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FTSE PAPER

FTSE Fundamentally Weighted Indices

Fundamental Indices

Fundamental indices are a category of alternatively weighted index. They depart from the traditional practice of weighting index constituents by their market capitalisation; instead, fundamental indices weight companies according to their economic footprint or fundamental size.

Fundamental indexation was described in a paper by Arnott, Hsu and Moore, published in the *Financial Analysts' Journal* in 2005[1].

"The genesis of our non-cap-weighted market indices was our concern that market capitalisation is a particularly volatile way to measure a company's size or its true fair value," wrote Arnott, Hsu and Moore.

"Cap-weighting assuredly gives additional weight to stocks that are currently overpriced relative to their (unknowable) discounted future cash flows (the true fair value) and reduces weights in stocks that are currently trading below that true fair value. This mismatch leads to a natural performance drag in cap-weighted and other price-weighted portfolios," the authors added[2].

FTSE, in conjunction with California-based Research Affiliates, has been compiling the FTSE RAFI series of fundamental equity indices since 2005.

How fundamental indices are compiled

The FTSE RAFI fundamental indices are compiled using four fundamental measures of companies' size: sales, cash flow, book value and dividends.

To smooth the variability in companies' fundamental measures (and thereby reduce potential index turnover), five-year averages are used for three of the four measures: sales, cash flow and dividends.

A composite fundamental score is calculated by averaging the individual fundamental scores for each company.

The companies are then ranked in descending order of their composite fundamental score and the total number of index constituents is chosen (for example, the FTSE RAFI US 1000 index selects the 1000 companies with the highest fundamental score from a starting universe comprising all common stocks from the New York Stock Exchange, American Stock Exchange and NASDAQ National Market System).

Constituents are allocated index weightings in proportion to their composite fundamental score.

The first FTSE RAFI indices were launched in 2005 and are rebalanced annually in March. In 2012 FTSE launched a second, complementary index series, called the FTSE RAFI QSR series. In this index series the annual rebalancing is implemented in a phased approach to mitigate the potential timing effects that may arise from a single annual rebalancing, and to reduce market impact by spreading rebalancing-related transactions across four time points.

1 http://www.researchaffiliates.com/Production%20content%20library/FAJ_Mar_Apr_2005_Fundamental_Indexation.pdf

2 Ibid.

Performance

In their 2005 *Financial Analysts' Journal* paper, Arnott, Hsu and Moore provided evidence of the long-term performance of the fundamental methodology.

Over a 43-year period from 1962-2004 and based upon a back-test, a US fundamental index produced a geometric average annual return of 12.47%, said the authors, compared with a geometric average annual return of 10.53% on the S&P 500 index over the same period. The volatility of the fundamental index (14.7%) was slightly lower than the volatility of the S&P 500 index (15.1%).

Return Characteristics of Fundamental Indices

Table 1: Return Characteristics of Alternative Indexing Metrics, 1962-2004

Portfolio/Index	Ending Value of $1	Geometric Return	Volatility	Sharpe Ratio	Excess Return vs. Reference	Tracking Error vs. Reference	Information Ratio	*t*-Statistic for Excess Return
S&P 500	$ 73.98	10.53%	15.1%	0.315	0.18 pps	1.52%	0.12	0.76
Reference	68.95	10.35	15.2	0.301	–	–	–	–
Book	136.22	12.11	14.9	0.426	1.76	3.54	0.50	3.22
Income	165.21	12.61	14.9	0.459	2.26	3.94	0.57	3.72
Revenue	182.05	12.87	15.9	0.448	2.52	5.03	0.50	3.25
Sales	184.95	12.91	15.8	0.452	2.56	4.93	0.52	3.36
Dividends	131.37	12.01	13.6	0.458	1.66	5.33	0.31	2.02
Employment	156.83	12.48	15.9	0.423	2.13	4.64	0.46	2.98
Composite	156.54	12.47	14.7	0.455	2.12	4.21	0.50	3.26
Average (ex Composite)	$159.44	12.50%	15.2%	0.444	2.15 pps	4.57%	0.47	3.09

Source: RAFI

The "live" performance history of one representative index from within the FTSE RAFI index series—the FTSE RAFI US 1000 index—is shown in the table below. The index's performance and that of two capitalisation-weighted reference indices (the FTSE USA and the FTSE US All-Cap) is shown for each calendar year since the launch of the FTSE RAFI index.

FTSE RAFI US 1000 vs. FTSE USA: Total Return by Calendar Year

Index (%, USD)	2006	2007	2008	2009	2010	2011	2012	2013	Return p.a
FTSE RAFI US 1000	19.7	3.0	-40.0	42.0	20.0	0.1	17.2	35.7	9.10
FTSE USA	15.7	6.0	-36.8	27.2	15.1	1.7	16.3	32.8	7.49
FTSE US All-Cap	15.8	5.9	-37.0	28.4	17.0	1.1	16.4	33.4	7.79

Source: FTSE

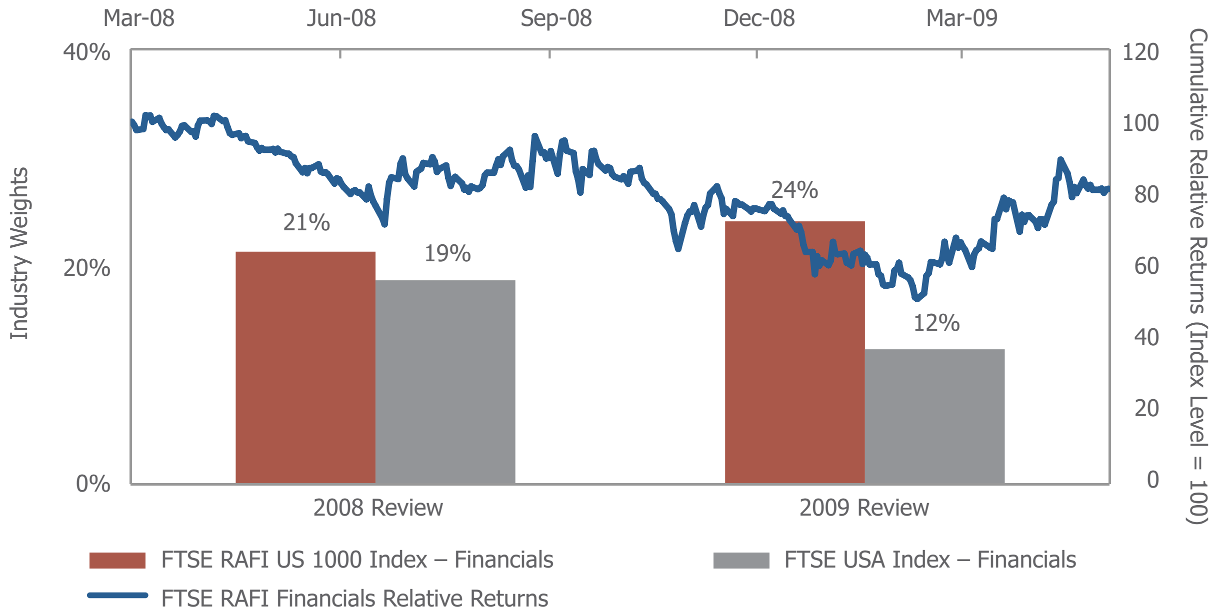
In US dollar terms, over the eight-year period from 2006-2013 the FTSE RAFI US 1000 index produced a geometric average annual return of 9.10%, while the two capitalisation-weighted indices (the FTSE USA and FTSE US All-Cap) produced geometric average annual returns of 7.49% and 7.79%, respectively.

Financials in 2008/09

The difference between the capitalisation-weighted and fundamental index approaches can be seen clearly from the weightings attached by each type of index to financial shares in 2008/09.

The bar chart below shows the weightings of financial stocks in the FTSE RAFI US 1000 index and in the capitalisation-weighted FTSE USA index at two rebalancing points for the FTSE RAFI index series, in March 2008 and March 2009.

March 2008 and March 2009 Index Reviews: Changes in Weighting of Financial Stocks



Source: FTSE

As the sub-prime mortgage crisis spread and the US equity market fell during 2008 and early 2009, the share prices of banks and other financials underperformed the broader market. This underperformance led to a declining weighting for financial stocks within the capitalisation-weighted FTSE USA index: financials' weighting fell from 19% in March 2008 to 12% in March 2009.

Financial stocks were allocated a 21% weighting in the FTSE RAFI US 1000 index at the 2008 index review, reflecting their composite fundamental scores at the time. Over the twelve-month period to the next rebalancing, the underperformance of financials also led to a downward drift in this sector weighting within the FTSE RAFI US 1000 index.

However, as a result of the increase in fundamental size of financials relative to other industries, the FTSE RAFI US 1000 index allocated an increased target weighting of 24% to financials at the March 2009 index review.

Research Affiliates' Rob Arnott argued in 2009 that fundamental indices' ability to shift weightings in the opposite direction to capitalisation-weighted indices is a major source of their long-term performance.

"The main source of value-added is not the average value tilt of the RAFI portfolios, but its dynamic contra-trading against the most extreme market bets", said Arnott[3].

"Value stocks got cheaper and cheaper and—as a direct consequence—our value tilt got larger and larger," added Arnott, referring to the period around the March 2009 FTSE RAFI index rebalancing.

Factor Exposure

In their 2005 paper, Arnott Hsu and Moore noted that fundamental indices, within the three-factor Fama-French context[4], have exposure to the value factor and, to a lesser extent, to the size factor.

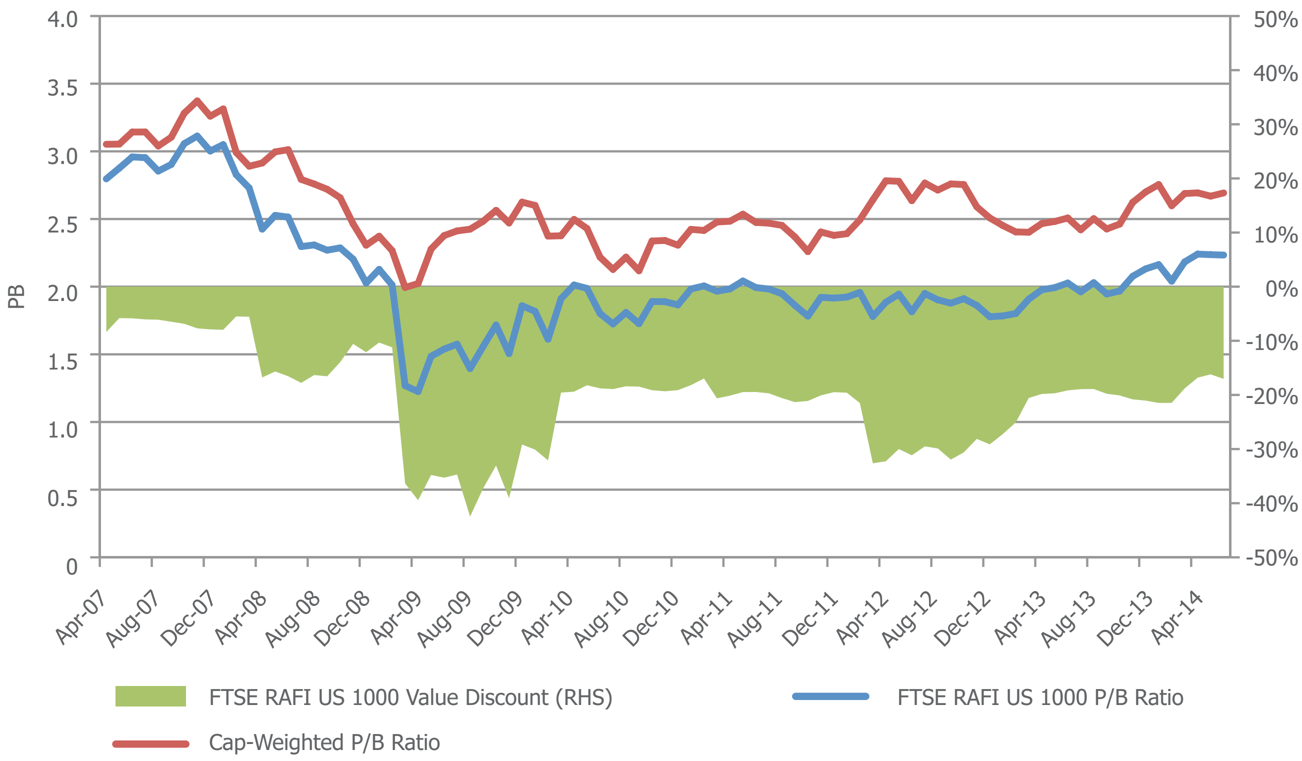
Fundamental indices' exposure to value stocks can be seen by comparing the weighted average price-to-book ratio of the stocks in a fundamental index to the weighted average price-to-book ratio of stocks in a comparable capitalisation-weighted index.

In the chart below we show this ratio for the FTSE RAFI US 1000 index and a capitalisation-weighted version of the same index. The shaded green area shows the percentage valuation discount of the FTSE RAFI 1000 index relative to the capitalisation-weighted equivalent.

3 https://www.researchaffiliates.com/Our%20Ideas/Insights/Fundamentals/Pages/F_2009_May_Great_Contra-Trade.aspx

4 See our FTSE Briefing, *"What are Factors?"*.

Valuation Discount of FTSE RAFI US 1000 index



Source: FTSE

In early 2009 the FTSE RAFI US 1000 index had a price-to-book ratio of just over 1.2, while the price-to-book ratio of the capitalisation-weighted equivalent was just over 2. As a result, the FTSE RAFI US 1000 index traded at a valuation discount of 40% to the capitalisation-weighted index. Since then, the FTSE RAFI index's valuation discount has decreased and in June 2014 was 17%.

Investability and Concentration

Investors seeking to run index-replicating portfolios frequently cite investability and index capacity as a key concern. In their 2005 study Arnott, Hsu and Moore showed that, compared to capitalisation-weighted indices, fundamental indices have somewhat lower levels of capacity but broadly similar levels of concentration.

In the table below, taken from the 2005 study, the relative capacity and concentration ratios[5] of the fundamental indices are calculated by reference to a capitalisation-weighted index. The CAP ratio of 0.66 for the composite fundamental index suggests that its weighted average capitalisation is two-thirds as large as that of the reference capitalisation-weighted index. The concentration ratios of the fundamental indices, most of which are between 51-57%, are similar to the 55% concentration ratio of the capitalisation-weighted index.

5 The relative capacity of each fundamental index is calculated as its weighted average market capitalisation, divided by the weighted average capitalisation of the reference (capitalisation-weighted) index. The concentration ratio is the proportion of the overall index represented by the collective weightings of largest 100 stocks in the index.

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Capacity and Concentration Ratios

Table 3: Liquidity Characteristics of Alternative Indexing Metrics, 1962-2004

Portfolio/Index	Ending Value of $1	CAP Ratio	Concentration Ratio	Weighted $ Trading Volume[a] (millions)	Weighted Trading Days[a]	Turnover	Excess Return at 1% Trade Cost	Trade Cost for No Excess Return
Reference	$ 68.95	1.00	55.06%	$191	0.9	6.30%	–	–
Book	136.22	0.64	51.46	134	1.5	13.20	1.62%	12.73%
Income	165.21	0.65	57.06	126	1.3	12.14	2.14	19.34
Revenue	182.05	0.55	54.66	105	2.0	14.15	2.36	16.05
Sales	184.95	0.54	52.48	99	1.7	13.41	2.42	17.99
Dividends	131.37	0.71	61.99	110	1.6	11.10	1.56	17.27
Employment	156.83	0.38	42.76	70	9.3	14.56	1.96	12.89
Composite	156.54	0.66	51.76	102	1.5	10.55	2.03	24.93
Average (ex Composite)	$159.44	0.58	53.40%	$107	2.9	13.09%	2.01%	16.04%

[a]Information for 1962-2003.

Source: RAFI

Concentration varies over time. In the table below we show the levels of index concentration at the 2009 and 2014 index review for the FTSE RAFI US 1000 index and a capitalisation-weighted equivalent index, following a similar methodology to that used by Arnott, Hsu and Moore in 2005.

Although the FTSE RAFI 1000 index was less concentrated than the capitalisation-weighted equivalent index in 2009, in 2014 the levels of concentration in the two indices were similar.

Concentration Ratios: FTSE RAFI US 1000 vs. Cap-Weighted Equivalent

	2009 Review	2014 Review
FTSE US RAFI 1000 INDEX	51.2%	56.1%
Cap-weighted equivalent	60.7%	56.9%

Source: FTSE

So whilst fundamental index weightings are independent of companies' market capitalisation, such measures are correlated with market measures of size, suggesting that capacity and investability constraints may be less of a concern for fundamental indices than for some other types of alternatively weighted index.

Uses of Fundamental Indices

Fundamental indices may be of interest to those seeking an index whose constituent weightings are determined independently of market measures of company size, and which is therefore less prone to the periodic bouts of concentration that may occur in capitalisation-weighted indices.

Fundamental indices also offer investors systematic and dynamic exposure to value by selecting and periodically reweighting stocks according to measures such as book value, sales and dividends. As fundamental measures of companies' size are not entirely divorced from companies' market capitalisation, fundamental indices display relatively high capacity and low turnover for alternatively weighted indices, an attractive feature for those seeking to manage index-replicating portfolios.

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