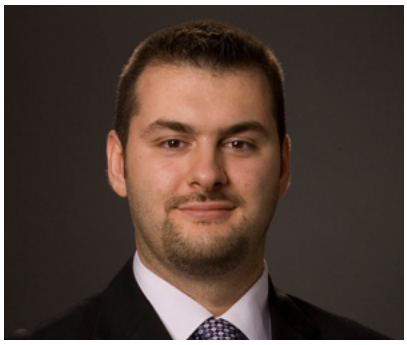
FUNDAMENTALS

research affiliates | May 2014

The High Cost of Equal Weighting



Engin Kose, Ph.D.

Max Moroz

Equal-weight indices have two clear advantages: They are easy to understand, and they generally outperform cap-weight indices over the long term. Their drawbacks are less apparent. They have higher turnover due to rebalancing than other smart beta strategies, and that turnover includes buying and selling lower-liquidity stocks. Our market impact model demonstrates that, as global assets under management increase, implementation costs tend to rise faster in equal-weight than in fundamentally weighted strategies. This article summarizes what we have learned about the relative performance of equal-weight indices before and after implementation costs.

KEY POINTS

1. Equal-weight indices are easy to understand, amply diversified, and superior to cap-weight indices in long-term performance.
2. Equal-weight indices have higher turnover and less liquid stocks than fundamentally weighted indices; they are also prone to select stocks that are more likely to be overpriced.
3. The net-of-cost performance of an equal-weight strategy falls off with asset size much faster than a fundamentally weighted strategy.

The very first index fund, created by Wells Fargo in 1970, equal-weighted the stocks in the NYSE index. But it didn't last very long. The process of trading stocks to maintain equal weights was too time consuming and costly.[1]

That historical outcome might surprise modern investors. Consider, however, that until 1975 the brokerage commissions were set by NYSE (even for institutional trading), and they were 10–15 times higher than they are today (Eisenach and Miller, 1981). In addition, computers were just emerging on Wall Street, and the effort involved in making them work often exceeded any benefits they offered. Because equal weighting was impractical in those times, capitalization weighting—a buy-and-hold strategy for index investing—became the predominant industry standard.

By the 1990s, however, major index providers started offering equal-weight versions of certain indices. In the past decade, the range of equal-weight indices increased, and ETFs and other investable vehicles linked to these indices came to market. More than 40 years after the first attempt, equal weighting finally took off as a viable approach to index investing.

It might seem that an investment strategy as incredibly simple as equal weighting couldn't possibly offer anything of interest to sophisticated investors. But equal weighting should not be dismissed so quickly. Without a material increase in risk, the equal-weight strategy robustly outperforms the traditional cap-weight benchmark on a gross basis.

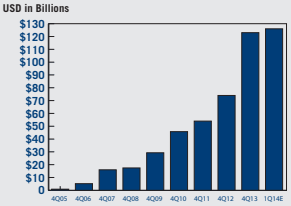
If equal-weighted strategies are not only easy to understand but also provide better risk-adjusted returns than cap-weighted indices, why should anyone bother with a more complicated smart beta strategy such as the fundamentally weighted approach? For two

research affiliates

620 Newport Center Drive, Suite 900
Newport Beach, CA 92660
+1 (949) 325-8700

info@researchaffiliates.com
www.researchaffiliates.com

RAFI® Managed Assets*



**Includes RAFI® assets managed or sub-advised by Research Affiliates or RAFI licensees.*

Media Contacts
Tucker Hewes
Hewes Communications
+1 (212) 207-9450
hewesteam@hewescomm.com

reasons: The fundamentally weighted index outperforms its equally weighted counterpart before accounting for costs; and it also has lower implementation costs. In addition to reviewing simulated performance records, we will describe the mechanism that drives the returns of both smart beta strategies, and we will explain why selecting and weighting stocks on the basis of fundamentals uses the mechanism more efficiently.

Both fundamental and equal-weight strategies owe their attractive performance to the noise in prices—the fact that stocks are often mispriced—and the tendency for stock prices to reverse direction and head back toward their long-term averages. Stocks that are temporarily overpriced automatically receive a higher weight in the cap-weighted benchmark; conversely, stocks that are temporarily underpriced are given a lower weight. This internal dynamic causes a performance drag for the cap-weight strategy: it overweights expensive stocks, magnifying the adverse return impact when their prices revert toward the mean, and it underweights cheap stocks that may be poised to rise in price.

> *"Why bother with a more complicated smart beta strategy?"*

In comparison, fundamentally and equally weighted strategies avoid the return drag because they do not use prices as weighting inputs.

Nonetheless, there are important differences between the two strategies. First, the equal-weight strategy disregards not only stock prices but also the size of the companies in the index. Consequently, it takes disproportionate positions in smaller—and therefore less liquid—stocks. These bets only indirectly capture the noise in prices, and are therefore less effective in generating performance. In addition, as one might expect, they create very significant implementation costs. The fundamental-weighted strategy breaks the link between stock price and index weight while still maintaining a high degree of investability. It achieves this by maintaining a systematic relationship between a company's index weight and its economic size, as reflected by the financial variables that serve as weighting factors.

Second, equal-weight strategies *select* the stocks they hold by market capitalization (when, for example, their construction rule is to equal-weight the largest 100 stocks in a given universe). Well-designed fundamental indices select as well as weight stocks on the basis of fundamental metrics. This key methodological difference contributes to the performance advantage enjoyed by the fundamentally weighted strategy: the stocks that are selected by the equally weighted index, and not by the fundamentally weighted strategy, are more likely to be overpriced. The selection effect would disappear if the equal-weight strategy were to invest in the entire universe of stocks; however, this would further impair investability, because microcap stocks would get the same allocation as the largest of the large-cap stocks in the opportunity set.

Comparative Returns

In a long-run simulation, the fundamentally weighted strategy outperformed equal weighting by as much as 280 bps. **Table 1** shows the hypothetical performance of the two smart beta strategies and the cap-weight benchmark in multiple countries from 1985 to 2013. Here,

Table 1. Simulated Performance by Country (1985–2013)

Country	Cap-Weight	Fundamental-Weight	Equal-Weight	Fundamental-Weight Minus Equal-Weight
Australia	12.4%	14.5%	11.7%	2.8%
Canada	10.1%	13.1%	11.2%	2.0%
France	12.8%	15.1%	14.1%	0.9%
Germany	11.4%	14.6%	12.4%	2.3%
Italy	10.0%	10.6%	9.9%	0.7%
Japan	5.0%	8.8%	6.2%	2.6%
United Kingdom	11.7%	13.7%	12.6%	1.1%
United States	9.9%	11.9%	11.0%	0.9%

Source: Research Affiliates.

the starting universe is set to the 85th percentile by cumulative market capitalization (for the cap-weight and equal-weight strategies) or by cumulative fundamental weight (for the fundamental strategy). This threshold leaves a modest amount of room for the selection effect to play a role. Over the measurement period, the annualized returns of both smart beta strategies exceed those of the cap-weighted benchmark in almost every case, and the fundamentally weighted index consistently outperformed the equally weighted one.

An argument sometimes heard in favor of equal-weight strategies is their greater diversification compared to the fundamental-weight strategy. In itself, however, diversification is not the ultimate goal; rather, it is a means to achieving the desired risk characteristics. And, as can be seen from **Table 2**, the volatilities of the equal-weight indices are roughly the same magnitude as those of the fundamentally weighted indices. It may be surprising that the much broader diversification of the equal-weight strategy does not ensure materially better risk characteristics. However, most of the benefits of diversification can be achieved with a relatively small number of stocks; incrementally reducing concentration results only in marginal improvements.[2]

> *"Equal weighting is simple—easy to grasp and easy to explain—but its simplicity comes at a price."*

Relative Implementation Costs

In estimating implementation costs, we focus on what happens upon rebalancing the non-price weighted indices, because that's where most of the cost variation across the strategies occurs. Our cost model assumes that the cost of trading a security is proportional to the fraction of its volume being traded.[3]

Intuitively, allocating a large weight to stocks with low liquidity (as measured by trading volume) should result in higher trading costs. In that respect, the equal-weight suffers greatly relative to both the fundamental- and cap-weight strategies.

It is obvious that the strategy with the higher turnover will cost more to trade. A more careful examination suggests that a given amount of turnover is more costly if it is caused by replacing a stock rather than trading a stock back to its target weight. This finding lends the fundamental strategy a further advantage, because stock selection by fundamental score is more stable than it is by market capitalization.

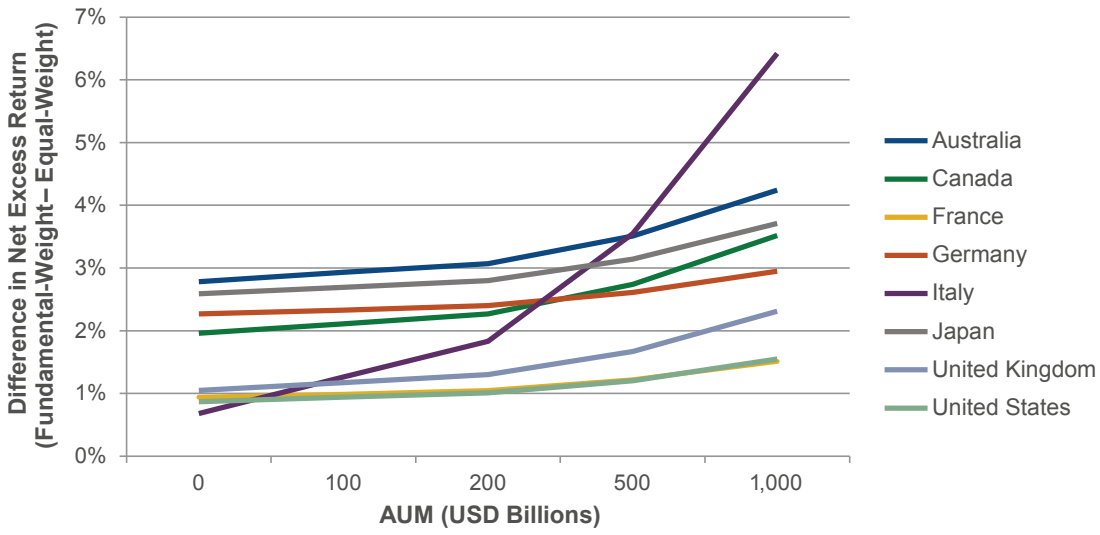
Of course, if the total size of the assets invested in a strategy is very small, the market impact at rebalance is not a concern. To obtain an estimate of the costs, then, we need to specify the amount of assets. **Figure 1** shows the differences in simulated excess returns, net of costs, after adjustment for various amounts of assets under management.[4] The lines slope upward, demonstrating the progressively superior results of the fundamentally weighted indices, because the net-of-cost performance of the equal-weight strategy falls off with

Table 2. Simulated Volatility by Country (1985–2013)

	Volatility		
Country	**Cap-Weight**	**Fundamental-Weight**	**Equal-Weight**
Australia	23.4%	23.2%	23.7%
Canada	18.7%	17.2%	18.4%
France	21.3%	22.3%	21.7%
Germany	22.0%	22.1%	19.8%
Italy	25.6%	26.6%	25.5%
Japan	22.1%	22.2%	21.7%
United Kingdom	18.0%	19.3%	19.2%
United States	15.0%	15.1%	16.4%

Source: Research Affiliates.

Figure 1. Differences in Net Excess Returns (1985–2013)



Source: Research Affiliates.

asset size much faster than does that of the corresponding fundamental-weight strategy.

In Closing

Explicit transaction costs are much lower today than they were when Wells Fargo first experimented with index investing. Nonetheless, equal weighting still entails high turnover, often in less liquid stocks. Our study of the market impact of index rebalancing demonstrates that portfolio construction methods potentially make a big difference in investment results. Equal weighting is simple—easy to grasp and easy to explain—but its simplicity comes at a price. Over the long term, and over a very wide range of global AUM, fundamentally weighted smart beta strategies are likely to outperform the equal-weight approach. The prospective performance advantage results in part from the selection effect and in part from the implicit cost of trading. In smart beta investing, as elsewhere, implementation matters.

Endnotes

1. Clowes (2000), pp. 85–86; Fox (2009), p. 125.
2. A portfolio whose top three stocks account for 60% of the weight can be greatly improved by reducing the concentration by half. A portfolio where the top three stocks account for 10% of the weight is already well-diversified, and reducing the concentration by half has little if any impact.
3. For a complete description of Research Affiliates' market impact model, see Aked and Moroz (2013).
4. In Figure 1, assets are allocated to the countries in proportion to market capitalization in order to create a meaningful cross-country comparison of costs. Because the Research Affiliates market impact model has to be calibrated to a specific index, we standardize all results to correspond to a 50 bps market impact for the $2 trillion in the U.S. market cap-weighted strategies.

References

Aked, Michael, and Max Moroz. 2013. "The Market Impact of Index Rebalancing." Research Affiliates White Paper.

Clowes, Michael J. 2000. *The Money Flood: How Pension Funds Revolutionized Investing*. New York: John Wiley & Sons, Inc.

Eisenach, Jeffrey A., and James C. Miller III. 1981. "Price Competition on the NYSE." *Regulation*, vol. 5, no. 1 (January):16-19.

Fox, Justin. 2009. *The Myth of the Rational Market: A History of Risk, Reward, and Delusion on Wall Street*. New York: HarperCollins.

Performance Update

FTSE RAFI® Equity Index Series*

TOTAL RETURN AS OF 4/30/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED 3 YEAR	ANNUALIZED 5 YEAR	ANNUALIZED 10 YEAR	10 YEAR STANDARD DEV.
FTSE RAFI® All World 3000[1]	TFRAW3	3.33%	18.54%	8.04%	17.27%	10.12%	18.57%
MSCI All Country World[2]	GDUEACWF	2.23%	14.98%	8.03%	16.03%	7.89%	16.60%
FTSE RAFI® Developed ex US 1000[3]	FRX1XTR	3.49%	19.21%	4.93%	14.13%	8.62%	20.28%
MSCI World ex US[4]	MLCUWXUG	2.53%	13.63%	5.47%	14.00%	7.66%	18.24%
FTSE RAFI® Developed ex US Mid Small[5]	TFRDXUSU	3.30%	15.37%	6.07%	17.69%	10.69%	18.73%
MSCI World ex US Small Cap[6]	GCUDWXUS	3.27%	17.76%	6.11%	18.42%	9.17%	20.12%
FTSE RAFI® Emerging Markets[7]	TFREMU	−0.54%	−5.06%	−5.85%	9.47%	13.68%	24.24%
MSCI Emerging Markets[8]	GDUEEGF	0.01%	−1.49%	−3.41%	11.43%	11.44%	23.77%
FTSE RAFI® 1000[9]	FR10XTR	3.47%	22.13%	14.68%	22.33%	9.64%	17.16%
Russell 1000[10]	RU10INTR	2.53%	20.81%	13.80%	19.52%	8.05%	14.99%
S&P 500[11]	SPTR	2.56%	20.44%	13.83%	19.14%	7.67%	14.69%
FTSE RAFI® US 1500[12]	FR15USTR	−1.24%	25.50%	12.53%	23.97%	11.40%	21.77%
Russell 2000[13]	RU20INTR	−2.80%	20.50%	10.74%	19.84%	8.67%	19.71%
FTSE RAFI® Europe[14**]	TFREUE	6.27%	24.75%	8.63%	14.09%	7.63%	17.51%
MSCI Europe[15**]	GDDLE15	4.24%	16.88%	9.60%	14.68%	6.82%	14.45%
FTSE RAFI® Australia[16**]	FRAUSTR	4.21%	10.12%	11.79%	13.66%	10.33%	13.60%
S&P/ASX 200[17**]	ASA51	3.90%	10.46%	9.29%	12.56%	9.60%	13.66%
FTSE RAFI® Canada[18**]	FRCANTR	7.98%	22.16%	7.09%	14.35%	10.07%	13.38%
S&P/TSX 60[19**]	TX60AR	7.97%	21.55%	4.73%	11.31%	9.00%	13.77%
FTSE RAFI® Japan[20**]	FRJPNTR	−10.25%	2.85%	12.48%	8.61%	2.89%	19.74%
MSCI Japan[21**]	GDDLJN	−10.50%	1.22%	12.86%	8.77%	1.83%	19.20%
FTSE RAFI® UK[22**]	FRGBRTR	2.29%	11.34%	9.18%	13.73%	8.64%	15.66%
MSCI UK[23**]	GDDLUK	1.69%	9.19%	7.73%	13.87%	7.92%	13.72%

*To see the complete series, please go to: http://www.ftse.com/Indices/FTSE_RAFI_Index_Series/index.jsp.

**The above indices have been restated to reflect the use of local currencies for all single country strategies and EUR for Europe regional strategies rather than USD.

Russell Fundamental Index Series*

TOTAL RETURN AS OF 4/30/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED 3 YEAR	ANNUALIZED 5 YEAR	ANNUALIZED 10 YEAR	10 YEAR STANDARD DEV.
Russell Fundamental Global Index Large Company[24]	RUFGLTU	3.44%	19.55%	9.37%	17.80%	10.32%	16.90%
MSCI All Country World Large Cap[25]	MLCUAWOG	2.13%	14.87%	8.10%	15.65%	7.53%	16.30%
Russell Fundamental Developed ex US Index Large Company[26]	RUFDXLTU	4.55%	21.54%	6.36%	14.79%	9.25%	18.38%
MSCI World ex US Large Cap[27]	MLCUWXUG	2.30%	13.43%	5.48%	13.70%	7.39%	18.14%
Russell Fundamental Developed ex US Index Small Company[28]	RUFDXSTU	2.57%	15.49%	8.52%	18.32%	10.61%	18.05%
MSCI World ex US Small Cap[6]	GCUDWXUS	3.27%	17.76%	6.11%	18.42%	9.17%	20.12%
Russell Fundamental Emerging Markets[29]	RUFGETRU	−0.89%	0.37%	−2.98%	12.92%	14.93%	23.74%
MSCI Emerging Markets[8]	GDUEEGF	0.01%	−1.49%	−3.41%	11.43%	11.44%	23.77%
Russell Fundamental US Index Large Company[30]	RUFUSLTU	3.29%	21.44%	14.83%	21.36%	9.98%	15.55%
Russell 1000[10]	RU10INTR	2.53%	20.81%	13.80%	19.52%	8.05%	14.99%
S&P 500[11]	SPTR	2.56%	20.44%	13.83%	19.14%	7.67%	14.69%
Russell Fundamental US Index Small Company[31]	RUFUSSTU	1.01%	24.75%	13.19%	24.49%	12.61%	20.73%
Russell 2000[13]	RU20INTR	−2.80%	20.50%	10.74%	19.84%	8.67%	19.71%
Russell Fundamental Europe[32**]	RUFEUTE	5.50%	22.82%	8.82%	15.43%	8.82%	15.84%
MSCI Europe[15**]	GDDLE15	4.24%	16.88%	9.60%	14.68%	6.82%	14.45%

*To see the complete series, please go to: http://www.russell.com/indexes/data/Fundamental/About_Russell_Fundamental_indexes.asp.

**The above indices have been restated to reflect the use of local currencies for all single country strategies and EUR for Europe regional strategies rather than USD.

Performance Update

Fixed Income/Alternatives

TOTAL RETURN AS OF 4/30/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED 3 YEAR	ANNUALIZED 5 YEAR	ANNUALIZED 10 YEAR	ANNUALIZED 10 YEAR STANDARD DEV.
RAFI® Bonds US Investment Grade Master[33]	—	4.15%	0.51%	5.78%	9.05%	6.03%	5.71%
ML Corporate Master[34]	C0A0	4.17%	0.89%	5.86%	9.47%	5.73%	5.84%
RAFI® Bonds US High Yield Master[35]	—	3.29%	4.09%	8.25%	15.75%	9.34%	9.44%
ML Corporate Master II High Yield BB-B[36]	H0A4	3.69%	5.76%	8.25%	13.97%	8.03%	9.14%
RAFI® US Equity Long/Short[37]	—	2.67%	9.24%	3.85%	8.83%	5.07%	11.26%
3-Month T-Bill[38]	GB3M	0.02%	0.04%	0.06%	0.09%	1.56%	0.53%
FTSE RAFI® Global ex US Real Estate[39]	FRXR	0.01%	−4.60%	4.19%	17.37%	—	—
FTSE EPRA/NAREIT Global ex US[40]	EGXU	2.06%	−6.79%	4.75%	15.53%	—	—
FTSE RAFI® US 100 Real Estate[41]	FRUR	11.62%	1.26%	9.48%	24.93%	—	—
FTSE EPRA/NAREIT United States[42]	UNUS	13.80%	1.15%	9.69%	22.59%	—	—
Citi RAFI Sovereign Developed Markets Bond Index Master[43]	CRFDMU	3.75%	1.69%	2.97%	5.57%	5.88%	7.18%
Merrill Lynch Global Governments Bond Index II[44]	W0G1	3.80%	1.08%	1.30%	4.13%	4.84%	6.54%
Citi RAFI Sovereign Emerging Markets Local Currency Bond Index Master[45]	CRFELMU	2.22%	−11.74%	—	—	—	—
JPMorgan GBI-EM Global Diversified[46]	JGENVUUG	2.81%	−9.42%	—	—	—	—

Sources and Method: All index returns are calculated using total return data from Bloomberg and FactSet. Returns for all single country strategies and Europe regional strategies are in local currency. All other returns are in USD. Annualized returns are geometrically linked returns, calculated using monthly data. Annualized standard deviation is calculated using sample standard deviation and monthly return data.

Definition of Indices

(1) The FTSE RAFI® All World 3000 Index is a measure of the largest 3,000 companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value), across both developed and emerging markets.

(2) The MSCI All Country World Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed and emerging markets.

(3) The FTSE RAFI® Developed ex US 1000 Index is a measure of the largest 1000 non U.S. listed, developed market companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(4) The MSCI World ex US Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed markets, excluding the United States.

(5) The FTSE RAFI® Developed ex US Mid Small Index tracks the performance of small and mid-cap companies domiciled in developed international markets (excluding the United States), selected and weighted based on the following four fundamental measures of firm size: sales, cash flow, dividends and book value.

(6) The MSCI World ex US Small Cap Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of small cap developed markets, excluding the United States.

(7) The FTSE RAFI® Emerging Markets Index comprises the largest 350 Emerging Market companies selected and weighted using fundamental factors (sales, cash flow, dividends, book value).

(8) The MSCI Emerging Markets Index is an unmanaged, free-float-adjusted cap-weighted index designed to measure equity market performance of emerging markets.

(9) The FTSE RAFI® 1000 Index is a measure of the largest 1,000 U.S. listed companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(10) The Russell 1000 Index is a market-capitalization-weighted benchmark index made up of the 1,000 highest-ranking U.S. stocks in the Russell 3000.

(11) The S&P 500 Index is an unmanaged market index that focuses on the large-cap segment of the U.S. equities market.

(12) The FTSE RAFI® US 1500 Index is a measure of the 1,001st to 2,500th largest U.S. listed companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(13) The Russell 2000 is a market-capitalization weighted benchmark index made up of the 2,000 smallest U.S. companies in the Russell 3000.

(14) The FTSE RAFI® Europe Index is comprised of all European companies listed in the FTSE RAFI® Developed ex U.S. 1000 Index, which in turn is comprised of the largest 1,000 non U.S. listed developed market companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(15) The MSCI Europe Index is a free-float adjusted market capitalization weighted index that is designed to measure the equity market performance of the developed markets in Europe.

(16) The FTSE RAFI® Australia Index is comprised of all Australian companies listed in the FTSE RAFI® Developed ex U.S. 1000 Index, which in turn is comprised of the largest 1,000 non U.S. listed developed market companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(17) The S&P/ASX 200 Index, representing approximately 78% of the Australian equity market, is a free-float-adjusted, cap-weighted index.

(18) The FTSE RAFI® Canada Index is comprised of all Canadian companies listed in the FTSE RAFI® Developed ex U.S. 1000 Index, which in turn is comprised of the largest 1,000 non U.S. listed developed market companies, selected andweighted using fundamental factors; (sales, cash flow, dividends, book value).

(19) The S&P/Toronto Stock Exchange (TSX) 60 is a cap-weighted index consisting of 60 of the largest and most liquid (heavily traded) stocks listed on the TSX, usually domestic or multinational industry leaders.

(20) The FTSE RAFI® Japan Index is comprised of all Japanese companies listed in the FTSE RAFI® Developed ex U.S. 1000 Index, which in turn is comprised of the largest 1,000 non U.S. listed developed market companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(21) The MSCI Japan Index is an unmanaged, free-float-adjusted cap-weighted index that aims to capture 85% of the publicly available total market capitalization of the Japanese equity market.

(22) The FTSE RAFI® UK Index is comprised of all UK companies listed in the FTSE RAFI® Developed ex U.S. 1000 Index, which in turn is comprised of the largest 1,000 non-U.S. listed developed market companies, selected and weighted using fundamental factors; (sales, cash flow, dividends, book value).

(23) The MSCI UK Index is an unmanaged, free-float-adjusted cap-weighted index that aims to capture 85% of the publicly available total market capitalization of the British equity market.

(24) The Russell Fundamental Global Index Large Company is a measure of the largest companies, selected and weighted using fundamental factors; (adjusted sales, retained cash flow, dividends + buybacks), across both developed and emerging markets.

(25) The MSCI All Country World Large Cap Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed and emerging markets.

(26) The Russell Fundamental Developed ex US Large Company is a subset of the Russell Fundamental Developed ex US Index, and is a measure of the largest non-U.S. listed developed country companies, selected and weighted using fundamental factors; (adjusted sales, retained cash flow, dividends + buybacks).

(27) The MSCI World ex US Large Cap Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of large cap-developed markets, excluding the United States.

(28) The Russell Fundamental Developed ex US Index Small Company is a subset of the Russell Fundamental Developed ex US Index, and is a measure of small non-U.S. listed developed country companies, selected and weighted using fundamental factors; (adjusted sales, retained cash flow, dividends + buybacks).

(29) The Russell Fundamental Emerging Markets Index is a measure of Emerging Market companies, selected and weighted using fundamental factors; (adjusted sales, retained cash flow, dividends + buybacks).

(30) The Russell Fundamental U.S. Index Large Company is a subset of the Russell Fundamental US Index, and is a measure of the largest U.S. listed companies, selected and weighted using fundamental measures; (adjusted sales, retained cash flow, dividends + buybacks).

(31) The Russell Fundamental US Index Small Company is a subset of the Russell Fundamental US Index, and is a measure of U.S. listed small companies, selected and weighted using fundamental measures; (adjusted sales, retained cash flow, dividends + buybacks).

(32) The Russell Fundamental Europe Index is a measure of European companies, selected and weighted using fundamental factors; (adjusted sales, retained cash flow, dividends + buybacks).

(33) The RAFI® Bonds US Investment Grade Master Index is a U.S. investment-grade corporate bond index comprised of non-zero fixed coupon debt with maturities ranging from 1 to 30 years issued by publicly traded companies. The issuers held in the index are weighted by a combination of four measures of their fundamental size—sales, cash flow, dividends, and book value of assets.

(34) The Merrill Lynch U.S. Corporate Master Index is representative of the entire U.S. corporate bond market. The index includes dollar-denominated investment-grade corporate public debt issued in the U.S. bond market.

(35) The RAFI® Bonds US High Yield Master is a U.S. high-yield corporate bond index comprised of non-zero fixed coupon debt with maturities ranging from 1 to 30 years issued by publicly traded companies. The issuers held in the index are weighted by a combination of four measures of their fundamental size—sales, cash flow, dividends, and book value of assets.

(36) The Merrill Lynch Corporate Master II High Yield BB-B Index is representative of the U.S. high yield bond market. The index includes domestic high-yield bonds, including deferred interest bonds and payment-in-kind securities. Issues included in the index have maturities of one year or more and have a credit rating lower than BBB-/Baa3, but are not in default.

(37) The RAFI® US Equity Long/Short Index utilizes the Research Affiliates Fundamental Index® (RAFI®) methodology to identify opportunities that are implemented through long and short securities positions for a selection of U.S. domiciled publicly traded companies listed on major exchanges. Returns for the index are collateralized and represent the return of the strategy plus the return of a cash collateral yield.

(38) The 3-Month T-bill return is calculated using the Bloomberg Generic 3-month T-bill. The index is interpolated based off of the currently active U.S. 3 Month T-bill and the cash management bill closest to maturing 90 days from today.

(39) The FTSE RAFI® Global ex US Real Estate Index comprises 150 companies with the largest RAFI fundamental values selected from the constituents of the FTSE Global All Cap ex U.S. Index that are classified by the Industry Classification Benchmark (ICB) as Real Estate.

(40) The FTSE EPRA/NAREIT Global ex US Index is a free float-adjusted index, and is designed to represent general trends in eligible listed real estate stocks worldwide, excluding the United State. Relevant real estate activities are defined as the ownership, trading and development of income-producing real estate.

(41) The FTSE RAFI® US 100 Real Estate Index comprises of the 100 U.S. companies with the largest RAFI fundamental values selected from the constituents of the FTSE USA All Cap Index that are classified by the Industry Classification Benchmark (ICB) as Real Estate.

(42) The FTSE EPRA/NAREIT United States Index is a free float-adjusted index, is a subset of the EPRA/NARIET Global Index and the EPRA/NAREIT North America Index and contains publicly quoted real estate companies that meet the EPRA Ground Rules. EPRA/NARIET Index series is seen as the representative benchmark for the real estate sector.

(43) The Citi RAFI Sovereign Developed Markets Bond Index Series seeks to reflect exposure to the government securities of a universe of 22 developed markets. By weighting components by their fundamentals, the indices aim to represent each country's economic footprint and proxies for its ability to service debt. Performance may be positive or negative. Past performance is not an indication of future results. Historical data used from index inception date of 09/30/2001 (index = 100) until 12/31/2011. Live data used since 01/01/2012.

(44) The Merrill Lynch Global Government Bond Index II tracks the performance of investment grade sovereign debt publicly issued and denominated in the issuer's own domestic market
and currency.

(45) The Citi RAFI Sovereign Emerging Markets Local Currency Bond Index Series seeks to reflect exposure to the government securities of a universe of 15 emerging markets. By weighting components by their fundamentals, the indices aim to represent each country's economic footprint and proxies for its ability to service debt. Performance may be positive or negative. Past performance is not an indication of future results. Historical data used from index inception date of 09/30/2011 (index = 100) until 12/31/2011. Live data used since 1/1/2012.

(46) The JPMorgan GBI-EM Diversified Index seeks exposure to the local currency sovereign debt of over 15 countries in the emerging markets.

Disclosures

The material contained in this document is for general information purposes only. It is not intended as an offer or a solicitation for the purchase and/or sale of any security or financial instrument, nor is it advice or a recommendation to enter into any transaction. Research results relate only to a hypothetical model of past performance (i.e., a simulation) and not to an asset management product. No allowance has been made for trading costs or management fees, which would reduce investment performance. Actual results may differ. Index returns represent back-tested performance based on rules used in the creation of the index, are not a guarantee of future performance, and are not indicative of any specific investment. Indexes are not managed investment products and cannot be invested in directly. This material is based on information that is considered to be reliable, but Research Affiliates® and its related entities (collectively "Research Affiliates") make this information available on an "as is" basis without a duty to update, make warranties, express or implied, regarding the accuracy of the information contained herein. Research Affiliates is not responsible for any errors or omissions or for results obtained from the use of this information. Nothing contained in this material is intended to constitute legal, tax, securities, financial or investment advice, nor an opinion regarding the appropriateness of any investment. The information contained in this material should not be acted upon without obtaining advice from a licensed professional. Research Affiliates, LLC, is an investment adviser registered under the Investment Advisors Act of 1940 with the U.S. Securities and Exchange Commission (SEC). Our registration as an investment adviser does not imply a certain level of skill or training.

Citigroup Index LLC, a subsidiary of Citigroup Inc., and Research Affiliates, LLC have agreed to jointly create and distribute investable fixed income indices (the "Citi RAFI Bonds Index Series") based on the Research Affiliates' patented Fundamental Index methodology. All intellectual property, including trademarks, contributed by Research Affiliates, LLC and Citigroup Index LLC shall remain solely vested with the respective contributor. Neither Citigroup Index LLC nor Research Affiliates, LLC makes any warranties, expressed or implied, to any of their customers nor anyone else regarding the accuracy or completeness of any data related to the Citi RAFI Bonds Index Series. All information is provided for information purposes only. Neither Citigroup Index LLC nor Research Affiliates, LLC accepts any liability for any errors or any loss arising from the use of any data or information set forth in this publication. CITI is a registered trademark and service mark of Citigroup Inc. or Citibank, N.A., is used under license by Research Affiliates, LLC, and is used and registered throughout the world.

The RAFI® US Equity Long/Short Index is calculated by S&P Dow Jones Indices LLC or its affiliates. S&P® is registered trademark of Standard & Poor's Financial Services LLC and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC; the marks have been licensed for use by S&P Dow Jones Indices LLC and its affiliates. Investment products based on the RAFI® US Equity Long/Short Index are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, S&P or their respective affiliates and none of S&P Dow Jones Indices LLC, Dow Jones, S&P or their respective affiliates makes any representation regarding the advisability of investing in such product(s). S&P Dow Jones Indices LLC, its affiliates, sources and distribution agents, and each of their respective officers, directors, employees, agents, representatives and licensors (collectively, the "Index Calculation Agent") shall not be liable to Research Affiliates, any customer or any third party for any loss or damage, direct, indirect or consequential, arising from (i) any inaccuracy or incompleteness in, or delays, interruptions, errors or omissions in the delivery of the RAFI® US Equity Long/Short Index or any data related thereto (the "Index Data") or (ii) any decision made or action taken by Research Affiliates, any customer or third party in reliance upon the Index Data. The Index Calculation Agent does not make any warranties, express or implied, to Research Affiliates, any of its customers or anyone else regarding the Index Data, including, without limitation, any warranties with respect to the timeliness, sequence, accuracy, completeness, currentness, merchantability, quality or fitness for a particular purpose or any warranties as to the results to be obtained by Research Affiliates, any of its customers or other person in connection with the use of the Index Data. The Index Calculation Agent shall not be liable to Research Affiliates, its customers or other third parties for loss of business revenues, lost profits or any indirect, consequential, special or similar damages whatsoever, whether in contract, tort or otherwise, even if advised of the possibility of such damages.

The RAFI® Bonds US Investment Grade Index and RAFI® Bonds US High Yield Index are calculated by ALM Research Solutions, LLC, (ALM) in conjunction with Research Affiliates. All rights and interests in the RAFI® Bonds US Investment Grade Index and the RAFI® Bonds US High Yield Index vest in Research Affiliates. All rights in and to the Research Affiliates Fundamental Index® concept used in the calculation of the RAFI® Bonds US Investment Grade Index and the RAFI® Bonds US High Yield Index vest in Research Affiliates. The above RAFI® indexes are not sponsored or promoted by ALM or its respective affiliates. Neither ALM nor Research Affiliates make any warranties, express or implied, to any of their customers or anyone else regarding the accuracy or completeness of any data related to the RAFI® Bonds US Investment Grade Index, or the RAFI® Bonds US High Yield Index. All information is provided for information purposes only. Neither ALM nor Research Affiliates accept any liability for any errors or any loss arising from the use of information in this publication.

Russell Investments is the source and owner of the Russell Index data contained or reflected in this material and copyrights related thereto. Russell Investments and Research Affiliates have entered into a strategic alliance with respect to the Russell Fundamental Index Series. Subject to Research Affiliates' intellectual property rights in certain content (see below), Russell Investments is the owner of all copyrights related to the Russell Fundamental Indexes. Russell Investments and Research Affiliates jointly own all trademark and service mark rights in and to the Russell Fundamental Indexes. The presentation may contain confidential information and unauthorized use, disclosure, copying, dissemination, or redistribution is strictly prohibited. Russell Investments is not responsible for the formatting or configuration of this material or for any inaccuracy in the presentation.

MSCI returns information provided under license through MSCI. All returns based calculations are calculated by Research Affiliates, LLC. MSCI Index returns information provided under license through MSCI. Without prior written permission of MSCI, this information and nay other MSCI intellectual property may only be used for your internal use, may not be reproduced or re-disseminated in any form and may not be used to create any financial instruments or products or any indices. This information is provided on an "as is" basis, and the user of this information assumes the entire risk of any use made of this information. Neither MSCI nor any third party involved in or related to the computing or compiling of the data makes any express or implied warranties, representations or guarantees concerning the MSCI index-related data, and in no event will MSCI or any third party have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) relating to any use of this information.

Investors should be aware of the risks associated with data sources and quantitative processes used in our investment management process. Errors may exist in data acquired from third party vendors, the construction of model portfolios, and in coding related to the index and portfolio construction process. While Research Affiliates takes steps to identify data and process errors so as to minimize the potential impact of such errors on index and portfolio performance, we cannot guarantee that such errors will not occur.

Research Affiliates is the owner of the trademarks, service marks, patents and copyrights related to the Fundamental Index methodology. The trade names Fundamental Index®, RAFI®, the RAFI logo, and the Research Affiliates corporate name and logo among others are the exclusive intellectual property of Research Affiliates, LLC. Any use of these trade names and logos without the prior written permission of Research Affiliates, LLC is expressly prohibited. Research Affiliates, LLC reserves the right to take any and all necessary action to preserve all of its rights, title and interest in and to these terms and logos.

Various features of the Fundamental Index® methodology, including an accounting data-based non-capitalization data processing system and method for creating and weighting an index of securities, are protected by various patents, and patent-pending intellectual property of Research Affiliates, LLC. (See all applicable US Patents, Patent Publications, and Patent Pending intellectual property located at http://www.researchaffiliates.com/Pages/legal.aspx#d, which are fully incorporated herein.)