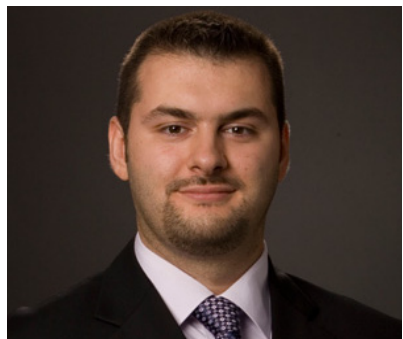




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Engin Kose, Ph.D.

KEY POINTS

1. Academics and practitioners have come forward with a large number of quality indicators, but they do not appear to be reliably associated with a factor premium.
2. The Nifty Fifty stocks of the late 1960s and early 1970s validate a simple rule of investing: The higher the price paid for a stock, the lower the long-term return.
3. Value investing may be more successful when conditioned on the measures of likelihood of default, company profitability and growth, and trustworthiness of financial statements.

The Moneyball of Quality Investing

Factor investing has rightfully gained adherents among investors seeking superior risk-adjusted returns. Our research reveals that quality is not a factor that reliably commands a premium in its own right. Nonetheless, value investing conditioned on certain indicators of company quality is a promising strategy.

In 2000, Mike Hampton, a star pitcher, signed the largest contract in sports history up to that time. His compensation was \$121 million over eight years. As it turned out, however, Hampton had only one truly successful year out of the eight. He was a great ballplayer, but he was not worth the negotiated amount. In baseball—and in soccer, too¹—hiring great players at high salaries is a bad business decision.

Billy Beane, the general manager of the Oakland Athletics, was one of the first major league baseball executives to understand that traditional scouting methods lead to overpaying for skills that don't reliably contribute to success. Beane's objective was to make the best possible use of the A's limited salary budget by winning games as cheaply as possible. (His European counterpart would be Sir Alex Ferguson, who managed Manchester United from 1986 to 2013.)² Beane was playing what came to be known as "moneyball." He and his staff learned to focus on players' statistics, rather than appearances, and in time, they isolated the metrics that count.

In the investment field, the factor framework has migrated from academia to the real world of investment decision making. Investors are seeking higher returns at lower costs, and

factor investing seems to offer the solution. But factors may not offer the returns that many believe are linked to them. Quality is one such factor.

The meaning of quality as an investment practitioner's term is unclear. It is tempting to believe that good companies—quality companies—are good investments, but the evidence does not support this thesis. Our research shows that quality is not a factor that reliably commands a premium in its own right. Nonetheless, value investing, conditional on certain indicators of company quality, is a promising strategy.

What Is Quality?

Given the focus on factor investing as well as the allure of quality to many investors, we test if there is a reliable premium associated with a quality factor. Unlike more established factors such as market, value, or momentum, no precise, generally accepted definition of investment quality exists. In academic circles, the most commonly used definition is profitability as measured by the gross-profits-to-assets ratio.³ The presumably homogeneous inputs make it an apt choice for identifying profitable companies, but it is not the only financial measure of a quality company. Scanning academic pub-



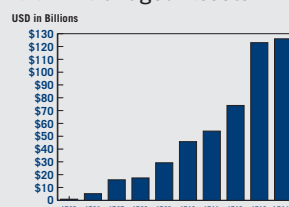
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lications and investment managers' approaches, we identified 10 quality-related factors⁴:

1. Profitability
2. Margins
3. Growth in profitability
4. Growth in margins
5. Leverage
6. Financial constraints and distress
7. Earnings stability
8. Net payout/issuance
9. Growth activities (R&D, advertising expenses, etc.)
10. Accounting quality

The list is long, but not exhaustive. Knowledgeable readers could surely enumerate a few more possible definitions. Nonetheless, these categories suggest a number of variables that might serve as quality metrics. We choose three to

five metrics within each category and report in **Table 1** performance results for the long-short strategies based on these measures. The measures associated with published studies are highlighted.

Of the 40 measures we examine, 25 have positive performance, including 6 whose results are statistically different from zero. Of the 9 reported in the literature, 8 had positive returns, and 5 of these were statistically significant. Of the 31 unpublished factors, 18 had positive performance, and only 1 was statistically significant. These results are indistinguishable from random occurrences. We did observe, however, that measures with a positive return are more likely to get published. For example, in the profitability category, only the gross-profits-to-assets ratio (proposed

by Novy-Marx) has a statistically significant positive return.⁵ Two of five measures of profitability produced negative, albeit statistically insignificant, returns. With statistical instability like this, one catches a whiff of data snooping.

The obvious incentives pushing academics to ferret out investment strategies with anomalous returns lead to what Cochrane (2011) memorably characterized as a zoo of factors. We are not alone in questioning the reliability of many of the long-short factors investigated in the literature. Papers by Chordia, Subrahmanyam, and Tong (2014), McLean and Pontiff (2013), and Harvey, Liu, and Zhu (2014) explore the multitude of biases in the publication process. Levi and Welch (2014) examine the literature and report that, among 600 factors that worked in-

Table 1. Performance by Quality Measure (U.S. Stocks, July 1965–January 2014)

Name	Mean	Vol	t-stat	Name	Mean	Vol	t-stat
Accounting Quality				Financing/Capital Structure			
Accruals	2.2%	9.7%	1.58	Equity Issuance	4.5%	9.7%	3.25**
Net Operating Assets	4.1%	9.8%	2.95**	Debt Issuance	3.2%	7.3%	3.06**
Accruals (Sloan 1996)	2.9%	11.4%	1.77	Change in L.T. Leverage	1.8%	6.5%	1.87
Accruals Decline/Growth	1.5%	8.9%	1.16	Market Leverage	-3.8%	13.9%	-1.88
Earnings Smoothness	0.8%	10.1%	0.58	Book Leverage	-1.5%	10.7%	-0.96
Growth in Margins				Growth Activities			
L.T. Change in Margin	0.0%	8.8%	-0.03	R&D Expense	0.4%	19.1%	0.14
S.T. Change in Asset Turnover	2.2%	9.4%	1.66	Capital Expense	-2.8%	9.3%	-2.07
S.T. Change in Margin	0.6%	8.5%	0.46	Advertising Expense	-0.1%	16.2%	-0.06
Growth in Profitability				Earnings Stability			
L.T. Change in ROA	-1.1%	11.7%	-0.64	S.T. Change in Inventory	4.3%	9.9%	3.01**
L.T. Change in ROE	-1.0%	10.3%	-0.65	Stability of Gross Profitability	0.7%	13.0%	0.36
L.T. Change in Cash Flow Profitability	4.2%	9.9%	2.91**	Stability of Cash Flow Profitability	0.0%	17.0%	0.02
L.T. Change in Gross Profitability	2.3%	12.2%	1.33	Stability of Margins	0.0%	9.1%	0.00
Margins				Payout			
ROR	1.2%	18.3%	0.47	Net Payout Ratio	2.2%	12.0%	1.26
Margins	-0.8%	10.2%	-0.55	Total Payout Ratio	0.9%	15.8%	0.39
Operating Margins	1.8%	18.6%	0.68	Dividend Payout Ratio	-0.9%	12.2%	-0.51
Financial Constraint/Distress				Profitability			
Kaplan Zingales Index	-1.0%	12.6%	-0.53	Gross profitability	3.2%	10.7%	2.09**
Debt Coverage Ratio	3.6%	15.4%	1.62	ROA	-0.7%	18.5%	-0.25
S.T. Change in Asset Liquidity	-2.2%	8.2%	-1.82	ROE	-1.6%	15.0%	-0.73
Net Cash Outflow	2.6%	16.0%	1.13	Net ROE	2.1%	15.4%	0.96
Interest Coverage Ratio	-0.4%	16.7%	-0.15	Cash Flow profitability	4.1%	18.8%	1.51

Source: Research Affiliates, LLC, using data from CRSP and Compustat.

sample, 51% work after publication and 49% fail.

The long list of quality variables facilitates data mining and impedes independent verification of factor effects. In addition, each product offering captures the supposed factor in its own unique way. One product’s implementation of a quality investment strategy may have little to do with the methodology employed by others claiming to harvest the quality premium. Moreover, much like academic results, practitioner-supplied returns for quality strategies tend to be inflated due to data mining and survivorship bias. When the conversation turns to quality, we recommend a healthy degree of skepticism.

The Nifty Fifty

In the late 1960s and early 1970s, institutional investors became enamored of 50 large, stable, fast-growing companies including such household names as

“It is tempting to believe that good companies—quality companies—are good investments.”

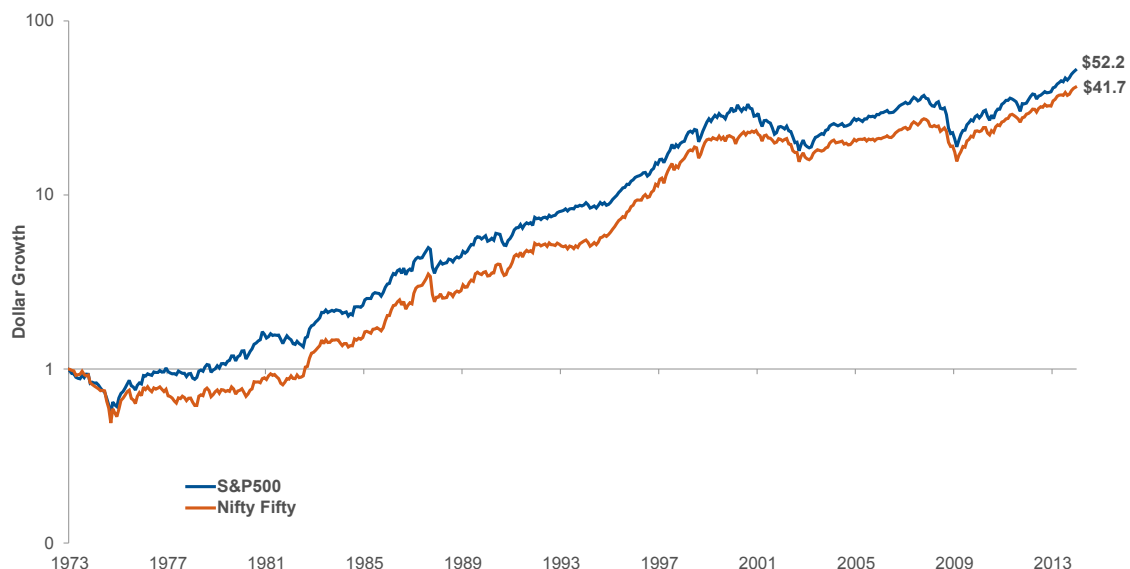
General Electric, Xerox, Polaroid, and IBM. They were popularly called the Nifty Fifty. Because of their strong record of growth, valuation ratios seemed irrelevant; investors found them attractive at 50, 80, and even 100 times earnings. At the end of 1972, when the S&P 500 Index traded at a P/E of 20, the Nifty Fifty were trading at a P/E of 40. The popularity of the Nifty Fifty spurred a shift from value investing to a “growth at any price” paradigm. Sadly for many investors, company popularity did not translate into investment performance.

The late 1960s and early 1970s were a period of remarkable growth in the U.S. economy. In 1973-1974, however, the S&P 500 fell by 39%, and the basket

of Nifty Fifty stocks fell by 47%. The broad market regained confidence, and around the end of 1976, S&P 500 investors broke even with their initial 1973 investment. But it took Nifty Fifty investors nearly a decade to recoup their losses, and they never caught up with the broad market. Forty-one years later, the S&P 500 investors of 1973 would have earned about 23% more than the Nifty Fifty investors. **Figure 1** displays the growth of a dollar invested in a hypothetical capitalization-weighted Nifty Fifty index relative to a dollar invested in the S&P 500 for the period 1973-2013.

The Nifty Fifty were great companies. But buying quality companies does not expose investors to a systematic factor that commands a risk premium. Just as hiring great ballplayers at rocket-high salaries may be bad business decisions, buying quality stocks at high prices are likely to be bad investment decisions.

Figure 1. Cumulative Performance of Nifty Fifty Cap-Weighted Index and S&P 500 Index (1973-2013)



Source: Research Affiliates, LLC, using data from CRSP and Compustat.

Information That Counts

Beane’s staff concluded that a ballplayer’s on-base percentage and slugging percentage are better predictors of offensive success than conventional box-score statistics.⁶ They also discovered players with moderate salary expectations who scored high on these overlooked metrics. Using these selection criteria allowed the Oakland A’s to increase their wins significantly, even in competition with richer teams. Lewis (2003, p. 292) explained that the goal was not to have the highest on-base percentage but to win games as cheaply as possible: “And the way to win games cheaply is to buy the qualities in a baseball player that the market undervalues, and sell the ones that the market overvalues.”

Are there statistical measures that can do for quality investing what the on-base and slugging percentages did for the Oakland Athletics’ performance?

In one of the past decade’s finest research papers, John Cochrane asks whether aggregate equity returns can be predicted by the aggregate market dividend yield.⁷ He observes that a high dividend yield has to predict either high dividend growth or high returns. Given that dividend growth is extremely hard

to forecast, Cochrane concludes that the market’s current dividend yield should be indicative of future long-term equity returns.

“When the conversation turns to quality, we recommend a healthy degree of skepticism.”

Analogous reasoning applies to individual stocks. The price-to-cash-flows ratio must predict either high growth in cash flows or high returns. The predictability of growth in cash flows is demonstrably low;⁸ therefore price-to-cash-flows ratios—and other price-to-fundamentals ratios—should be strong predictors of future returns. Indeed, a stock’s value characteristic as measured by price-to-fundamentals ratios is strongly predictive of the long-term return.⁹ Given this, we hypothesize that the following three pieces of information can help investors make better use of a value signal:¹⁰

1. Likelihood of default,
2. Company profitability and growth, and
3. Degree to which the reported accounting variables of the company can be trusted.

Considering the Nifty Fifty, we do not expect any long-term premium from low chances of bankruptcy, high profitability, high growth, or trustworthy financial accounting. Research corroborates this view by asserting there are no long-term fundamental risks associated with these factors for which the market would require a premium.¹¹ Nonetheless, a company whose stock price relative to fundamentals is low may be a particularly good investment if it also scores well on these variables.

We use three measures to capture the pertinent information: return on equity (ROE) to reflect growth and profitability; the debt coverage ratio to represent the likelihood of default; and the accruals-to-average-total-assets measure defined by Sloan (1996) to quantify possible accounting red flags.¹² To arrive at company-specific quality measures, we use the simple arithmetic average of each stock’s percentile rank for these three variables.

The first line of **Table 2** shows the performance of a simple long-short strategy based on this quality measure. On average the strategy produces a small negative return. It has some alpha after we control for factor exposure and negative exposure to the value factor.

When we use quality in conjunction with value, the results are much better.

Table 2. Long-Short Performance on Quality and Value Plus Quality (U.S. Stocks, July 1963-January 2014)

Strategy	Average Ret (ann.)	Vol. (ann.)	t-stat	S.R.	Alpha (ann.)	t-stat	Market Exposure	Size Exposure	Value Exposure	Momentum Exposure
Simple Long Short	-0.4%	14.0%	0.29	-0.03	3.9%	2.52	-0.17	-0.77	-0.19	0.11
Diagonal Long Short	11.2%	24.6%	3.96	0.46	9.3%	3.10	-0.13	-0.40	1.15	0.16

Source: Research Affiliates, LLC, using data from CRSP and Compustat.

**Table 3. Quality Value Portfolio Statistics
(U.S. Stocks, July 1963–January 2014)**

	Value, Low Quality	Value, High Quality	Difference (High minus Low)
Average Return	15.7%	16.3%	0.6%
Volatility	21.4%	18.5%	-2.9%
Sharpe Ratio	0.49	0.60	0.11

Source: Research Affiliates, LLC, using data from CRSP and Compustat.

The second line of Table 2 shows the results of a portfolio in which we go long value stocks with high quality and short growth stocks with low quality. This long-short strategy has annual alpha of 11.2% per annum. A substantial portion of this statistically significant alpha comes from conditioning on quality information. The annualized alpha, controlling for the Fama-French/Asness-Carhart four-factor model, is 9.3% per annum.

Leverage-constrained investors might be more interested in how a long-only implementation of this approach could benefit their retirement account. To illustrate the potential benefit, we start by using companies' combined book-, dividends-, earnings-, and sales-to-price ratios to select 400 value stocks from the largest 1,000 stocks by market capitalization in our universe. We then sort them into two groups: low-quality

stocks and high-quality stocks. **Table 3** displays the simulated average returns, volatilities, and Sharpe ratios for these two portfolios.

The high-quality value portfolio has fewer distressed, slow-growing, unprofitable companies with potentially questionable accounting practices. As a result, the high-quality value portfolio has a better risk-adjusted return. Quality is not, in itself, a factor that generates a premium; but value investing conditioned on a properly specified concept of quality is a powerful investment strategy.

In Closing

The approach we advocate is not new. Graham and Dodd formulated the principles of value investing in the 1930s: find high-quality stocks and buy them at low prices. Active value managers have been using

these principles for generations. Of course, statistical sophistication has advanced, and research in corporate finance and accounting has identified statistically valid predictors of company fundamentals.¹³ In academia, the interaction of value and quality has recently been studied,¹⁴ and quantitative active managers use quality measures together with value to make better portfolios.¹⁵ But the core of the approach is the same.

What is new is the healthy degree of skepticism toward the proposition that a quality factor is a good investment approach on its own. What is also new, or at least renewed, is a certain willingness to challenge traditional thinking on the basis of solid empirical research. In Lewis's (2003, p. 292) opinion, Billy Beane's contribution to baseball was not genius but intellectual courage. In this way, too, moneyball is a fine model for investing.

Endnotes

1. For example, in 2003 Roman Abramovich purchased Chelsea Football Club and started managing it with a simple strategy: if you want a player, get him at any cost. The 2006 transfer of star striker Andriy Shevchenko from AC Milan to Chelsea for 30.8 million pounds was an English club record at the time. But Shevchenko was already 29 years old, and, frequently injured, he scored only nine goals in two seasons with Chelsea.
2. *The Economist* (2011) wrote, "Manchester United has become one of the world's most valuable sports businesses on [Ferguson's] watch, and...one of the secrets of his success has been knowing the value of money." The same article describes him as "notably meritocratic" in his hiring decisions. Anita Elberse and Tom Dye note in a Harvard case study that, over the course of his career, he adapted to meaningful changes in the world of soccer: "Ferguson had massively expanded his backroom staff, and had appointed a team of sports scientists to support the coaching staff."
3. Novy-Marx (2013). Gross profit is the difference between sales and the costs of goods sold.
4. We did not include quality measures related to the quality of corporate governance or practitioner-oriented measures of investment quality (e.g., earnings-to-price ratios or low volatility).
5. The gross profitability measure has been critically examined by Ball et al. (2014).
6. A player's on-base percentage is the proportion of at-bats for which he walked or got a hit. A player's slugging percentage is the number of bases he ran in proportion to the number available (four bases per at-bat).
7. Cochrane (2008).
8. Chan, Karceski, and Lakonishok (2003).
9. If the market were adept at predicting cash flow growth, and if price-to-fundamentals ratios reflected the market's forecast, then the value effect would disappear. Companies whose growth is predictable and correctly reflected in the valuation ratios would not generate any value premium.
10. By introducing these three criteria, we are not trying to lengthen the list of quality indicators. On the contrary, we are trying to set apart the reasonably predictable information about company fundamentals that may prove useful in appraising value signals.
11. It has been argued that bankruptcy risk may be associated with a premium; however, Dichew (1998) shows that companies in distress historically did not pay a premium.
12. Sloan (1996) defines the measure as the change in non-cash current assets less the change in current liabilities (exclusive of short-term debt and taxes payable) and less depreciation expense, all divided by average total assets.
13. Piotroski (2000).
14. Piotroski and So (2013).
15. Fama and French (2013); Asness, Frazzini, and Pedersen (2014).

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Performance Update

FTSE RAFI® Equity Index Series*

TOTAL RETURN AS OF 5/31/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR STANDARD DEV.
FTSE RAFI® All World 3000 ¹	TFRAW3	5.28%	20.29%	9.64%	15.08%	10.31%	18.57%
MSCI All Country World ²	GDUEACWF	4.49%	17.75%	9.58%	14.32%	8.03%	16.61%
FTSE RAFI® Developed ex US 1000 ³	FRXIXTR	5.19%	22.01%	6.76%	11.61%	8.75%	20.28%
MSCI World ex US ⁴	MLCUWXUG	4.25%	18.05%	7.08%	11.65%	7.78%	18.24%
FTSE RAFI® Developed ex US Mid Small ⁵	TFRDXSU	4.76%	20.33%	7.45%	14.58%	10.93%	18.73%
MSCI World ex US Small Cap ⁶	GCUDWXUS	4.64%	22.11%	7.55%	15.48%	9.42%	20.11%
FTSE RAFI® Emerging Markets ⁷	TFREMU	3.28%	2.55%	-3.73%	7.04%	14.49%	24.21%
MSCI Emerging Markets ⁸	GDUEEGF	3.52%	4.61%	-1.44%	8.71%	12.05%	23.76%
FTSE RAFI® 1000 ⁹	FRIOXTR	5.27%	20.95%	15.80%	20.82%	9.74%	17.16%
Russell 1000 ¹⁰	RU10INTR	4.88%	20.90%	15.08%	18.77%	8.14%	15.00%
S&P 500 ¹¹	SPTR	4.97%	20.45%	15.15%	18.40%	7.77%	14.70%
FTSE RAFI® US 1500 ¹²	FR15USTR	-0.51%	19.99%	13.52%	22.69%	11.34%	21.77%
Russell 2000 ¹³	RU20INTR	-2.02%	16.79%	11.73%	19.32%	8.59%	19.71%
FTSE RAFI® Europe ^{14**}	TFREUE	8.99%	24.09%	9.94%	13.19%	7.94%	17.52%
MSCI Europe ^{15**}	GDDLE15	7.06%	17.59%	10.57%	14.12%	7.11%	14.47%
FTSE RAFI® Australia ^{16**}	FRAUSTR	4.72%	16.34%	12.97%	13.93%	10.19%	13.60%
S&P/ASX 200 ^{17**}	ASA51	4.60%	16.45%	10.26%	12.41%	9.46%	13.66%
FTSE RAFI® Canada ^{18**}	FRCANTR	7.50%	18.49%	6.94%	11.94%	9.89%	13.39%
S&P/TSX 60 ^{19**}	TX60AR	7.99%	18.73%	5.08%	8.80%	8.80%	13.76%
FTSE RAFI® Japan ^{20**}	FRJPNTR	-6.85%	6.42%	14.45%	7.80%	3.54%	19.74%
MSCI Japan ^{21**}	GDDLJN	-7.23%	7.28%	14.80%	8.07%	2.55%	19.19%
FTSE RAFI® UK ^{22**}	FRGBRTR	3.32%	9.18%	9.77%	13.32%	8.83%	15.66%
MSCI UK ^{23**}	GDDLUK	3.21%	7.81%	8.58%	13.18%	8.20%	13.71%

*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 5/31/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR STANDARD DEV.
Russell Fundamental Global Index Large Company ²⁴	RUFGLTU	5.33%	20.68%	10.95%	16.00%	10.48%	16.90%
MSCI All Country World Large Cap ²⁵	MLCUAWOG	4.38%	17.67%	9.69%	13.92%	7.68%	16.31%
Russell Fundamental Developed ex US Index Large Company ²⁶	RUFDXLTU	6.06%	23.52%	8.14%	12.50%	9.38%	18.38%
MSCI World ex US Large Cap ²⁷	MLCUWXUG	4.00%	17.89%	7.12%	11.34%	7.53%	18.14%
Russell Fundamental Developed ex US Index Small Company ²⁸	RUFDXSTU	4.42%	21.31%	9.94%	15.41%	10.96%	18.04%
MSCI World ex US Small Cap ⁶	GCUDWXUS	4.64%	22.11%	7.55%	15.48%	9.42%	20.11%
Russell Fundamental Emerging Markets ²⁹	RUFGETRU	2.66%	6.46%	-0.84%	10.40%	15.63%	23.72%
MSCI Emerging Markets ⁸	GDUEEGF	3.52%	4.61%	-1.44%	8.71%	12.05%	23.76%
Russell Fundamental US Index Large Company ³⁰	RUFUSLTU	5.23%	20.58%	16.05%	20.49%	10.09%	15.56%
Russell 1000 ¹⁰	RU10INTR	4.88%	20.90%	15.08%	18.77%	8.14%	15.00%
S&P 500 ¹¹	SPTR	4.97%	20.45%	15.15%	18.40%	7.77%	14.70%
Russell Fundamental US Index Small Company ³¹	RUFUSSTU	2.33%	21.66%	14.29%	23.69%	12.58%	20.73%
Russell 2000 ¹³	RU20INTR	-2.02%	16.79%	11.73%	19.32%	8.59%	19.71%
Russell Fundamental Europe ^{32**}	RUFEUETE	8.53%	22.73%	10.27%	14.70%	9.19%	15.85%
MSCI Europe ^{15**}	GDDLE15	7.06%	17.59%	10.57%	14.12%	7.11%	14.47%

*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 5/31/14	BLOOMBERG TICKER	YTD	12 MONTH	ANNUALIZED			
				3 YEAR	5 YEAR	10 YEAR	10 YEAR STANDARD DEV.
RAFI® Bonds US Investment Grade Master ³³	—	5.58%	4.35%	5.73%	8.40%	6.26%	5.70%
ML Corporate Master ³⁴	COAO	5.77%	4.83%	5.89%	8.88%	5.97%	5.84%
RAFI® Bonds US High Yield Master ³⁵	—	4.24%	6.07%	8.18%	14.15%	9.58%	9.41%
ML Corporate Master II High Yield BB-B ³⁶	HOA4	4.73%	7.57%	8.39%	13.00%	8.31%	9.11%
RAFI® US Equity Long/Short ³⁷	—	1.29%	4.58%	3.58%	7.30%	4.98%	11.27%
3-Month T-Bill ³⁸	GB3M	0.02%	0.04%	0.05%	0.09%	1.56%	0.53%
FTSE RAFI® Global ex US Real Estate ³⁹	FRXR	4.49%	9.01%	6.12%	14.43%	—	—
FTSE EPRA/NAREIT Global ex US ⁴⁰	EGXU	5.76%	5.20%	6.12%	12.33%	—	—
FTSE RAFI® US 100 Real Estate ⁴¹	FRUR	15.00%	11.05%	10.27%	24.86%	—	—
FTSE EPRA/NAREIT United States ⁴²	UNUS	16.58%	10.13%	10.09%	22.62%	—	—
Citi RAFI Sovereign Developed Markets Bond Index Master ⁴³	CRFDMU	4.22%	5.95%	3.25%	4.88%	5.83%	7.17%
Merrill Lynch Global Governments Bond Index II ⁴⁴	WOG1	4.27%	5.14%	1.47%	3.57%	4.81%	6.54%
Citi RAFI Sovereign Emerging Markets Local Currency Bond Index Master ⁴⁵	CRFELMU	4.90%	-3.13%	—	—	—	—
JPMorgan GBI-EM Global Diversified ⁴⁶	JGENVUUG	4.94%	-1.37%	—	—	—	—

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 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 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/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 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.

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