalued countries and underweighting the undervalued countries) as we observe in the US indexes. This is the subject of some current research that we hope to publish in the coming year.

- This method outpaces most active managers, by a much greater margin and with more consistency, than conventional capitalization-weighted indexes. This need not argue against active management; it only suggests that active managers have perhaps been using the wrong "market portfolio" as a starting point, making active management "bets" relative to the wrong index. If an active management process can add value, then it should perform far better if it makes active bets against one of these Fundamental Indexes than against capitalization-weighted indexes.

- This work may reveal interesting insights into the nature of market inefficiencies. One peculiarity in our results herein may suggest an interesting path for additional research. The Fundamental Indexes sharply outpace the capitalization-weighted indexes in bear markets, but not bull markets. On the other hand, they add more value when interest rates are falling, which correspond more to bull markets than bear markets, than when interest rates are rising. The clear implication is that when stocks are rising in the face of rising interest rates,

shrugging off the rising cost of capital, Fundamental Indexes must be disappointing indeed! We might infer that these are market environments characterized by a less disciplined focus on objective fundamentals (bubbles?). But, such speculations would not be consistent with an efficient market – so we'll leave that investigation for another time!

- There may be important risk premium implications. If these simple indexes outpace the capitalization-weighted indexes by some **2.1%** per annum, then an optimally-constructed market portfolio must have a risk premium relative to bonds or cash at least **2.1%** higher than the risk premium of a capitalization-weighted index. Stocks are more attractive, at any level of risk premium, to investors in these indexes than to investors in capitalization-weighted indexes.

- We think that it is a worthy question whether the Fundamental Indexes have a "value bias" relative to the capitalization-weighted indexes or the capitalization-weighted indexes have a "growth bias" relative to the Fundamental Indexes. This is more than a mere matter of semantics. It may well be that the returns for the APT and Fama-French risk factors are driven by the *negative* return drag in the inherent capitalization-weighting overweighting of intrinsically overvalued companies (those trading above their – unknowable – true fair value) and underweighting of intrinsically undervalued companies. It would be interesting to see the impact of respecifying and size-weighting APT or Fama-French based on the Fundamental Indexes; it may make a material difference.

- Many value-oriented indexes have been created in response to concerns about the higher risk and, perhaps, lower returns of growth stocks. Most of these involve eliminating half of the stocks in the market (more or less), *and then applying capitalization weighting to the value stocks that are left.* If capitalization weighting is a source of the very problem that we're trying to address, then the existing value indexes *reintroduce that same error* after stripping out half of the market. Also, because stocks drift up or down in size and between the growth and value segments of the stock market, the turnover in these value indexes is surprisingly high. The Fundamental Indexes historically produce higher average returns with less tracking error, greater statistical significance, lower turnover, and better liquidity than the conventional value-oriented indexes. It would be interesting to better understand why the

conventional value indexes are so inferior, on a risk-adjusted basis, to these simple Fundamental Indexes.

- Most of the arguments favoring value "anomalies" center on a common theme: mean reversion. If price/earnings ratios mean-revert, if return on equity mean-reverts, if profit margins mean revert, if the return on capital mean reverts relative to the return on labor, if productivity growth rates mean revert, if earnings growth rates mean revert (Little, 1962), each of these can produce one or another of the much-studied market "anomalies." These same mean reversion tendencies will accrue to the benefit of the fundamentally-based indexes and/or to the detriment of a capitalization-weighted index. It would be useful to better understand whether mean reversion creates market inefficiencies, or asset values correctly reflect the likely impact of mean reversion in these many measures.

- We continue to seek improvements on the Fundamental Indexes described here, but keep finding ourselves straying into the use of data mining. Accordingly, we do not include any of these attempts in this article.

Conclusion

In this paper we offer a selection of fundamentally-based market portfolios whose construction method is based on selection and weighting with metrics of firm size other than capitalization weighting. These size measures include book value, revenue, dividends, and others. The resulting portfolios outperform the S&P500 by an average of **1.91%** per annum over the 42-year span tested. The performance is robust across time, across phases of the business cycle, across bear and bull stock markets, and across rising and falling interest rate regimes. We note that the excess return of the Fundamental Index portfolios over the S&P500 can arise from (1) superior market portfolio construction, (2) price inefficiency, (3) additional exposure to distress risk, or (4) a mixture of the three. We leave it to readers to choose a favorite explanation.

The mean-variance superiority of the Fundamental Indexes is robust and significant. If higher mean return and lower total return volatility are the goals of investment management and if there is reason to expect these robust historical results will continue into the future, then investment in

these Fundamental Indexation metric market indexes will be preferred to traditional capitalization-weighted market indexes.

Table 1. Return Characteristics of Alternative Indexing Metrics, 1962-2003

	Ending Value of $1	Geometric Return	Volatility	Sharpe Ratio	Excess Return vs REF CAP	Tracking Error vs REF CAP	Information Ratio	t-Stat for Excess Return
S&P 500	$ 66.72	10.52%	15.3%	0.304	0.22%	1.52%	0.14	0.93
REFERENCE CAP	$ 61.41	10.30%	15.4%	0.288	-	-	-	-
BOOK	$ 117.76	12.02%	15.0%	0.409	1.72%	3.54%	0.49	3.16
INCOME	$ 141.68	12.52%	15.1%	0.441	2.22%	3.94%	0.56	3.64
REVENUE	$ 154.64	12.75%	16.0%	0.430	2.45%	5.03%	0.49	3.16
SALES	$ 157.15	12.80%	15.9%	0.434	2.50%	4.93%	0.51	3.28
GROSS DIV	$ 114.03	11.94%	13.8%	0.440	1.64%	5.33%	0.31	1.99
EMPLOYMENT	$ 142.73	12.54%	16.2%	0.412	2.24%	6.26%	0.36	2.32
COMPOSITE	**$ 135.48**	**12.40%**	**14.8%**	**0.441**	**2.10%**	**4.29%**	**0.49**	**3.17**
Average (x-COMP)	**$ 138.00**	**12.43%**	**15.3%**	**0.428**	**2.13%**	**4.84%**	**0.44**	**2.92**
Equal Wt REF CAP	*$ 122.83*	*12.15%*	*17.3%*	*0.363*	*1.85%*	*5.39%*	*0.34*	*2.22*

Table 2. CAPM Characteristics of Alternative Indexing Metrics, 1962-2003

	Ending Value of $1	Geometric Return	Correlation vs REF CAP	CAPM Beta vs REF CAP	Excess Return vs REF CAP	CAPM Alpha vs REF CAP	Information Ratio of Alpha	t-stat for CAPM Alpha
S&P 500	$ 66.72	10.52%	100%	0.99	0.22%	0.27%	0.18	1.15
REFERENCE CAP	$ 61.41	10.30%	-	-	-	-	-	-
BOOK	$ 117.76	12.02%	97%	0.95	1.72%	1.94%	0.56	3.63
INCOME	$ 141.68	12.52%	97%	0.95	2.22%	2.45%	0.64	4.12
REVENUE	$ 154.64	12.75%	95%	0.99	2.45%	2.50%	0.50	3.23
SALES	$ 157.15	12.80%	95%	0.99	2.50%	2.56%	0.52	3.37
GROSS DIV	$ 114.03	11.94%	94%	0.84	1.64%	2.34%	0.48	3.11
EMPLOYMENT	$ 142.73	12.54%	92%	0.97	2.24%	2.38%	0.38	2.47
COMPOSITE	**$ 135.48**	**12.40%**	**96%**	**0.92**	**2.10%**	**2.43%**	**0.59**	**3.80**
Average (x-COMP)	**$ 138.00**	**12.43%**	**95%**	**0.95**	**2.13%**	**2.36%**	**0.49**	**3.21**
Equal Wt REF CAP	*$ 122.83*	*12.15%*	*95%*	*0.95*	*1.85%*	*2.06%*	*0.39*	*2.51*

Table 3. Liquidity Characteristics of Alternative Indexing Metrics, 1962-2003

	Ending Value of $1	CAP Ratio	Concentration Ratio	Weighted $ Trading Volume*	Weighted Trading Days*	Turnover	Excess Return @ 1% Trade Cost	Trade Cost for no Excess Return
REFERENCE CAP	$ 61.41	1.00	55.06%	191 MM	0.9	6.30%	-	-
BOOK	$ 117.76	0.64	51.46%	134 MM	1.5	13.20%	1.59%	12.49%
INCOME	$ 141.68	0.65	57.06%	126 MM	1.3	12.14%	2.10%	18.97%
REVENUE	$ 154.64	0.55	54.66%	105 MM	2.0	14.15%	2.30%	15.63%
SALES	$ 157.15	0.54	52.48%	99 MM	1.7	13.41%	2.35%	17.53%
GROSS DIV	$ 114.03	0.71	61.99%	110 MM	1.6	11.10%	1.54%	17.04%
EMPLOYMENT	$ 142.73	0.38	42.76%	70 MM	9.3	14.56%	2.07%	13.54%
COMPOSITE	**$ 135.48**	**0.66**	**51.76%**	**102 MM**	**1.5**	**10.55%**	**2.01%**	**24.67%**
Average (x-COMP)	**$ 138.00**	**0.58**	**53.40%**	**107 MM**	**2.9**	**13.09%**	**1.99%**	**15.87%**
Equal Wt REF CAP	*$ 122.83*	*0.14*	*10.00%*	*39 MM*	*2.5*	*20.66%*	*1.81%*	*7.30%*

Table 4. Outlier Risks of Alternative Indexing Metrics, 1962-2003

	skewness	excess kurtosis	maximum monthly return	minimum monthly return	maximum 3-month return	minimum 3-month return	maximum trail 12mo return	minimum trail 12mo return
S&P500	(0.32)	1.72	17.0%	-21.7%	27.1%	-29.7%	61.6%	-39.0%
REFERENCE CAP	(0.36)	1.63	17.5%	-21.3%	27.0%	-28.8%	62.4%	-41.0%
BOOK	(0.29)	1.87	17.9%	-21.3%	27.2%	-28.3%	62.8%	-32.9%
INCOME	(0.29)	1.93	18.4%	-21.0%	28.0%	-28.7%	64.6%	-34.3%
REVENUE	(0.33)	2.29	21.3%	-23.3%	33.1%	-30.7%	72.9%	-33.9%
SALES	(0.33)	2.30	21.2%	-23.3%	33.1%	-30.7%	72.8%	-33.9%
GROSS DIV	(0.22)	1.92	17.8%	-19.1%	25.8%	-26.3%	58.8%	-32.7%
EMPLOYMENT	(0.33)	2.39	18.9%	-24.3%	29.2%	-30.6%	75.7%	-30.8%
COMPOSITE	**(0.29)**	**2.03**	**18.7%**	**-21.1%**	**27.5%**	**-28.4%**	**64.5%**	**-33.5%**
Average (x-COMP)	**(0.30)**	**2.12**	**19.3%**	**-22.1%**	**29.4%**	**-29.2%**	**67.9%**	**-33.1%**

Figure 1A. Growth of $1, Various Indexation Metrics, 1962-2003

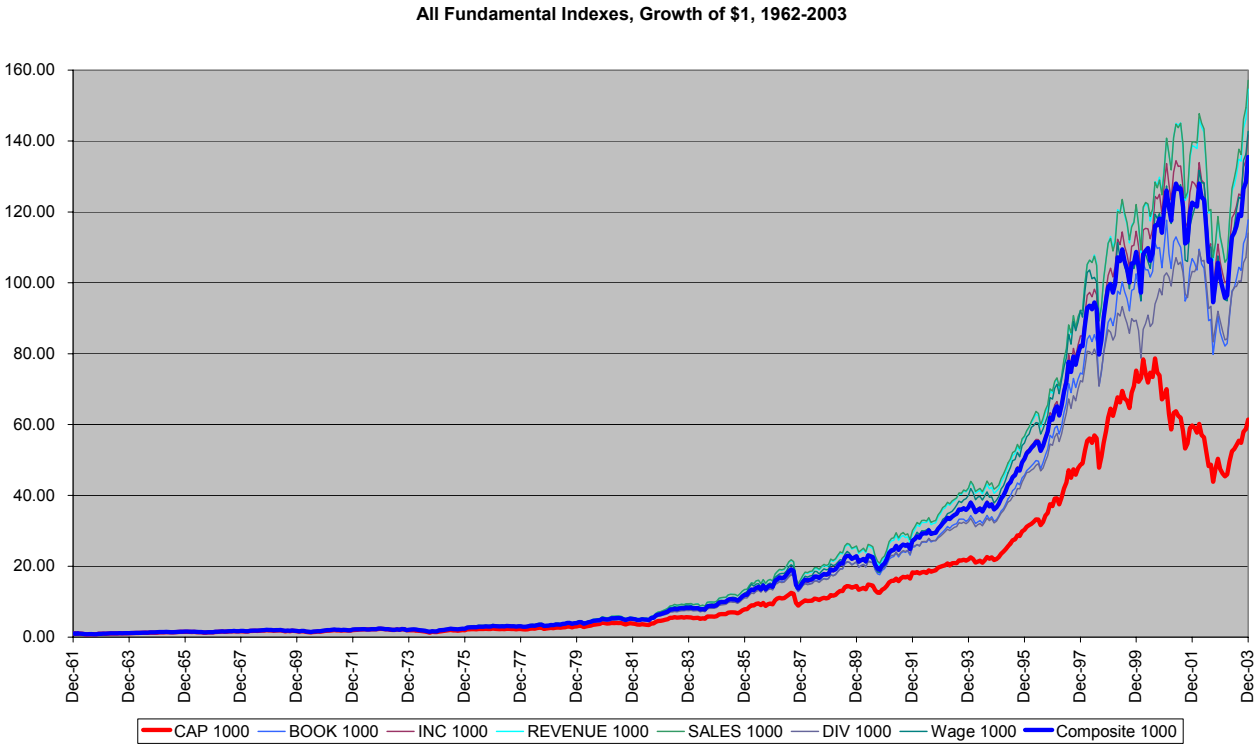


Figure 1B. Value-Added versus Reference Capitalization Portfolio, 1962-2003

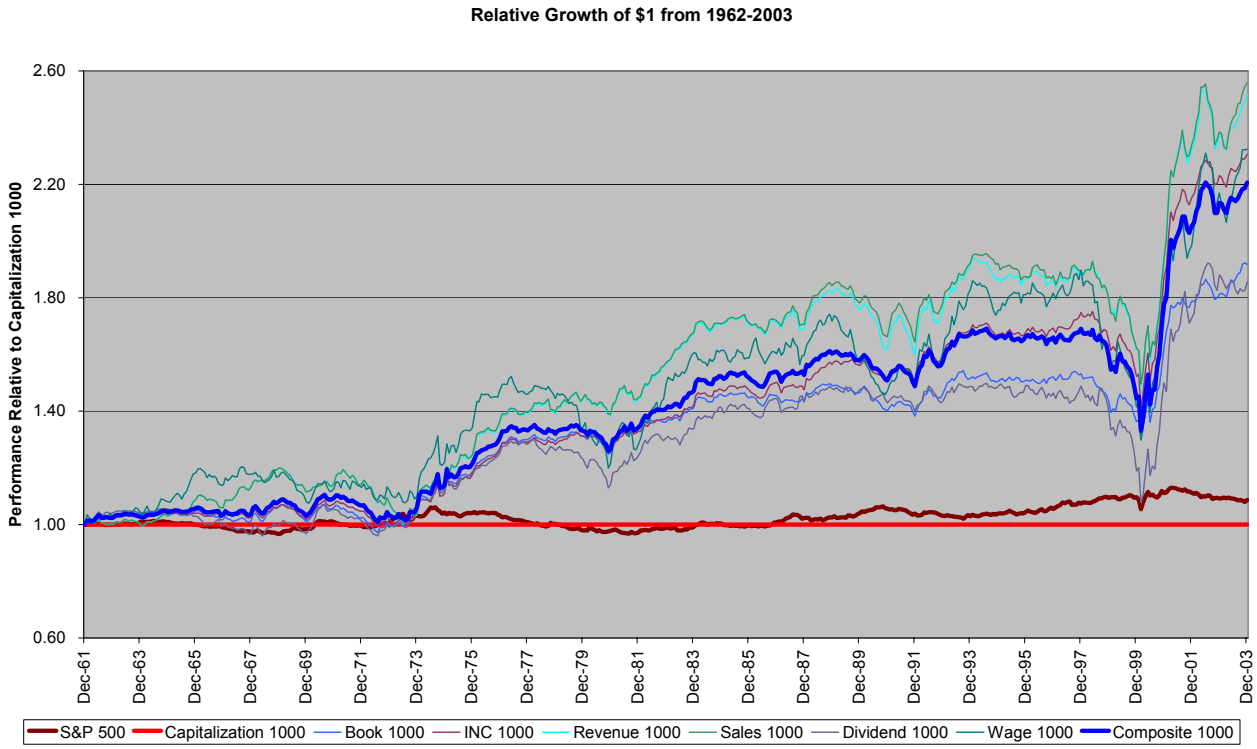


Table 5. Return Characteristics of Alternative Indexing Metrics, by Decade, 1962-2003

Panel A. Geometric Return

Geometric Return	1/62 - 12/69	1/70-12/79	1/80-12/89	1/90-12/99	1/00-12/03
S&P500	6.58%	5.86%	17.71%	18.57%	-5.17%
REFERENCE CAP	6.80%	5.90%	17.00%	17.94%	-4.95%
BOOK	6.94%	8.72%	18.29%	17.09%	3.52%
INCOME	7.04%	8.64%	19.04%	17.65%	5.46%
REVENUE	8.26%	8.67%	19.32%	16.99%	6.16%
SALES	8.26%	8.70%	19.47%	16.84%	6.52%
GROSS DIV	6.37%	8.48%	19.15%	15.42%	6.25%
EMPLOYMENT	7.85%	8.23%	18.83%	16.73%	7.61%
COMPOSITE	**7.21%**	**8.65%**	**19.02%**	**16.89%**	**5.65%**
Average (x-COMP)	**7.45%**	**8.57%**	**19.02%**	**16.79%**	**5.92%**

Panel B. Value Added Relative to Reference Capitalization

Excess Return	1/62 - 12/69	1/70-12/79	1/80-12/89	1/90-12/99	1/00-12/03
S&P500	-0.22%	-0.05%	0.71%	0.63%	-0.22%
REFERENCE CAP	-	-	-	-	-
BOOK	0.13%	2.81%	1.29%	-0.85%	8.46%
INCOME	0.23%	2.73%	2.04%	-0.29%	10.41%
REVENUE	1.46%	2.77%	2.32%	-0.95%	11.11%
SALES	1.46%	2.79%	2.47%	-1.10%	11.46%
GROSS DIV	-0.44%	2.57%	2.15%	-2.52%	11.20%
EMPLOYMENT	1.05%	2.32%	1.83%	-1.22%	12.56%
COMPOSITE	**0.41%**	**2.74%**	**2.02%**	**-1.05%**	**10.60%**
Average (x-COMP)	**0.65%**	**2.67%**	**2.02%**	**-1.15%**	**10.87%**

Panel C. Annualized Standard Deviation of Returns

Standard Deviation	1/62 - 12/69	1/70-12/79	1/80-12/89	1/90-12/99	1/00-12/03
S&P500	12.38%	16.11%	16.56%	13.55%	17.98%
REFERENCE CAP	12.61%	16.62%	16.40%	13.46%	18.07%
BOOK	12.40%	16.58%	15.61%	13.22%	18.18%
INCOME	12.27%	16.55%	15.81%	13.52%	17.63%
REVENUE	13.38%	18.23%	16.59%	13.96%	18.22%
SALES	13.38%	18.21%	16.60%	13.64%	18.15%
GROSS DIV	11.80%	15.47%	14.45%	11.95%	15.27%
EMPLOYMENT	13.56%	17.14%	17.19%	14.67%	19.29%
COMPOSITE	**12.36%**	**16.54%**	**15.53%**	**12.96%**	**17.00%**
Average (x-COMP)	**12.80%**	**17.03%**	**16.04%**	**13.49%**	**17.79%**

Panel D. Sharpe Ratios

Sharpe Ratio	1/62 - 12/69	1/70-12/79	1/80-12/89	1/90-12/99	1/00-12/03
S&P500	0.19	(0.03)	0.53	1.01	(0.46)
REFERENCE CAP	0.20	(0.03)	0.49	0.97	(0.44)
BOOK	0.22	0.14	0.60	0.93	0.03
INCOME	0.23	0.14	0.64	0.95	0.14
REVENUE	0.30	0.13	0.63	0.87	0.17
SALES	0.30	0.13	0.64	0.88	0.19
GROSS DIV	0.18	0.14	0.71	0.89	0.21
EMPLOYMENT	0.26	0.11	0.58	0.81	0.24
COMPOSITE	**0.24**	**0.14**	**0.65**	**0.93**	**0.15**
Average (x-COMP)	**0.25**	**0.13**	**0.63**	**0.89**	**0.16**

Table 6. Return Characteristics of Alternative Indexing Metrics, in NBER Business Cycles, 1962-2003

	EXPANSIONS			RECESSIONS		
	Geometric Return	Volatility	Sharpe Ratio	Geometric Return	Volatility	Sharpe Ratio
S&P500	11.77%	14.33%	0.44	3.17%	20.26%	(0.25)
REFERENCE CAP	11.64%	14.32%	0.43	2.48%	20.81%	(0.28)
BOOK	13.12%	14.11%	0.51	5.53%	20.11%	(0.13)
INCOME	13.52%	14.17%	0.55	6.56%	20.04%	(0.08)
REVENUE	13.72%	14.96%	0.54	7.05%	21.75%	(0.05)
SALES	13.73%	14.90%	0.53	7.26%	21.63%	(0.04)
GROSS DIV	12.63%	12.96%	0.53	7.75%	18.41%	(0.03)
EMPLOYMENT	13.57%	15.40%	0.52	6.45%	20.65%	(0.09)
COMPOSITE	**13.32%**	**13.91%**	**0.53**	**6.91%**	**19.83%**	**(0.07)**
Average (x-COMP)	**13.38%**	**14.42%**	**0.53**	**6.76%**	**20.43%**	**(0.07)**

Table 7. Return Characteristics of Alternative Indexing Metrics, in Bull and Bear Markets over 20%, 1962-2003

	BULL MARKETS			BEAR MARKETS		
	Geometric Return	Volatility	Sharpe Ratio	Geometric Return	Volatility	Sharpe Ratio
S&P500	21.11%	14.00%	1.11	-23.99%	17.73%	(1.76)
REFERENCE CAP	21.16%	13.93%	1.12	-24.86%	18.31%	(1.75)
BOOK	21.36%	13.90%	1.14	-19.27%	17.47%	(1.51)
INCOME	21.78%	14.04%	1.16	-18.59%	17.15%	(1.50)
REVENUE	22.37%	14.87%	1.13	-19.33%	18.55%	(1.43)
SALES	22.41%	14.78%	1.14	-19.27%	18.50%	(1.43)
GROSS DIV	19.81%	13.01%	1.10	-15.25%	15.31%	(1.47)
EMPLOYMENT	21.26%	15.21%	1.03	-17.07%	18.39%	(1.32)
COMPOSITE	**21.34%**	**13.83%**	**1.14**	**-17.82%**	**16.86%**	**(1.48)**
Average (x-COMP)	**21.50%**	**14.30%**	**1.12**	**-18.13%**	**17.56%**	**(1.44)**

Table 8. Return Characteristics of Alternative Indexing Metrics, in Rising and Falling 10-Year T-Note Yield, Moves larger than 20%, 1962-2003

	FALLING RATES			RISING RATES		
	Geometric Return	Volatility	Sharpe Ratio	Geometric Return	Volatility	Sharpe Ratio
S&P500	14.49%	16.96%	0.52	7.51%	14.13%	0.11
REFERENCE CAP	14.34%	16.85%	0.51	7.24%	14.41%	0.09
BOOK	16.81%	16.58%	0.67	8.41%	14.11%	0.17
INCOME	17.90%	16.71%	0.73	8.47%	14.06%	0.18
REVENUE	17.74%	17.32%	0.69	9.00%	15.34%	0.20
SALES	17.54%	17.17%	0.69	9.21%	15.33%	0.21
GROSS DIV	17.97%	15.15%	0.81	7.43%	13.00%	0.11
EMPLOYMENT	17.27%	17.89%	0.64	8.97%	15.11%	0.20
COMPOSITE	**17.71%**	**16.26%**	**0.74**	**8.40%**	**13.98%**	**0.17**
Average (x-COMP)	**17.54%**	**16.80%**	**0.70**	**8.58%**	**14.49%**	**0.18**

Table 9. Correlations with Major Asset Classes, 1988-2003

Correlation of Index Returns	S&P 500 Index	Hedged EAFE Index	Wilshire REIT Index	Lehman Aggregate US Bond Index	Lehman US TIPS*	Merrill US High Yield B-BB Index	JP Morgan Unhedged Non-US Bonds	JP Morgan Emerging Markets Bonds	Dow Jones AIG Commodity Index
S&P500	1.00	0.54	0.30	0.20	(0.22)	0.49	0.01	0.54	(0.05)
REFERENCE CAP	0.99	0.54	0.31	0.19	(0.22)	0.51	0.01	0.55	(0.04)
BOOK	0.96	0.52	0.41	0.19	(0.18)	0.52	(0.01)	0.54	(0.01)
INCOME	0.95	0.51	0.42	0.21	(0.16)	0.53	(0.02)	0.55	(0.03)
REVENUE	0.92	0.50	0.46	0.17	(0.15)	0.56	(0.04)	0.52	(0.03)
SALES	0.92	0.51	0.46	0.16	(0.15)	0.56	(0.03)	0.52	(0.02)
GROSS DIV	0.90	0.45	0.42	0.25	(0.13)	0.48	0.03	0.50	(0.03)
# EMPLOYEES	0.88	0.49	0.46	0.15	(0.15)	0.53	(0.05)	0.52	(0.01)
COMPOSITE	**0.94**	**0.50**	**0.43**	**0.21**	**(0.16)**	**0.52**	**(0.01)**	**0.53**	**(0.02)**
Average (x-COMP)	**0.92**	**0.50**	**0.44**	**0.19**	**(0.15)**	**0.53**	**(0.02)**	**0.53**	**(0.02)**

Correlation of Index VA over Reference Cap	S&P 500 Index	Hedged EAFE Index	Wilshire REIT Index	Lehman Aggregate US Bond Index	Lehman US TIPS*	Merrill US High Yield B-BB Index	JP Morgan Unhedged Non-US Bonds	JP Morgan Emerging Markets Bonds	Dow Jones AIG Commodity Index
S&P500	0.12	0.01	(0.08)	0.09	0.03	(0.11)	0.05	(0.06)	(0.07)
REFERENCE CAP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BOOK	(0.17)	(0.12)	0.32	(0.03)	0.12	0.00	(0.06)	(0.05)	0.09
INCOME	(0.17)	(0.13)	0.28	0.02	0.16	0.02	(0.06)	(0.03)	0.04
REVENUE	(0.14)	(0.08)	0.36	(0.05)	0.15	0.12	(0.11)	(0.07)	0.03
SALES	(0.17)	(0.08)	0.37	(0.08)	0.15	0.10	(0.09)	(0.09)	0.05
GROSS DIV	(0.44)	(0.31)	0.10	0.05	0.19	(0.20)	0.03	(0.23)	0.03
# EMPLOYEES	(0.09)	(0.03)	0.36	(0.06)	0.11	0.11	(0.11)	0.02	0.06
COMPOSITE	**(0.28)**	**(0.19)**	**0.25**	**0.00**	**0.16**	**(0.05)**	**(0.04)**	**(0.13)**	**0.04**
Average (x-COMP)	**(0.20)**	**(0.12)**	**0.30**	**(0.02)**	**0.15**	**0.03**	**(0.07)**	**(0.08)**	**0.05**

*** - From February, 1997. US TIPS did not previously exist.**

Table 10. Largest by Capitalization and by Fundamental Composite, 12/31/2003

20 Largest by Capitalization

MICROSOFT CORP	3.061%
GENERAL ELECTRIC CO	2.682%
EXXON MOBIL CORP	2.586%
WAL-MART STORES	2.452%
PFIZER INC	2.081%
CITIGROUP INC	1.999%
JOHNSON & JOHNSON	1.761%
AMERICAN INTERNATIONAL GROUP	1.668%
INTL BUSINESS MACHINES CORP	1.475%
MERCK & CO	1.404%
PROCTER & GAMBLE CO	1.235%
BERKSHIRE HATHAWAY -CL A	1.234%
COCA-COLA CO	1.197%
VERIZON COMMUNICATIONS	1.174%
BANK OF AMERICA CORP	1.153%
INTEL CORP	1.131%
CISCO SYSTEMS INC	1.057%
SBC COMMUNICATIONS INC	0.994%
PHILIP MORRIS COS -PRE FASB	0.913%
WELLS FARGO & CO	0.873%

20 Largest by Fundamental Composite

WAL-MART STORES	3.078%
GENERAL MOTORS CORP	2.436%
EXXON MOBIL CORP	2.080%
GENERAL ELECTRIC CO	1.867%
AMERICAN INTERNATIONAL GROUP	1.839%
CITIGROUP INC	1.733%
MICROSOFT CORP	1.170%
WELLS FARGO & CO	1.134%
SBC COMMUNICATIONS INC	1.095%
FEDERAL NATIONAL MORTGAGE ASSN	1.052%
CHEVRONTEXACO CORP	0.987%
VERIZON COMMUNICATIONS	0.977%
FORD MOTOR CO	0.962%
BERKSHIRE HATHAWAY -CL A	0.941%
J P MORGAN CHASE & CO	0.860%
PFIZER INC	0.809%
INTL BUSINESS MACHINES CORP	0.801%
MERRILL LYNCH & CO	0.780%
METLIFE INC	0.752%
MERCK & CO	0.739%

Figure 2A. Sector Weightings, Reference Capitalization Index
(12-month centered moving average, 1962-2003)

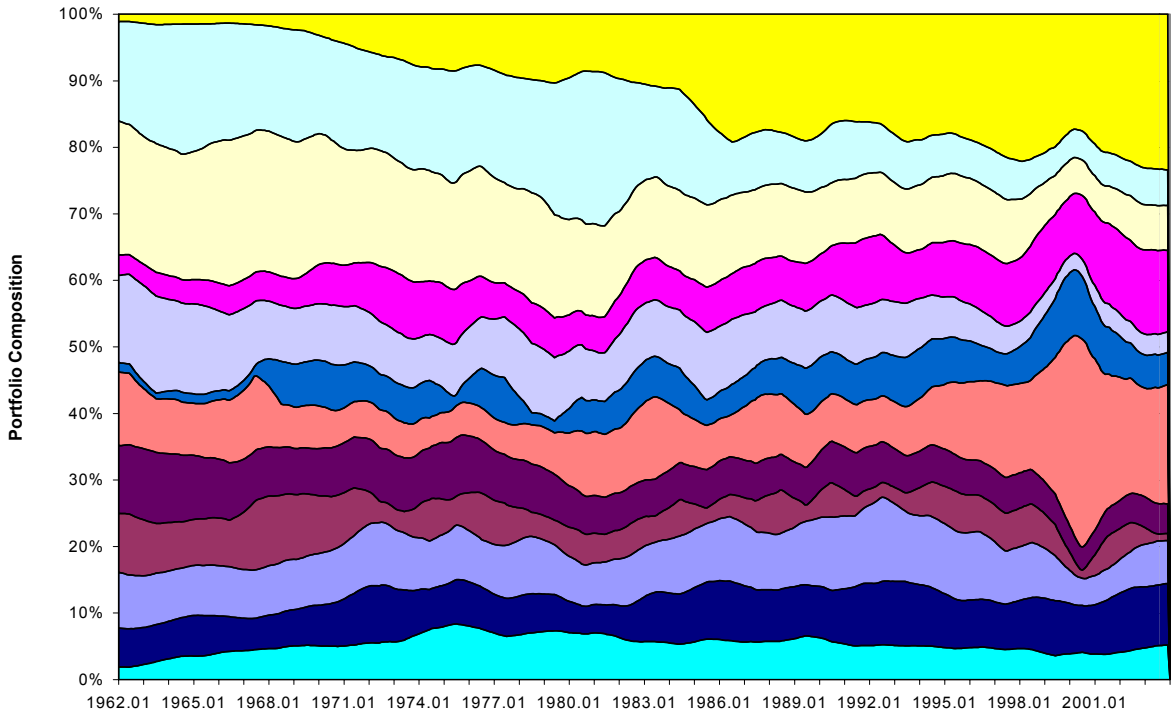
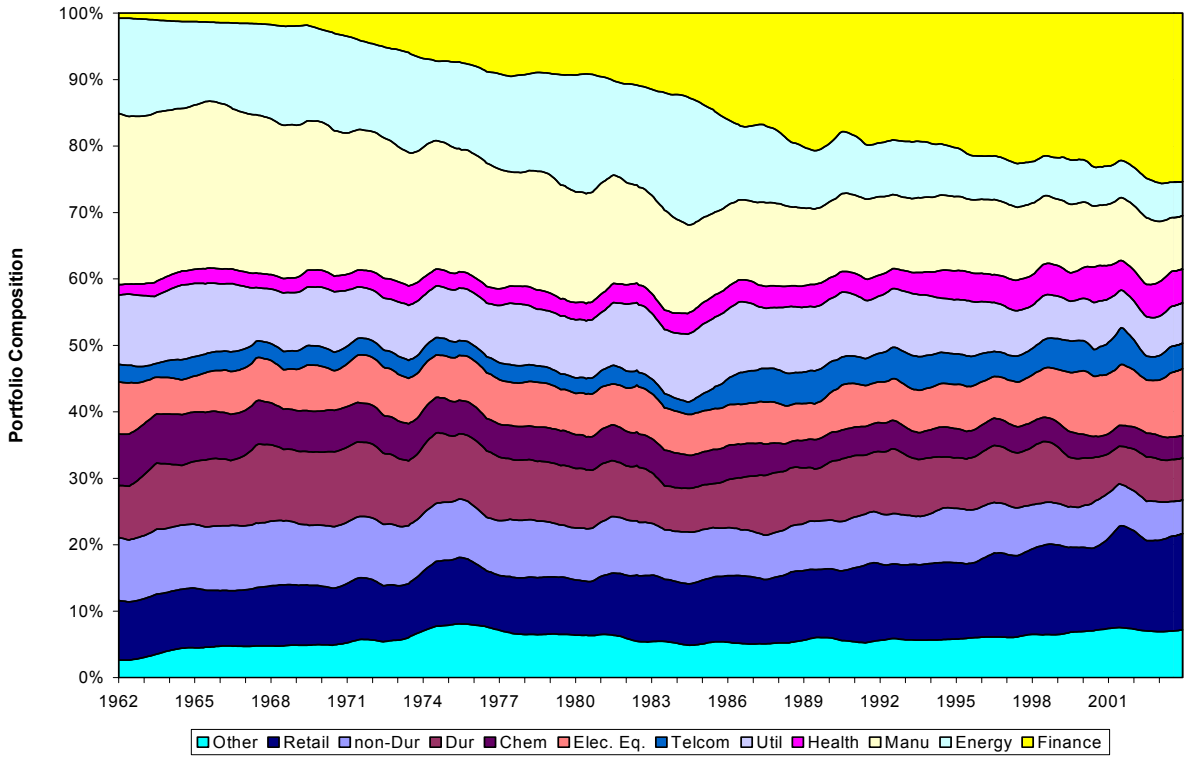


Figure 2B. Sector Weightings, Composite FIM Index
(12-month centered moving average, 1962-2003)



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[i] A patent is currently pending for the construction and management of indexes based on objective non-capitalization measures of company size. Please contact Research Affiliates, LLC, before using these ideas for index construction or for portfolio management.

[ii] We are indebted to George Keane who, as a member of the Investment Advisory Committee of the New York State Common Retirement Fund, became concerned early in 2000 with the valuation of the S&P 500 index used by the Fund for the majority of its domestic equity exposure. He later prepared a paper detailing several serious problems with the structure and management of the S&P 500 index, and proposed the development of better approaches to indexing. Subsequent discussions with George and with Marty Leibowitz, also a member of the NYCRF Investment Advisory Committee, focusing on finding better ways to manage passive portfolios, sowed the seeds for the research presented in this paper. We also appreciate the valued feedback and suggestions of Peter Bernstein, Burton Malkiel and Harry Markowitz, with additional help from Cliff Asness, Michael Brennan, Bob Greer, Phil Halpern, Bing Han, Max Moroz, Marlo Oaks, Richard Roll, Glenn Swartz, Jack Treynor, and Ashley Wang. The anonymous referees also had some very useful suggestions on content and structure.

[iii] Mayers (1976) is the first paper to point out that the CAPM market portfolio should include all assets in positive net supply and therefore the equity market portfolio cannot be a reasonable proxy for it. Traditional CAPM tests using the a capitalization weighted equity market portfolio have found the CAPM relationship to not hold, which represents either a rejection of the equity market portfolio as the CAPM portfolio or a rejection of the mean-variance optimality of individual's portfolio. Stambough (1986) extends on Mayers's idea and tests the CAPM model using a market portfolio that includes non-equity asset classes with improved success over traditional CAPM tests.

[iv] Roll and Ross (1994) state "*…it is well known that a positive and exact cross-sectional relation between ex ante expected returns and betas must hold if the market index against which betas are computed lies on the positively sloped segment of the mean-variance efficient frontier. Not finding a positive cross-sectional relation suggests that the index proxies used in empirical testing are not ex ante mean-variance efficient*." See Roll (1974), Ross (1974) and Roll and Ross (1994) for excellent reviews on this topic. Papers that reject the efficiency for various capitalization-weighted market indexes include Ross(1980), Gibbons (1982), Jobson and Korkie (1982), Shanken (1985), Kandel and Stambaugh (1987), Gibbons, Ross and Shanken (1989), Zhou (1991) and MacKinlay and Richardson (1991).

[v] Roll and Ross (1994) suggest that the standard capitalization-weighted market indexes may be located within 22 basis points below the true market index in the mean-variance space.

[vi] It's well worth noting that turnover is surprisingly high on the most widely used "passive" indexes. For example, the widely respected Frank Russell Company makes available annual 'index portfolio turnover', defined as "the percentage of an index fund that must be 'traded out' at reconstitution to maintain an exact replication of the index in the Russell 1000, which represents 92% of all domestic equity market value, has averaged 9.2% per year during the period 1983-2000. The Russell 3000, which represents 98% of all domestic market value, has averaged 9.0%.

[vii] We are indebted to Burton Malkiel for suggesting that we test this measure of company size.

[viii] These companies tend either to be fast-growing enough for shareholders to accept a policy of 100% earnings retention, or to be struggling enough to have cancelled the dividend and to be marked down in price as a consequence. See Robert D. Arnott, "What Hath MPT Wrought: What Risks Reap Rewards," Selected Topics in Investment Management, Institutional Investor, 1988.

[ix] The Russell indexes are weighted by float, not aggregate capitalization, and are rebalanced annually at mid-year.

[x] The information ratio is a ratio of the value-added, divided by the standard deviation in value-added (or the "tracking error").

[xi] Because of a more limited history, the required correlations for the TIPS correlations are 0.18 for 90% significance and 0.29 for 99% significance.

[xii] For example, the capitalization ratios of the AIM indexes are currently well within normal ranges, suggesting that the excess return is not merely a function of a 42-year revaluation of the Fundamental Indexing metrics.

[xiii] The CAPM market portfolio theoretically should be a portfolio that includes all assets in positive net supply including all financial instruments backed by physical assets as well as non-traded capital assets such as human capital. That means the true market portfolio should include (at least) U.S. and international stocks plus corporate bonds, commodities, real estates as well as human capital. This means that a globally diversified all-asset portfolio would be closer to being mean-variance efficient than a diversified stock portfolio. The word 'market' in 'CAPM market portfolio' is much more than the US stock market.

[xiv] Marty Leibowitz has referred to this as "underperformance relative to a 'true-value-weighted index'," which, of course, we cannot identify!

[xv] See Blume (1980), Campbell and Shiller (1988), Fama (1990), Chen, Grundy and Stambaugh (1990), Fama (1992), Hodrick (1992), Campbell (1992), Goetzmann and Jorion (1993), Goetzmann and Jorion (1995), Fama and French (1995), Lamont (1998), Barberis (2000), Arnott and Assness (2003).

[xvi] See Cochrane (1999) for an excellent review on return predictability.

[xvii] See Bansal, Dahlquist and Harvey (2004) for a trading strategy based on the literature of return predictability to enhance buy-and-hold portfolio returns.

[xviii] See Hsu (2004, Research Affiliates Internal Research Memo).