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“Financial theory hasn’t definitively explained why momentum exists.”

Hot Potato: Momentum as an Investment Strategy

Momentum investing has important features in common with other factor-based Smart Beta strategies. For example, it has straightforward index or portfolio construction rules that are easily explained and implemented. And, although momentum investing is emphatically not a contrarian strategy, neither is it necessarily inconsistent with the Smart Beta thesis that prices are noisy and mean-reverting. In this interpretation, momentum investing is a lively game of hot potato—buying rapidly appreciating stocks, holding them for a relatively short period, and selling them before their price trends reverse direction. And in favorable conditions it works very well.

Nonetheless, our research raises serious theoretical and practical questions about momentum as an investment strategy in its own right. In this issue, I review the evidence for momentum investing, consider momentum in comparison with other equity risk factors, and briefly touch upon implementation issues, including portfolio construction and rebalancing policies. I argue in favor of choosing another factor for the core investment strategy and using momentum only as an ancillary trading strategy.¹

Evidence and Explanations

Momentum has shown itself to be quite robust across U.S. and foreign equity markets, within industries and countries, and across

many different asset classes such as stocks, currencies, commodities, and bonds. In 1993, UCLA professors Narasimhan Jegadeesh and Sheridan Titman (1993) published what is considered to be the first comprehensive study of the momentum effect. They found strong evidence, over the 1965–1989 period, that stock prices trend—at least in the “short-term” of up to two years. In Jegadeesh and Titman’s study, the best performing portfolio selected stocks on the basis of the previous 12 months of price returns, bought winners, sold losers short, and held those positions for the subsequent three months.

Other academics confirmed that momentum is at work in international equities, emerging markets, industries and sectors, mutual funds, and asset classes.² In fact, commodity trading advisors (CTAs) have built a profitable business around trading momentum.³

Empirical studies have shown the momentum effect to be strong, but financial theory hasn’t definitively explained why momentum exists. Describing investors’ behavioral tendencies in the 1970s, Daniel Kahneman and Amos Tversky (1979) identified what they called the “anchoring and adjustment” heuristic.⁴ In the face of uncertainty, individuals estimate the expected future value of an asset by making adjustments to a reference price, that is, an “anchored” value. Investors manifest this



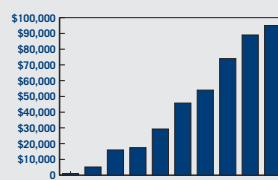
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tendency by anchoring to the current information (stock price) and being slow to adjust expected future values in light of new information. Thus, prices lag fundamental information and play “catch up” for a few quarters, leading to serial correlation in stock prices. Jegadeesh and Titman concluded that an under-reaction to firm-specific information was the likely cause of momentum. In further support of the anchoring hypothesis, Hong and Stein (1999) found that it takes time for information to be fully reflected in stock prices.

Other financial and psychological considerations may also prolong momentum by postponing price adjustments due to new information. Tax liabilities might make it preferable to defer the realization of capital gains. Company insiders may decide it is prudent to reduce their holdings over an extended period. Investors’ sentimental attachment to a company may discourage them from divesting the stock. (For instance, an individual might have inherited the stock, or the officers of a charitable organization may be loath to sell the stock of their founders’ company.) Serial correlation in earnings announcements might also lead to stock price momentum.⁵

Taken one by one, these insights make good sense. However, there isn’t a generally accepted theory that explains the causes of momentum in the financial markets. For example, it is not clear why the anchoring-and-adjustment heuristic would prevail over another psychological trait—investors’ tendency to overreact to new information. Nor is it clear that behavioral patterns which are perceptible in individual decision-making can be applied by simple extrapolation to untold numbers of investors interacting with one another.

The lack of a cogent theoretical explanation is not a trivial matter. Maintaining that, because the stock price has risen, it will continue to rise—as though the conservation of linear momentum applied, by analogy, to financial assets—is scientifically dubious. After all, an investment thesis that supports buying stocks solely on the basis of past prices violates even the weak form of the efficient market hypothesis. More than just a beauty contest, investing becomes Keynes’s (1936) third degree of speculation:

It is not a case of choosing those [faces] that, to the best of one’s judgment, are really the prettiest, nor even those that average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be.

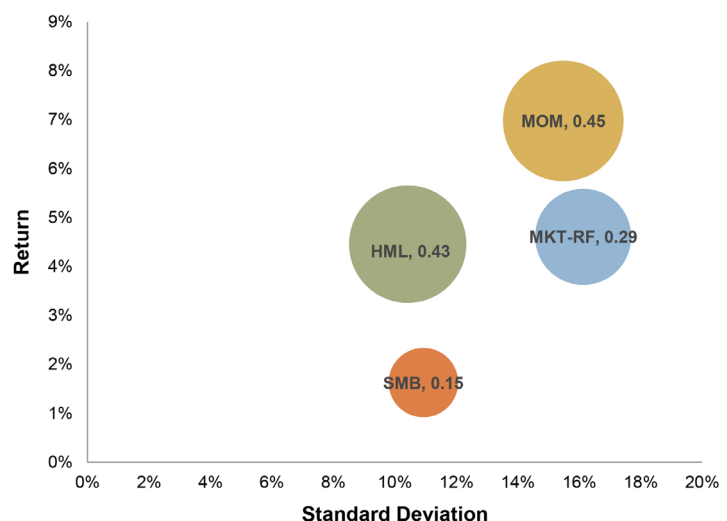
Momentum as an Equity Risk Factor

From our vantage point, it appears that investors are starting to look at equity risk factors more closely. We believe

there are two reasons for this new interest. One reason is to understand the nature and relative magnitude of the risks in their portfolio. This is a very sensible exercise because many actively managed portfolios have inapparent risk exposures. The other reason is that, with the growing acceptance of Smart Beta strategies, many investors are shifting their equity portfolios to capture specific long term risk premia. The commonly accepted equity risk factors are market beta (MKT - RF), value (HML), small size (SMB), momentum (MOM), and low volatility (BAB).⁶ Among the first four equity risk factors, over a period longer than 40 years, momentum registered the highest return and Sharpe ratio (see **Figure 1**).⁷

As attractive as momentum appears in Figure 1, it must be borne in mind that all equity risk factors are time-varying. That is, risk factor exposures will not add value consistently and all of the time. There will be some periods when certain risk factors are in favor and others when they are not—including extended intervals when factor-based investing is very discomfiting. As shown in **Figure 2**, the momentum

Figure 1. Risk Factor Sharpe Ratios, January 1970–June 2013



Source: Research Affiliates based on data from Ken French’s database.

risk factor has earned a *negative* risk premium for the 13 years ending June 30, 2013. We have also observed that momentum's strength has eroded over the past decade. Factor-based investing requires strong conviction and a steady hand.

The other major challenges with momentum include higher volatility and the associated left-tail risk of severe performance crashes. These traits make it difficult to adopt momentum as an investment strategy and may explain why we don't see many pure momentum strategies in the marketplace, where value strategies are ubiquitous. Although momentum and value factors have similar Sharpe ratios over time, momentum has 50% higher volatility, whereas value is more stable and, perhaps, more intuitively appealing.

Additionally, the momentum anomaly works best in illiquid, smaller cap stocks (Fama and French, 2011), and turnover is very high. Jegadeesh and Titman calculated turnover at 170% annually for their long/short portfolios. The trading

costs are real and can substantially erode the risk premium due to momentum. Research is mixed about the alpha net of trading costs, but there is evidence that momentum's high transaction costs offset the alpha potential at a fairly low level of assets invested in momentum strategies (Korajczyk and Sadka, 2004).⁸

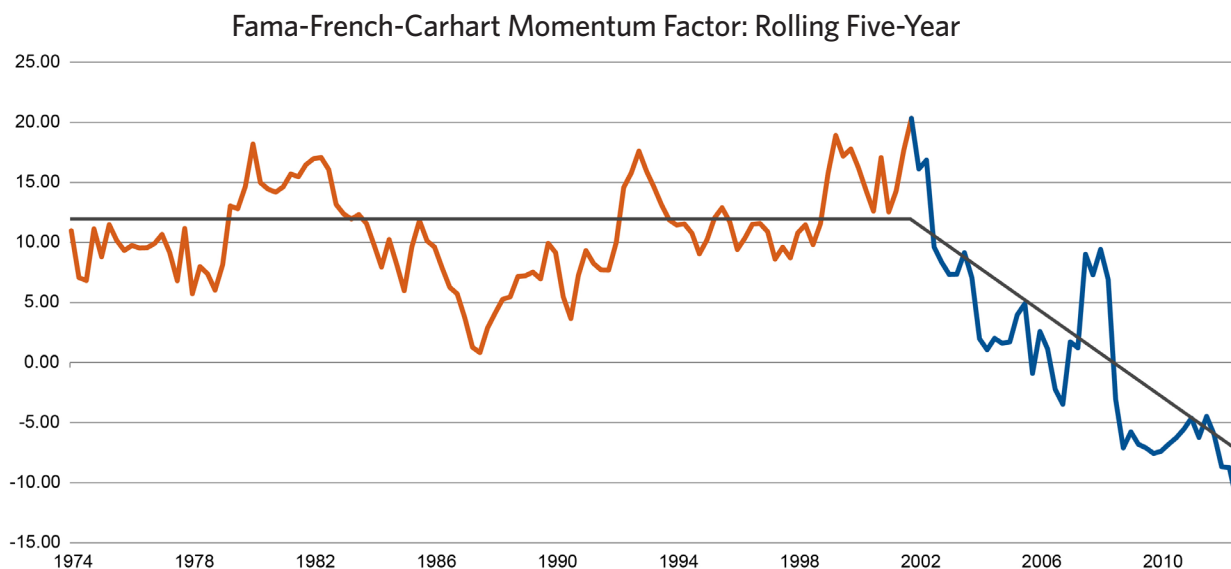
Implementation Matters

A better form of momentum strategy can be implemented by adopting portfolio construction rules that adjust for systematic risk. Naïve momentum strategies hold high beta stocks that lead to crowding into expensive stocks during bubbles. When the inevitable market correction occurs, high momentum stocks reverse (that is, revert to the mean) strongly, and the high beta names naturally tend to overcorrect. One of our colleagues, Denis Chaves (2012), finds that the alpha produced by idiosyncratic momentum is significantly more robust than the alpha associated with traditional momentum. The Carhart four-factor model explains less than half of the return generated by an idiosyncratic momentum strategy.

Chaves corrects for beta in calculating momentum for the purpose of stock selection. For example, if the market rises 20% and a stock with a beta of 2.0 rises 40%, the idiosyncratic momentum of that stock is zero because the stock is expected to rise twice as much as the market. All else equal, this stock is unlikely to be selected for an idiosyncratic momentum portfolio, but it would probably be held in a traditional or naïve momentum portfolio. Intuitively, adjusting for beta allows us to differentiate between stocks whose prices are rising for "authentic" reasons, and those that are just moving with the market.⁹

Apart from the equity market factor, the value factor is probably the best documented and most commonly targeted source of risk premium. Nonetheless, it is not entirely clear what value is. Some theorists refer to an unknown or hidden risk (e.g., default). We have a different view. We maintain that the value premium (and the size premium as well) is a byproduct of noisy, mean-reverting stock prices, and it can be captured through

Figure 2. Is Momentum in a Regime Change or a Cyclical Bottom?



Source: Research Affiliates based on data from Ken French's database.

contra-trading.¹⁰ In the RAFI® Fundamental Index® methodology, contra-trading is accomplished by means of systematic rebalancing to constituent weights that are not related to prices. Rebalancing, in this approach, does not merely correct for style drift; it is integral to the strategy. We favor annual rebalancing because it minimizes turnover and, therefore, transaction costs. Value investing is a long-term proposition.

Momentum strategies, in contrast, are profitable in the short run, and they call for more frequent rebalancing.¹¹ But, obviously, more frequent rebalancing

entails higher transaction costs. In addition, rebalancing a non-price-weighted portfolio has a strong positive value factor loading and a negative loading to momentum. These opposing characteristics are hardly surprising; momentum and value strategies are themselves opposites—procyclical vs. contrarian, short-term vs. long-term, and based upon trending vs. reverting to the mean. Recognizing these oppositions, I submit that complementing a long-term fundamentals-weighted strategy with a judicious commitment to a short-term momentum strategy might, in aggregate, produce attractive risk-adjusted returns. Indeed, Morningstar found a blended

portfolio of value and momentum outperformed a blended portfolio of value and growth by nearly 1% annually.¹²

And Yet...

So what are investors to do with momentum? Our conclusion is that momentum is inadvisable as a stand-alone strategy due to the risk of precipitous losses. Rather, we suggest that long-term investors seeking to tap more than one source of equity premium choose another, more stable factor for their core investment strategy (value is certainly a strong candidate), and consider adding momentum as a short-term trading strategy when market conditions are favorable.

Endnotes

1. For the record, the opinions expressed in this piece of writing are the author's; they do not necessarily reflect Research Affiliates' views.
2. See, for example, Rouwenhorst (1998), Griffin, Ji, and Martin (2005), Rouwenhorst (1999), Moskowitz and Grinblatt (1999), Carhart (1997), and Asness, Moskowitz, and Pedersen (2009).
3. For a fee on the order of 2 + 20%, CTAs will gladly provide you with the momentum returns across assets.
4. Kahneman devotes a very readable chapter to anchoring in Kahneman (2011).
5. Soffer and Walther (2000); Chordia and Shivakumar (2002).
6. Beta, value, size, and momentum constitute the classic "four-factor" Fama-French-Carhart risk model.
7. The risk factor portfolios are courtesy of Ken French at Dartmouth. Risk factor returns are calculated for zero-cost long/short portfolios. Momentum is calculated by taking the returns of all stocks from 12 months ago to 2 months ago, ranking them and selecting the top returning 30% of stocks for the long portfolio and shorting the worst 30% performing stocks.
8. The authors estimated that, for a single fund, momentum loses its statistical significance at \$1–2 billion, and its profits at \$5 billion.
9. Of course, traditional momentum portfolios have alpha beyond the beta risk factor, but idiosyncratic momentum dampens volatility, resulting in a more attractive risk premium.
10. If the stock market is not perfectly efficient for any reason, half of stocks are overpriced and half are underpriced. As market participants seek fair value, prices mean revert resulting in a return that has been shown to be approximately 2% over the capitalization-weighted index in developed markets such as the United States (Arnott, Hsu, and Moore, 2005).
11. Vayanos and Woolley (2013) determined that the Sharpe ratio of the momentum strategy is a function of the length of the window over which past returns are calculated, and they found that the highest Sharpe ratio was achieved using a window of four months. This implies a rebalancing frequency of three times per year.
12. Beginning in 1993 through June 2013, an equal-weighted Russell 1000 Value Index and AQR Momentum Index returned 9.53% relative to an equal-weighted Russell 1000 Value Index and Russell 1000 Growth Index that returned 8.63%. They had similar standard deviations of 15.4% (Bryan, 2013).

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Performance Update

FTSE RAFI® Equity Index Series*

TOTAL RETURN AS OF 7/31/13	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR VOLATILITY
FTSE RAFI® All World 3000 ¹	TFRAW3	13.36%	26.81%	11.12%	6.13%	11.11%	18.63%
MSCI All Country World ²	GDUEACWF	11.51%	21.16%	11.79%	4.38%	8.41%	16.59%
FTSE RAFI® Developed ex US 1000 ³	FRXIXTR	10.08%	27.02%	7.20%	2.17%	9.44%	20.29%
MSCI World ex US Large Cap ⁴	MLCUWXUG	8.88%	22.35%	8.63%	1.43%	8.68%	18.25%
FTSE RAFI® Developed ex US Mid Small ⁵	TFRDXUSU	8.65%	22.51%	9.32%	7.12%	12.65%	18.93%
MSCI World ex US Small Cap ⁶	GCUDWXUS	12.37%	28.13%	11.37%	5.02%	11.08%	20.09%
FTSE RAFI® Emerging Markets ⁷	TFREMU	-12.01%	-2.06%	-1.15%	0.73%	17.44%	24.59%
MSCI Emerging Markets ⁸	GDUEEGF	-8.40%	2.29%	1.33%	0.86%	13.45%	23.97%
FTSE RAFI® 1000 ⁹	FRIOXTR	23.18%	32.94%	18.71%	11.78%	10.00%	17.16%
Russell 1000 ¹⁰	RU10INTR	20.00%	26.23%	18.04%	8.49%	8.02%	14.95%
S&P 500 ¹¹	SPTR	19.62%	25.00%	17.74%	8.26%	7.64%	14.64%
FTSE RAFI® US 1500 ¹²	FR15USTR	25.71%	39.88%	19.32%	13.94%	12.81%	21.80%
Russell 2000 ¹³	RU20INTR	23.97%	34.76%	18.72%	9.45%	9.60%	19.76%
FTSE RAFI® Europe ^{14**}	TFREUE	9.80%	21.58%	6.06%	4.17%	7.28%	17.62%
MSCI Europe ^{15**}	GDDLE15	9.48%	17.73%	9.09%	4.62%	6.88%	14.56%
FTSE RAFI® Australia ^{16**}	FRAUSTR	13.68%	28.13%	10.85%	7.77%	10.28%	13.58%
S&P/ASX 200 ^{17**}	ASA51	10.95%	23.83%	8.81%	4.97%	9.60%	13.62%
FTSE RAFI® Canada ^{18**}	FRCANTR	6.13%	16.06%	6.30%	5.51%	9.85%	13.54%
S&P/TSX 60 ^{19**}	TX60AR	2.01%	10.87%	4.38%	0.36%	8.36%	14.01%
FTSE RAFI® Japan ^{20**}	FRJPNTR	37.00%	65.16%	12.10%	-0.10%	5.09%	19.73%
MSCI Japan ^{21**}	GDDLJN	33.48%	58.92%	12.39%	-1.06%	3.88%	19.12%
FTSE RAFI® UK ^{22**}	FRGBRTR	16.17%	26.36%	12.87%	9.28%	9.13%	15.63%
MSCI UK ^{23**}	GDDLUK	14.62%	21.80%	12.03%	8.25%	8.54%	13.60%

*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 7/31/13	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR VOLATILITY
Russell Fundamental Global Index Large Company ²⁴	RUFGLTU	14.08%	26.53%	12.96%	6.85%	11.15%	16.95%
MSCI All Country World Large Cap ²⁵	MLCUAWOG	11.06%	20.21%	11.57%	4.03%	7.89%	16.27%
Russell Fundamental Developed ex US Index Large Company ²⁶	RUFDXLTU	10.88%	27.36%	8.15%	2.77%	10.05%	18.37%
MSCI World ex US Large Cap ²⁷	MLCUWXUG	8.56%	21.93%	8.43%	1.08%	8.24%	18.13%
Russell Fundamental Developed ex US Index Small Company ²⁸	RUFDXSTU	12.44%	26.92%	11.45%	7.43%	12.93%	18.36%
MSCI World ex US Small Cap ⁶	GCUDWXUS	10.26%	24.67%	10.41%	4.77%	11.00%	20.32%
Russell Fundamental Emerging Markets ²⁹	RUFGETRU	-8.41%	3.23%	3.09%	3.53%	17.99%	24.28%
MSCI Emerging Markets ⁸	GDUEEGF	-8.40%	2.29%	1.33%	0.86%	13.45%	23.97%
Russell Fundamental US Index Large Company ³⁰	RUFUSLTU	22.53%	30.84%	19.41%	11.40%	10.40%	15.54%
Russell 1000 ¹⁰	RU10INTR	20.00%	26.23%	18.04%	8.49%	8.02%	14.95%
S&P 500 ¹¹	SPTR	19.62%	25.00%	17.74%	8.26%	7.64%	14.64%
Russell Fundamental US Index Small Company ³¹	RUFUSSTU	23.66%	37.87%	19.61%	14.25%	13.44%	20.77%
Russell 2000 ¹³	RU20INTR	23.97%	34.76%	18.72%	9.45%	9.60%	19.76%
Russell Fundamental Europe ^{32**}	RUFEUETE	8.43%	19.13%	7.49%	5.49%	8.80%	16.00%
MSCI Europe ^{15**}	GDDLE15	8.49%	16.64%	8.60%	4.19%	6.85%	14.82%

*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 7/31/13	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR VOLATILITY
RAFI® Bonds US Investment Grade Master ³³	—	-2.65%	-1.23%	5.24%	7.98%	5.99%	5.88%
ML Corporate Master ³⁴	COAO	-2.60%	-0.29%	5.35%	7.51%	5.71%	6.02%
RAFI® Bonds US High Yield Master ³⁵	—	1.64%	6.84%	9.72%	12.45%	9.99%	9.48%
ML Corporate Master II High Yield BB-B ³⁶	H0A4	2.57%	8.30%	9.50%	10.12%	8.37%	9.15%
RAFI® US Equity Long/Short ³⁷	—	10.83%	21.43%	3.38%	10.15%	5.96%	11.21%
1-Month T-Bill ³⁸	GB1M	0.02%	0.05%	0.07%	0.13%	1.54%	0.52%
FTSE RAFI® Global ex US Real Estate ³⁹	FRXR	1.34%	19.54%	10.37%	4.93%	—	—
FTSE EPRA/NAREIT Global ex US ⁴⁰	EGXU	-1.30%	13.58%	9.53%	2.75%	—	—
FTSE RAFI® US 100 Real Estate ⁴¹	FRUR	8.22%	13.65%	15.44%	10.62%	—	—
FTSE EPRA/NAREIT United States ⁴²	UNUS	7.45%	8.26%	14.97%	6.68%	—	—
Citi RAFI Sovereign Developed Markets Bond Index Master ⁴³	CRFDMU	-3.03%	0.88%	4.00%	3.76%	6.15%	7.57%
Merrill Lynch Global Governments Bond Index II ⁴⁴	WOG1	-4.63%	-4.59%	2.05%	3.42%	5.18%	6.95%
Citi RAFI Sovereign Emerging Markets Local Currency Bond Index Master ⁴⁵	CRFELMU	-7.47%	-1.86%	—	—	—	—
JPMorgan GBI-EM Global Diversified ⁴⁶	JGENVUUG	-7.67%	-1.45%	—	—	—	—

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 1,000 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 Large Cap 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 and weighted 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 1-Month T-bill return is calculated using the Bloomberg Generic 1-month T-bill. The index is interpolated based off of the currently active U.S. 1 Month T-bill and the cash management bill closest to maturing 30 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 States. 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/NAREIT Global Index and the EPRA/NAREIT North America Index and contains publicly quoted real estate companies that meet the EPRA Ground Rules. EPRA/NAREIT 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 23 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.
- (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 14 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.
- (46) The JPMorgan GBI-EM Diversified Index seeks exposure to the local currency sovereign debt of over 15 countries in the emerging markets.

Source: 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.

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