

What Makes the Fundamental Index[®] Methodology Work?

White paper presented by



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INTRODUCTION

The concept of equity indexing based on accounting measures of company size has caught on dramatically since the 2005 publication of “Fundamental Indexation” by Arnott, Hsu, and Moore.¹ Today, in addition to the Research Affiliates Fundamental Index (RAFI®) methodology, a number of other products use the idea outlined in the paper. Their common element is the use of economic measures of size rather than market capitalization to weight the securities in an index. Beyond that, however, the available alternatives vary widely with respect to design attributes such as selection criteria, rebalancing frequency, and the number of metrics employed. We explore the differences in this paper.

Among the possible designs, we argue that an optimal one should satisfy the following principles:

- Be uncorrelated to the over - or underpricing of the securities;
- Capture the economic size of each constituent company;
- Serve as a proxy for investability of the security; and
- Have lower turnover.

This paper identifies five key index design elements of the Fundamental Index methodology and examines differences among competing designs through the prism of these principles. The five key elements are: (1) stock selection, (2) rebalancing frequency, (3) number of years used to create the weighting metrics, (4) number of metrics used, and (5) rebalancing date.

To determine the fundamental size of a company, we use the methodology described in Arnott, Hsu, and Moore (2005). Four measures of accounting size are used: cash flows, book value, sales, and dividends. With the exception of book value, we use averages of the past five years of accounting data to reduce the level of turnover. The strategy is rebalanced annually.

STOCK SELECTION PROCESS

Of all the design variations studied, the stock selection process has the greatest impact on performance. Some strategies, including the Fundamental Index approach, select securities based on their fundamental size. Others, however, initially select securities based on market capitalization and then re-weight them using fundamental values. By using market capitalization to determine which constituents are in the universe, these strategies may fail to sever the link between price and weight, violating the first of the principles we outlined above.

In comparison, the Fundamental Index design selects as well as weights companies using fundamental measures of size. This selection rule provides a significant source of the Fundamental Index methodology's potential added value.

To illustrate how a link with price affects the selection decision, we compare the composition of two indices before, during, and after the tech bubble burst. As **Table 1** shows, in January 1998, before the bubble peaked, a simulated Fundamental Index strategy of 1,000 U.S. stocks had fewer tech companies than its cap-weighted counterpart (92 and 123, respectively). In just two years, the number of

technology companies nearly doubled in the cap-weighted index to 223 while edging up only to 100 in the Fundamental Index strategy. In contrast, when tech stock prices were cheap following the 2000-2002 bursting of the bubble, the Fundamental Index methodology increased the number of technology companies in its index while the cap-weighted index lowered its total number of tech company constituents.

To validate the conjecture that capitalization and fundamental value approaches select securities with different return characteristics, we compare the results of securities in three distinct groups:

- Group A: Selected by Market Cap but not by Fundamental Value
- Group B: Selected by Market Cap and Fundamental Value
- Group C: Selected by Fundamental Value but not by Market Cap

As **Table 2** shows, the performance of stocks in Group C is significantly higher than those in Group B. This difference in returns illustrates the importance of the selection criteria.

To measure the magnitude of the selection effect in the actual strategies, we compare five Fundamental Index strategies with cap-weighted indices that have been re-weighted in a simulation.² The results in

TABLE 1. TECHNOLOGY HOLDINGS OF FUNDAMENTAL INDEX AND CAP-WEIGHTED INDEX		
DATE	NUMBER OF TECHNOLOGY COMPANIES PRESENT	
	TOP 1,000 SELECTED BY CAPITALIZATION	TOP 1,000 SELECTED BY FUNDAMENTAL VALUE
1/1/1998	123	92
1/1/2000	223	100
1/1/2003	182	122

Note: We used Compustat and CRSP to compute the number of stocks in the two strategies.

TABLE 2. PERFORMANCE RESULTS FOR FUNDAMENTALLY WEIGHTED INDICES WITH DIFFERENT PROCESSES FOR SECURITY SELECTION (ANNUALIZED RETURN)					
	FUNDAMENTALLY RE-WEIGHTED INDICES WHERE SECURITIES ARE:				
	SELECTED BY CAPITALIZATION BUT NOT BY FUNDAMENTAL VALUE (A)		SELECTED BY CAPITALIZATION AND FUNDAMENTAL VALUE (B)		SELECTED BY FUNDAMENTAL VALUE BUT NOT BY CAPITALIZATION (C)
United States	10.17%	<	11.04%	<	15.96%
Global	8.95%	<	12.32%	<	19.28%

Note: U.S. simulation is for the period 1962-2010. Global simulation is for the period 1984-2010. For the period 1962-1983, we used Compustat and CRSP. For the period 1984-2010, we used Worldscope and Datastream. For simulated RAFI, we selected the top 85% of companies based on their fundamental value. For re-weighted indices, we selected the top 85% of companies based on the market capitalization. In the period 1962-1983, the top 85% were selected only from the pool of U.S. securities. For the period 1984-2010, the top 85% were selected from the pool of traded securities in all markets.

What Makes the Fundamental Index® Methodology Work?

Table 3 show that the selection effect ranges between 55 and 570 bps per year, with greater outperformance in the less efficient markets.

As one might expect, the ratio of value added by selection to value added by weighting remains relatively constant across markets. The added value from selection alone, which ranges from approximately 18% to 50% across markets, is statistically significant and persistent over time. Similar results were obtained by simulating performance in developed countries; the Fundamental Index methodology outperformed the re-weighted approach in 20 out of 23 developed countries. In this developed countries simulation, we observe strong evidence that approximately one-quarter to one-third of Fundamental Index value added is associated with the selection rules.

TABLE 3. SIMULATED FUNDAMENTAL INDEX PERFORMANCE COMPARISON						
	ANNUALIZED RETURN	SELECTION EFFECT	T-STATISTIC OF SELECTION EFFECT	PERCENTAGE OF VALUE ADDED DUE TO SELECTION	PERCENT THREE-YEAR FUNDAMENTAL INDEX OUTPERFORMS RE-WEIGHT	START DATE
Fundamental Index US 1000	11.8%	0.77%	3.05	32.51%	69.4%	1962
US Large Re-weight	11.0%					
S&P 500	9.4%					
Fundamental Index Global Dev 1000	12.8%	0.55%	2.87	17.62%	77.9%	1984
Global Dev Large Re-weight	12.2%					
MSCI World Dev Large Cap	9.7%					
Fundamental Index Dev x US 1000	13.5%	0.77%	3.83	22.14%	94.8%	1984
Dev x US Large Re-weight	12.7%					
MSCI EAFE	10.0%					
Fundamental Index All World 3000	11.2%	1.29%	3.71	26.10%	100.0%	1996
All World Large Re-weight	9.9%					
MSCI AC World	6.3%					
Fundamental Index EM 400	20.5%	5.70%	2.89	49.66%	99.3%	1996
EM Large Re-weight	14.8%					
MSCI EM	9.0%					

Note: U.S. simulation is for the period 1962–2010. Global simulation is for the period 1984–2010. For the period 1962–1983 we used Compustat and CRSP. For the period 1984–2010 we used Worldscope and Datastream. Reweighted indices are constructed by applying the RAFI methodology to the top 85% of companies selected by market capitalization. In the period 1962–1983, the top 85% by market capitalization were selected only from the pool of U.S. securities. For the period 1984–2010, the top 85% by market capitalization were selected from the pool of traded securities in all markets.

Source: Research Affiliates, LLC.

FREQUENCY OF REBALANCING

Some of the index approaches in our study rebalance more frequently than others. Our research shows that a higher rebalancing frequency hurts performance; this underperformance is likely due to contra-trading against the intra-year momentum effects. Additionally, rebalancing more often leads to higher turnover, which likely increases implementation costs. To measure the impact of alternative rebalancing rules on performance and turnover, we create portfolios rebalanced at annual, semi-annual, quarterly, and monthly frequencies. As **Table 4** shows, higher rebalancing frequencies decrease performance and increase turnover for both U.S. and global Fundamental Index portfolios. Similar results were observed in 23 developed countries.³ Moreover, combining re-weighting and more frequent rebalancing compounds the underperformance and further increases turnover.⁴

TABLE 4. HIGHER FREQUENCY OF REBALANCING EFFECT ON PERFORMANCE AND TURNOVER

REBALANCING FREQUENCY	FUNDAMENTAL INDEX US LARGE				FUNDAMENTAL INDEX GLOBAL LARGE			
	ANNUALIZED RETURN	ANNUALIZED VOLATILITY	SHARPE RATIOS	TURNOVER	ANNUALIZED RETURN	ANNUALIZED VOLATILITY	SHARPE RATIOS	TURNOVER
Monthly	11.6%	15.6%	0.40	35.6%	12.7%	15.8%	0.52	39.6%
Quarterly	11.5%	15.5%	0.40	21.0%	12.7%	15.6%	0.53	23.8%
Semi-annually	11.5%	15.4%	0.40	15.3%	12.6%	15.4%	0.53	17.2%
Annually	11.8%	15.4%	0.42	11.2%	12.8%	15.3%	0.55	13.0%

Note: U.S. simulation is for the period 1962–2010. Global simulation is for the period 1984–2010. For the period 1962–1983 we used Compustat and CRSP. For the period 1984–2010 we used Worldscope and Datastream.

Source: Research Affiliates, LLC.

NUMBER OF YEARS USED TO CALCULATE METRICS

The amount of data used to calculate the fundamental weights also affects performance. The Fundamental Index approach uses five years of data for sales, cash flows, and dividends plus the current book value to compute fundamental value. Other strategies use fewer years of data to calculate their fundamental values. Our study shows that averaging fundamentals over shorter periods of time results in less stable weights that can be correlated with prices. Recent data often are extrapolated into the future, resulting in over- or undervaluation of securities. The shorter the period used for computation of fundamental weights, the stronger the link between market pricing mistakes and security weights.

To illustrate the link between current data and price, we examine the composition of a hypothetical fundamentally weighted index that uses the most recent year of cash flows as a weighting metric, and thus is more subject to market errors. In particular, let us examine the portfolio allocation to financials during the global financial crisis. **Table 5** summarizes the portfolio allocation to the financial industry in 2008, 2009, and 2010. Year 2007 was quite favorable for financials and, therefore, the financial industry had a 23% allocation in 2008. Unfortunately, the performance of financials was poor in 2008, so the 2009 allocation dropped to 15% because of much lower 2008 cash flows. In 2009, fi-

What Makes the Fundamental Index® Methodology Work?

financial stocks significantly outperformed the market, but our hypothetical index missed the opportunity because of the lower allocation to financials. Had the weight of financials stayed more stable, the index performance would have been higher.

Shorter periods also tend to increase turnover and thus hurt performance. **Table 6** displays comparative return, volatility, Sharpe ratio, and turnover statistics for indices based upon one to five years of factor data. Turnover increases monotonically as we shorten the averaging period. When we look at the 23 developed markets, we see a similar result.⁵

TABLE 5. RE-WEIGHTING AND SEMI-ANNUAL REBALANCING COMBINED EFFECT

	US LARGE			GLOBAL		
	FUNDAMENTAL INDEX	VARIANT: RE-WEIGHT AND SEMI-ANNUAL REBALANCE	DIFFERENCE: FUNDAMENTAL INDEX - VARIANT	FUNDAMENTAL INDEX	VARIANT: RE-WEIGHT AND SEMI-ANNUAL REBALANCE	DIFFERENCE: FUNDAMENTAL INDEX - VARIANT
Annualized Return	11.8%	10.8%	1.0%	12.8%	12.0%	0.8%
Volatility	15.4%	14.8%	0.6%	15.3%	15.3%	0.0%
Turnover	11.2%	15.9%	-4.7%	13.0%	18.7%	-5.7%

Note: U.S. simulation is for the period 1962–2010. Global simulation is for the period 1984–2010. For the period 1962–1983 we used Compustat and CRSP. For the period 1984–2010 we used Worldscope and Datastream. Reweighted indices are constructed by applying the RAFI methodology to the top 85% of companies selected by market capitalization. In the period 1962–1983, the top 85% by market capitalization were selected only from the pool of U.S. securities. For the period 1984–2010, the top 85% by market capitalization were selected from the pool of traded securities in all markets.

Source: Research Affiliates, LLC.

TABLE 6. ONE-YEAR FUNDAMENTALS WEIGHT FOR FINANCIAL INDUSTRY

YEAR	FINANCIAL INDUSTRY FUNDAMENTAL WEIGHT
2008	23%
2009	15%
2010	20%

Note: We used Worldscope and Datastream to compute the sector weights.

Source: Research Affiliates, LLC.

NUMBER OF METRICS USED

Some competing strategies claim the weighting metric they use is superior to other choices. Our analysis suggests there is no such link between a particular weighting metric and strategy performance. That said, any single metric is likely to be more variable than a combination of metrics. Combining several measures improves index design by:

- Providing a more stable measure of the company's economic footprint;
- Mitigating reporting and data mistakes;
- Removing unintended biases associated with one particular fundamental measure; and
- Reducing exposure to companies with aggressive accounting.

To illustrate the difference of combining several measures in index design, we simulate indices individually based on one of the four metrics used in the Fundamental Index design: cash flows, sales, dividends, and book value. We compare these indices with one which is defined by the average of all four measures. We use only the most recent year's data to provide the single-factor indices the best chance to demonstrate if they contain any forward-looking information.

As can be seen in **Table 7**, we cannot discern any statistically meaningful pattern in the performance differences between the four measures. However, turnover levels vary considerably. When we go from an individual measure to the four combined measures, the average decrease in turnover is 1.8 percentage points in the United States and 1.0 percentage point in the global market. Again, similar results are found when we examine the 23 developed countries.⁶

TABLE 7. NUMBER OF YEARS USED TO CALCULATE METRICS

	FUNDAMENTAL INDEX US LARGE					FUNDAMENTAL INDEX GLOBAL LARGE				
	5 YEARS	4 YEARS	3 YEARS	2 YEARS	1 YEAR	5 YEARS	4 YEARS	3 YEARS	2 YEARS	1 YEAR
Annualized Return	11.77%	11.64%	11.60%	11.55%	11.49%	12.79%	12.76%	12.69%	12.70%	12.73%
Return vs. 5-Yr. Return	0.00%	-0.14%	-0.18%	-0.23%	-0.29%	0.00%	-0.03%	-0.10%	-0.08%	-0.05%
Volatility	15.39%	15.50%	15.51%	15.54%	15.51%	15.27%	15.36%	15.38%	15.43%	15.44%
Sharpe Ratio	0.41	0.40	0.40	0.39	0.39	0.54	0.54	0.53	0.53	0.54
Turnover	11.2%	11.5%	11.6%	11.9%	12.6%	13.0%	13.3%	13.5%	14.0%	15.2%
Turnover vs. 5-Yr.	0.0%	0.2%	0.4%	0.6%	1.3%	0.0%	0.3%	0.5%	1.0%	2.2%

Note: U.S. simulation is for the period 1962-2010. Global simulation is for the period 1984-2010. For the period 1962-1983 we used Compustat and CRSP. For the period 1984-2010 we used Worldscope and Datastream.

Source: Research Affiliates, LLC.

DATE OF REBALANCING

Lastly, we examine whether the date used for rebalancing matters. **Table 8** shows the performance of the simulated US Fundamental 1000, using the Fundamental Index construction methodology, for four alternate rebalancing dates. The results illustrate that rebalancing date choice does not matter for portfolio performance (when looked at over long time periods). The average performance differences are quite low and are not statistically significant. The result would hold if we were to apply the same approach to the series with the biggest difference—the January vs. October rebalance.

What Makes the Fundamental Index® Methodology Work?

TABLE 8. PERFORMANCE OF INDIVIDUAL AND COMBINED METRICS

	FUNDAMENTAL INDEX US LARGE					FUNDAMENTAL INDEX GLOBAL LARGE				
	CASH FLOWS	DIVIDENDS	SALES	BOOK VALUE	4-METRIC AVERAGE	CASH FLOWS	DIVIDENDS	SALES	BOOK VALUE	4-METRIC AVERAGE
Annualized Return	11.49%	11.63%	11.29%	11.22%	11.49%	13.00%	13.04%	12.62%	11.96%	12.73%
Return vs. 4 Factors	0.00%	0.15%	-0.20%	-0.27%		0.27%	0.31%	-0.12%	-0.77%	
Volatility	14.65%	13.86%	15.80%	14.99%	15.51%	15.08%	14.80%	16.44%	15.80%	15.44%
Turnover	15.3%	15.3%	13.5%	13.4%	12.6%	17.3%	18.5%	14.6%	15.4%	15.2%
Turnover vs. 4 Factors	2.7%	2.7%	0.9%	0.9%		2.2%	3.3%	-0.5%	0.2%	

Note: U.S. simulation is for the period 1962–2010. Global simulation is for the period 1984–2010. For the period 1962–1983 we used Compustat and CRSP. For the period 1984–2010 we used Worldscope and Datastream.

Source: Research Affiliates, LLC.

CONCLUSION

As the results of this research show, index design elements matter, and some decisions are more important than others. Specifically, we showed the following:

- Stock Selection Process—a significant reduction in the added value and an increase in turnover if capitalization (price) is used to select securities relative to a non-price decision rule.
- Rebalancing Frequency—a significant increase in turnover and worse performance with higher rebalancing frequency.
- Number of Years Used to Calculate Metrics—a significant increase in turnover and worse performance with fewer (and more current) years used to calculate fundamental measures of size.
- Number of Metrics Used—a reduction in turnover when multiple metrics are used to define the fundamental measure of size.
- Individual Metric Used—no significant difference among alternative measures.
- Rebalancing Date—no significant difference among alternative rebalancing dates.

Given these results, we believe the Fundamental Index design, which removes the link with price while capturing the economic footprint of each constituent company, is optimal. We note the Fundamental Index approach also exhibits the desirable characteristics of improved investability and lower implementation (turnover) costs.

ENDNOTES

1. Arnott, Robert D., Jason C. Hsu and Philip Moore. (2005). "Fundamental Indexation," *Financial Analysts Journal*, vol. 61, no. 2, March/April:83-99.
2. GWA launched a non-price-weighted strategy in 1998.
3. Stock selection for the re-weighted indices follows MSCI's methodology for standard indices (combining large- and mid-cap universes). Companies from the top 85% of the equity universe by market capitalization, represented by the Worldscope and Datastream merged database, were selected. Prior to 1984, the top 85% highest capitalized companies of the CRSP and Compustat merged database were selected. Identical accounting weighting metrics—five-year averages of dividends, cash flows, sales, and the most recent book value—were used to identify the pure selection effect for both the Fundamental Index strategy and the re-weighted cap-based index. Further, both Fundamental Index and re-weighted series of indices are rebalanced annually on the same date.
4. Results will be provided upon request.
5. Results will be provided upon request.
6. Results will be provided upon request.

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