FTSE RAFI® Index Series: Staggered Rebalancing

October 2012

FTSE

Contents

1. Introduction

Research shows that a systematic approach to rebalancing adds value for investors.[1] The FTSE RAFI® Index Series rebalances annually to a stable, economic measure of size. Over time, this disciplined rebalance has been shown to add value—in some years, such as 2009, more than in others. It is not surprising, then, that people have questioned whether recent experience is unduly influenced by a fortuitous rebalance. If that is the case, the logical question is whether there are designs or alternate rebalance dates that can mitigate the timing risk while retaining the core characteristics of the FTSE RAFI Index Series.[2]

This paper presents research related to the rebalance decision in the FTSE RAFI Index Series. First, we explore the sensitivity to the rebalance date of an annual rebalance. Second, we explore two alternatives to an annual rebalance: (1) a higher frequency rebalance and (2) a staggered or phased rebalance that spreads turnover over a 12-month period[3]. Throughout this paper, we use the methodology for the FTSE RAFI US 1000 to calculate our simulated results for different time periods.[4]

Our research shows that the timing risk exhibited by the FTSE RAFI US 1000 in 2009 is rare and does not appear to influence long-term performance results. Also, we do not find evidence that another month is better than March for an annual rebalance. For those interested in mitigating timing risk, we show that a staggered rebalance approach has attractive features.

---

[1] Trading against price movement in equity portfolios has two effects: 1) by trading against the recent price changes the portfolio acquires value and size characteristics which have been empirically demonstrated to produce excess returns (see, for example, Fama and French, 1992); 2) rebalancing against price movements creates a more diversified portfolio, which reduces the risk of the portfolio. By lowering volatility of the portfolio the geometric compounded return of the strategy over a long run increases (see, for example, Fernholz, 1998).

[2] The FTSE RAFI Index Series using the Research Affiliates Fundamental Index methodology. See Appendix C for a brief description of the methodology.

[3] We wish to acknowledge the contribution of Blitz, Van der Grient, and Van Vliet (2010) who first proposed this rebalancing approach.

[4] For a description of the FTSE RAFI US 1000 methodology, please
http://www.ftse.com/Indices/FTSE_RAFI_Index_Series/2007Downloads/FTSE_RAFI_Indexes_Methodology_Overview.pdf.

2. Rebalance Timing Sensitivity in the Short and Long Run

The timing of a rebalance can have a significant impact on short-term performance. For example, the FTSE RAFI US 1000 Index outperformed the S&P 500 Index by 15.5% in 2009—in part because the March rebalance occurred close to the bottom for financials. Following the U.S. mortgage crisis and related price declines for financials, the FTSE RAFI methodology began to overweight the financial sector in subsequent rebalances. The March 2009 index reconstitution resulted in a significant overweight position in financials following less significant overweight positions in the 2007 and 2008 reconstitutions. As market confidence returned in 2009, the price of financial stocks recovered and the FTSE RAFI US 1000 subsequently outperformed substantially.

In retrospect, we can show that the March 2009 rebalance was favorable for the FTSE RAFI Index Series, but, interestingly, it was not the best month to have rebalanced in that year. As **Figure 1** shows, rebalancing in February would have been better and January would have been pretty good too. In this figure, the results for each month correspond to an index rebalanced each year at the end of that month, with each month's performance assessed relative to the S&P 500 results for that month.

Figure 1.   Value Added of FTSE RAFI US 1000 Index Relative to S&P 500 Index by Rebalance Month, Calendar Year 2009
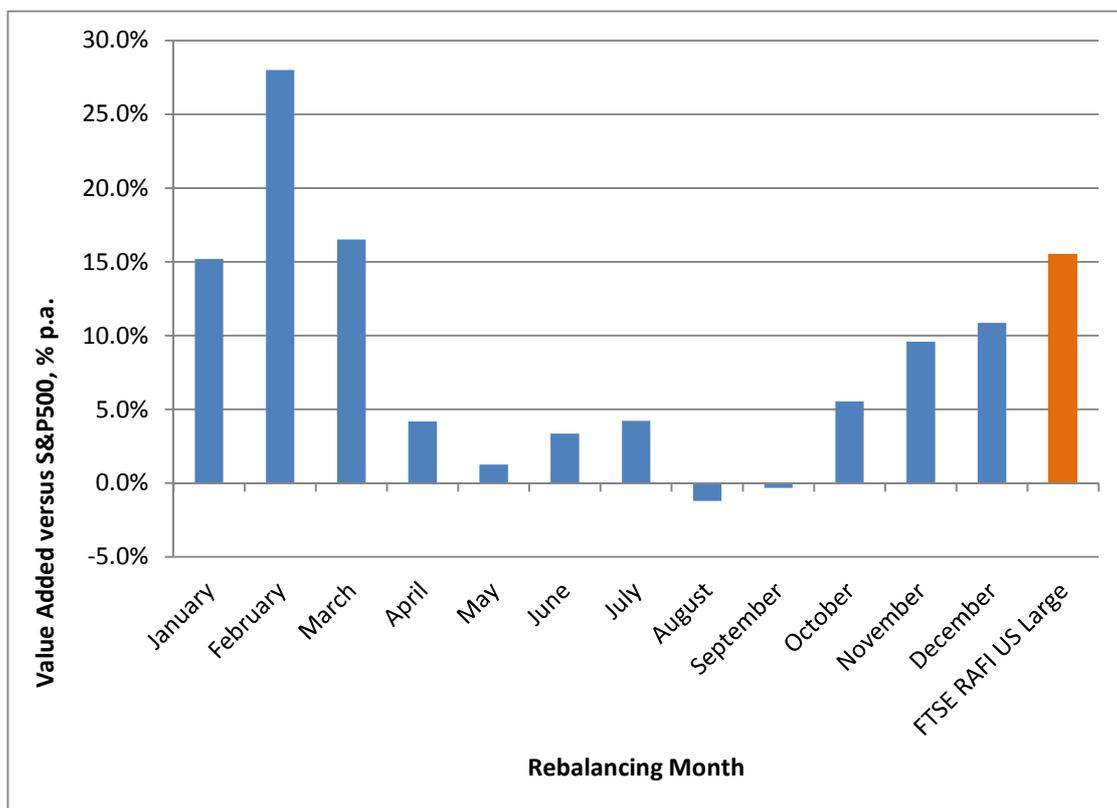
Source: Research Affiliates, LLC.

To assess whether the timing sensitivity observed in 2009 occurs regularly, we simulate different monthly rebalance dates for the Fundamental Index® strategies. All strategies use the same methodology applied to U.S. stocks for the period 1963–2011. Each of the 12 monthly strategies is rebalanced at their respective month-end. For instance, the February strategy is rebalanced to fundamentals weights in the end of February each year.

Figure 2 illustrates the difference in the annual performance between the best and worst rebalance points each year relative to the average outcome. Results for the March rebalance are included for comparison. These results show that the experience of 2009 was an isolated event. The normal difference in returns is within 5 percentage points. The second largest difference between the best and worst rebalance months was 7.4% in 2000. Further,

these results do not indicate that March is significantly better or worse than the average month over time. In almost half the years (23 out of 49), the March rebalance outperformed the average rebalance.

Figure 2.   Performance of Best and Worst Annual Rebalance Months vs. the Average Annual Outcome — FTSE RAFI US 1000 Index
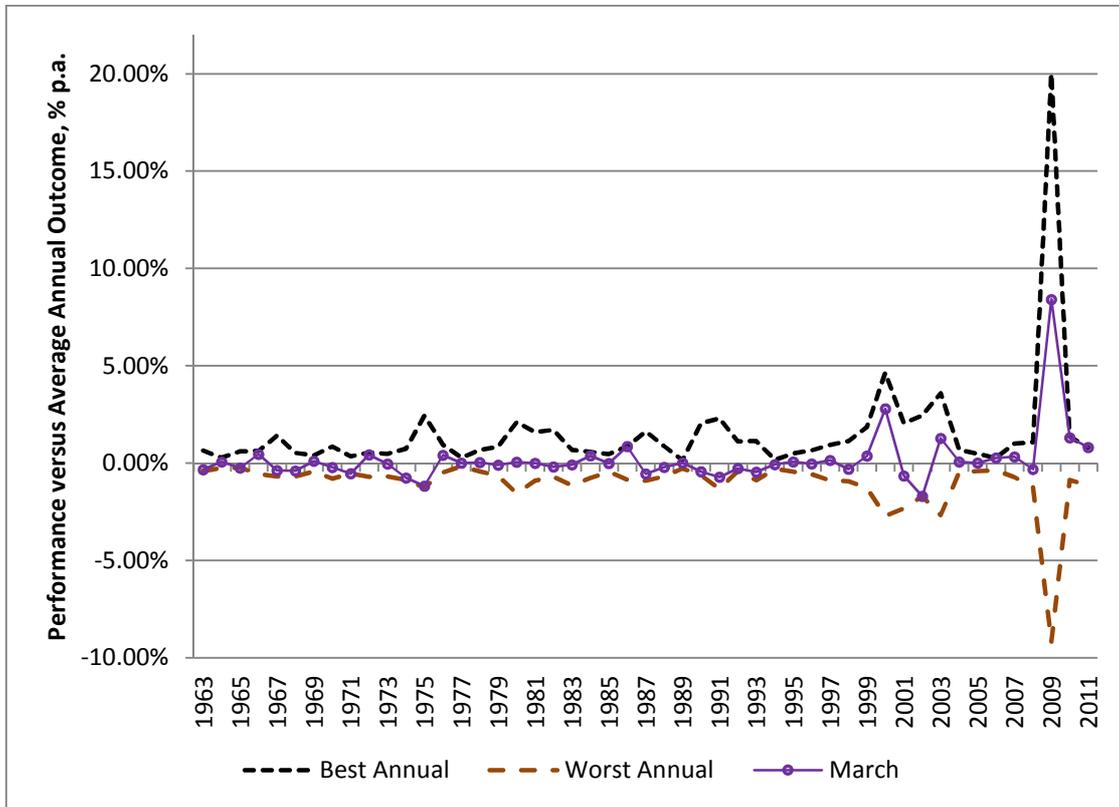
Source: Research Affiliates, LLC.

The lack of a clear pattern is confirmed in **Figure 3**, which shows the average value added by rebalance month for the 1963–2011 period, with and without 2009. The difference in outcomes between months is insignificant, indicating that no particular rebalance date exhibits a systematic timing advantage.

Figure 3. **Performance Versus S&P 500 By Rebalance Month,** **Average Outcome 1963–2011**
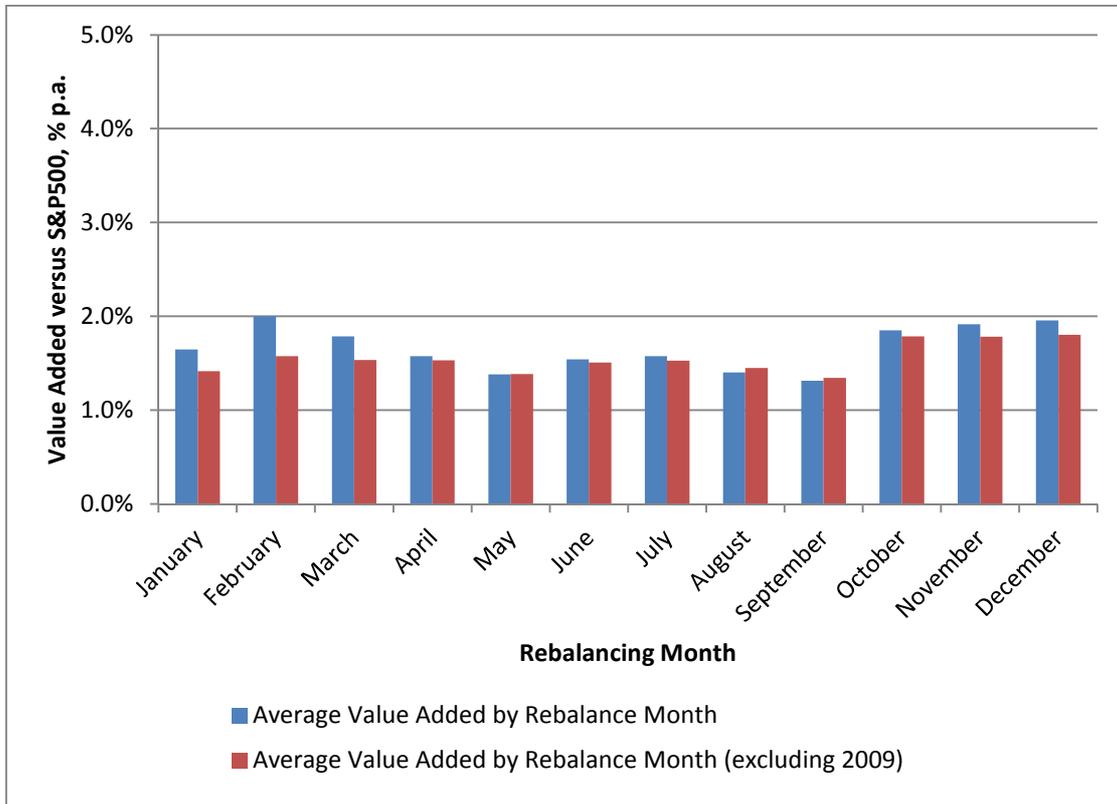
Source: Research Affiliates, LLC.

Collectively, the results of the timing sensitivity tests indicate that the timing risk exhibited by the FTSE RAFI indices in 2009 is rare and, therefore, does not influence the long-run performance charactersitics of the index. Additionally no particular rebalance timing exhibts any systematic advantage. In the short-term, however, extreme events such as those of 2009 may influence performance outcomes.

3. Rebalance Alternatives

Even with evidence that over long periods of time no one month is better or worse than another for rebalancing, there may be reasons to explore alternatives for mitigating the short-term timing risk. We present two alternatives to the annual rebalance: a higher rebalance frequency and a quarterly staggered rebalance.

3.1 Higher Rebalance Frequency

An obvious starting point for mitigating timing risk is to increase the rebalance frequency so that investors have more than one rebalance date in a 12-month period. To test whether a higher rebalance frequency adds value, we compare annual, semi-annual, and quarterly rebalance frequencies and benchmark the outcomes to the average of the corresponding rebalance frequency in terms of timing risk. We also compute performance and turnover for the three rebalance frequencies. In order to minimize noise in the comparisons, all simulations make use of the same fundamental data; in this case, the data is fixed at the beginning of the year.

As **Table 1** shows, over the full sample period, the value add performance of semi-annual and quarterly rebalanced indices are on a par with annually rebalancing. The more frequent rebalancing leads to an increase in turnover, however. The average annual turnover of the quarterly rebalance strategy is double that of the annual rebalance. At the observed levels of turnover, the semi-annual frequency is the only viable alternative to the annually rebalanced strategy.

Table 1.   Performance and Turnover as a Function of Rebalance Frequency

Frequency Statistics	Annually[a]	Semi-annually[b]	Quarterly[c]
Average Value-Add vs. S&P 500 (Annualized 1963–2011)	1.67%	1.64%	1.66%
Average Turnover (Annualized 1963-2011)	11.13%	15.62%	21.42%

[a] Average of the 12 annually rebalanced indices versus the S&P 500 .

[b] Average of the 6 semi-annually rebalanced indices versus the S&P 500.

[c] Average of the 3 quarterly rebalanced indices versus the S&P 500.

Source: Research Affiliates, LLC.

Figure 4 illustrates the best and worst outcomes for the three rebalance strategies. The semi-annual and quarterly rebalance strategies mitigate timing risk by approximately 25% and 75%, respectively. The annual rebalance strategy dominates higher frequency rebalance strategies in terms of turnover and trading costs, but exhibits higher timing risk and market impact. There are no discernible performance benefits from a higher rebalance frequency.

Figure 4.   Annual, Semi-annual and Quarterly: Best and Worst Rebalance Outcomes vs. the Average of the Matching Frequency — FTSE RAFI US 1000 Index
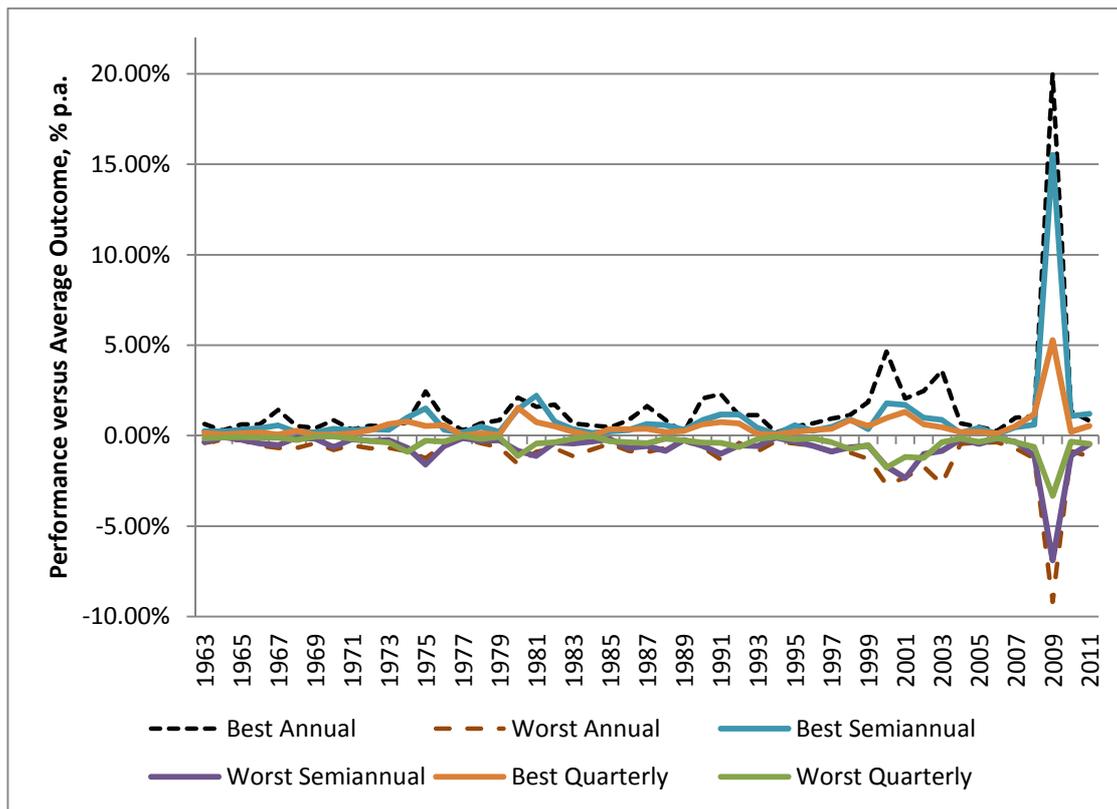
Source: Research Affiliates, LLC.

3.2 Quarterly Staggered Rebalance

The idea for a staggered rebalance approach came from a desire to capture some of the benefits of more frequent rebalancing while mitigating the turnover costs. The quarterly staggered rebalanced strategy simulated in this research is analogous to investing equal amounts into four sub-indices, each of which is rebalanced annually at a different quarter-end to a set of annually re-determined weights.

Figure 5 illustrates the mechanics of a staggered rebalance approach. Consider a portfolio divided into four tranches. Each of these tranches is rebalanced annually at a different point during the year. The first tranche is rebalanced in March, the second in June, the third in September, and the fourth in December. Each tranche is rebalanced to the set of fundamental weights determined in March of that year. The fundamental weights are not adjusted during the year. Because the four tranches contain different constituents and weightings, they will diverge in value. The staggered index consists of the aggregate position across all four tranches.

Figure 5.   Mechanics of Staggered Rebalancing
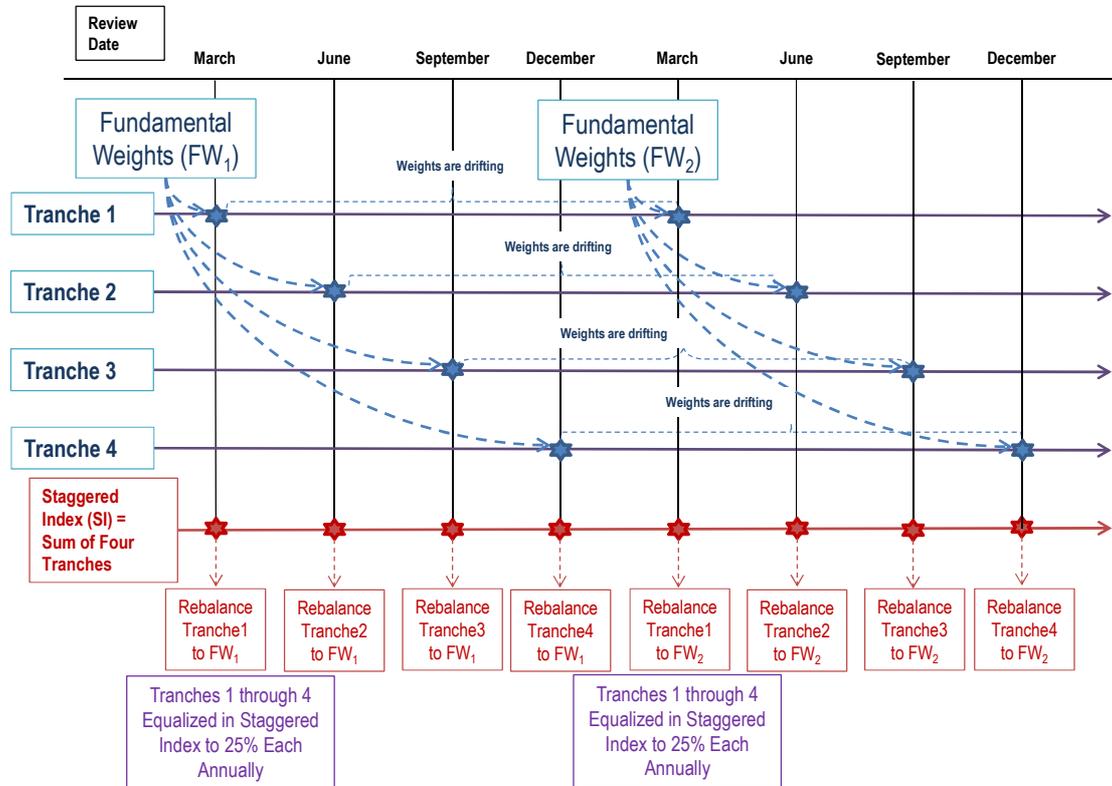
Source: Research Affiliates, LLC.

The staggered rebalance may follow several different approaches and any implementation across the FTSE RAFI Index Series may vary from the approach detailed here, but would follow the spirit of the stylized example illustrated in Figure 5 and have similar objectives and results. Appendix D provides details on the FTSE RAFI QSR index series, which is one implementation of the staggered rebalancing approach.

An index that is rebalanced using the staggered approach should experience performance and turnover similar to an index rebalanced at an annual frequency over meaningful time periods. In the short run, differences will arise. However, the rebalance is effectively spread throughout the year, mitigating timing risk. The results in **Figure 6** support this hypothesis. The staggered strategy is almost indistinguishable from the average of the 12 annual rebalanced strategies. The strategy mitigates the timing risk associated with a single entry point of an annual rebalance. The performance and turnover characteristics are also similar to those of the average of the annually rebalanced strategies (see **Table 2**).

Figure 6   Annual and Staggered: Best and Worst Outcomes versus the Average of the Matching Frequency — FTSE RAFI US 1000 Index
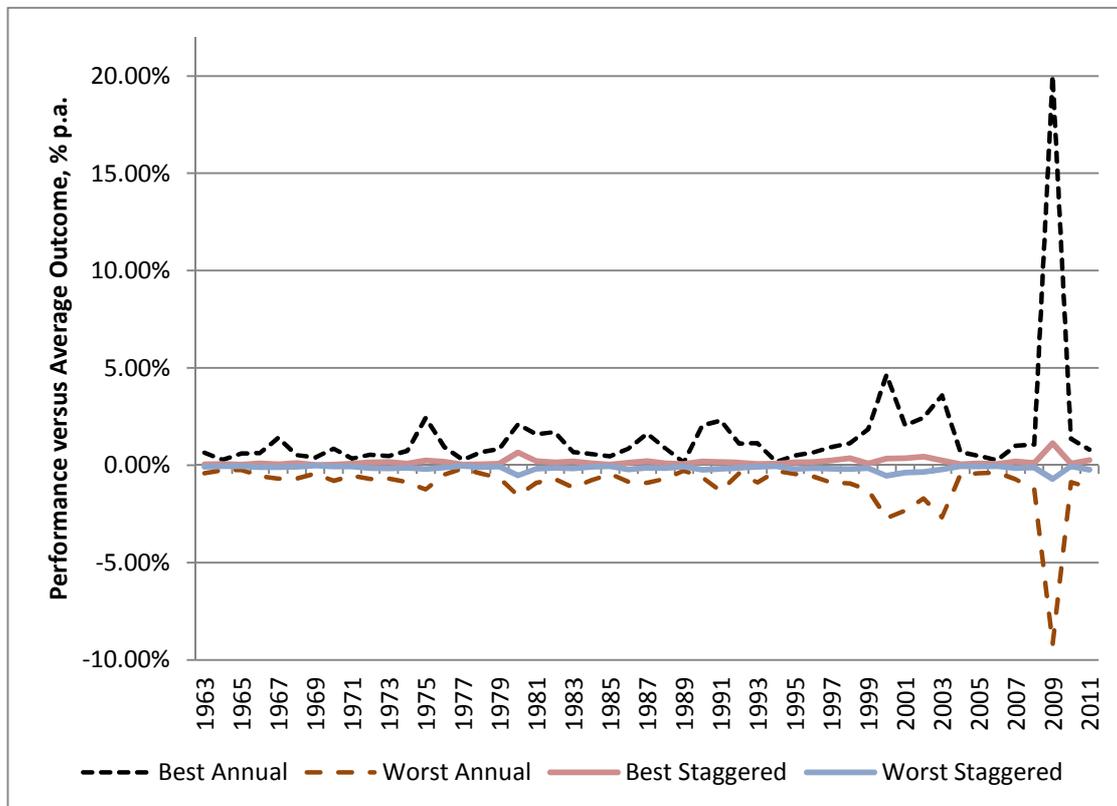
Source: Research Affiliates, LLC.

Table 2.   Performance and Turnover as a Function of Rebalance Frequency

Frequency / Statistics	Annually[a]	Semi-annually[b]	Quarterly[c]	Staggered Rebalancing[d]
Average Value-Add (Annualized 1963-2011)	1.67%	1.64%	1.66%	1.67%
Average Turnover (Annualized 1963-2011)	11.13%	15.62%	21.42%	11.25%

[a] Average of the 12 annually rebalanced indices each rebalanced at a difference month-end.

[b] Average of the 6 semi-annually rebalanced indices.

[c] Average of the 3 quarterly rebalanced indices.

[d] Average of the 3 rebalanced indices each rebalanced at a different quarter-end.

Source: Research Affiliates, LLC.

4. Summary and Recommendation

Our results show that an annually rebalanced Fundamental Index portfolio exhibits infrequent timing risk; that such timing risk is not apparent over longer investment horizons and that no particular choice of rebalance month exhibits a persistent timing advantage.

Our results also show that higher frequency rebalancing has both attractive features and drawbacks. Some of the drawbacks can be mitigated with a staggered rebalance approach. Broadly, the staggered approach achieves a more substantial reduction in timing risk with no increase in turnover. The staggered approach and higher rebalance frequencies reduce market impact costs by spreading turnover over multiple transaction points, thereby increasing the capacity of the index. The reduction in the size of the required trades at each rebalance point may reduce the incentive to front-run the index as the potential gains from such activity are lower. If timing risk and capacity are a concern, the staggered approach is the preferred solution; where timing risk and capacity are not a concern, the annual rebalance is an appropriate mechanism for rebalancing the FTSE RAFI Index. **Table 3** summarizes our conclusions.

Table 3.   Summary of Rebalance Alternatives

	Semi-Annual Rebalance	**Fixed Annual Rebalance**	**Staggered Rebalance**
Performance	Comparable to annual	Comparable to semi-annual and staggered approaches	Comparable to annual
Turnover	5% increase	Comparable to stagger; superior to higher frequency rebalances	Comparable to annual
Market Impact	Reduces impact	Baseline impact	Lowest impact
Trading Costs	Indeterminate[5],	Baseline costs	Lowest[5]
Timing Risk	Mitigates risk	Worse risk	Mitigates risk substantially

Source: Research Affiliates, LLC.

Summary results for our analysis applied to international and emerging markets are presented in **Appendices A & B**.

---

[5] For small funds any market impact benefit may be outweighed by the increase in ticketing costs associated with the increased number of trades required. For larger funds the benefits of lower price impact may dominate the higher ticket costs.

End Note

To ensure that existing users of the FTSE RAFI Index Series who are indifferent to timing risk are not inconvenienced and continue to receive a consistent index series, FTSE and Research Affiliates propose to continue to provide **all** existing FTSE RAFI indices on an annually rebalanced basis. Additionally, effective with the March 2013 rebalance, some FTSE RAFI indices will also be available with a staggered rebalance for those investors who are sensitive to the timing issues addressed in this paper. The staggered rebalance will be provided for those indices that have or will have funds benchmarked against them. The index naming convention will follow the existing annual series with additional information highlighting the rebalance approach incorporated (e.g., FTSE RAFI Developed 1000 – QSR). A complete list of indices incorporating a staggered rebalance is shown in **Table 4**.

Table 4. Available Indices Following a Staggered Approach

FTSE RAFI All World 3000 - QSR	FTSE RAFI North America – QSR	FTSE RAFI Italy 30 – QSR
FTSE RAFI Developed Asia Pacific ex Japan - QSR	FTSE RAFI UK 100 – QSR	FTSE RAFI Korea 200 – QSR
FTSE RAFI Canada - QSR	FTSE RAFI US 3000 – QSR	FTSE/JSE RAFI 40 – QSR
FTSE RAFI Emerging - QSR	FTSE RAFI US 1000 – QSR	FTSE RAFI China 50 – QSR
FTSE RAFI Europe – QSR	FTSE RAFI US 1500 Mid Small – QSR	FTSE JSE RAFI All Share – QSR
FTSE RAFI Developed Europe Mid Small – QSR	FTSE RAFI ITALY 30 – QSR	FTSE RAFI UK 300 – QSR
FTSE RAFI Developed ex US 1000 – QSR	FTSE RAFI Developed Mid Small 1500 – QSR	FTSE RAFI China 70 (Red Chip and H Share) – QSR
FTSE RAFI Developed Mid Small ex US 1500 - QSR	FTSE RAFI Japan – QSR	FTSE RAFI JAPAN 350 – QSR
FTSE RAFI Developed 1000 – QSR	FTSE RAFI Switzerland – QSR	FTSE RAFI Hong Kong/China 80 – QSR

References

Blitz, David, Van der Grient, Bart and Van Vliet, Pim, Fundamental Indexation: Rebalancing Assumptions and Performance (August 3, 2010). Journal of Index Investing, Vol. 1, No. 2, pp. 82-88, 2010

Fama, Eugene F., and Kenneth R. French. 1992. "The Cross-Section of Expected Stock Returns." *Journal of Finance*, vol. 47, no. 2 (June):427–465.

Fernholz, E. Robert. 1998. "Portfolio Generating Functions." Working Paper, INTECH (June 2).

APPENDIX A. International Market Results

Figure A1.   Value Added of FTSE RAFI All World 3000 Relative to FTSE Developed by Rebalance Month, Calendar Year 2009
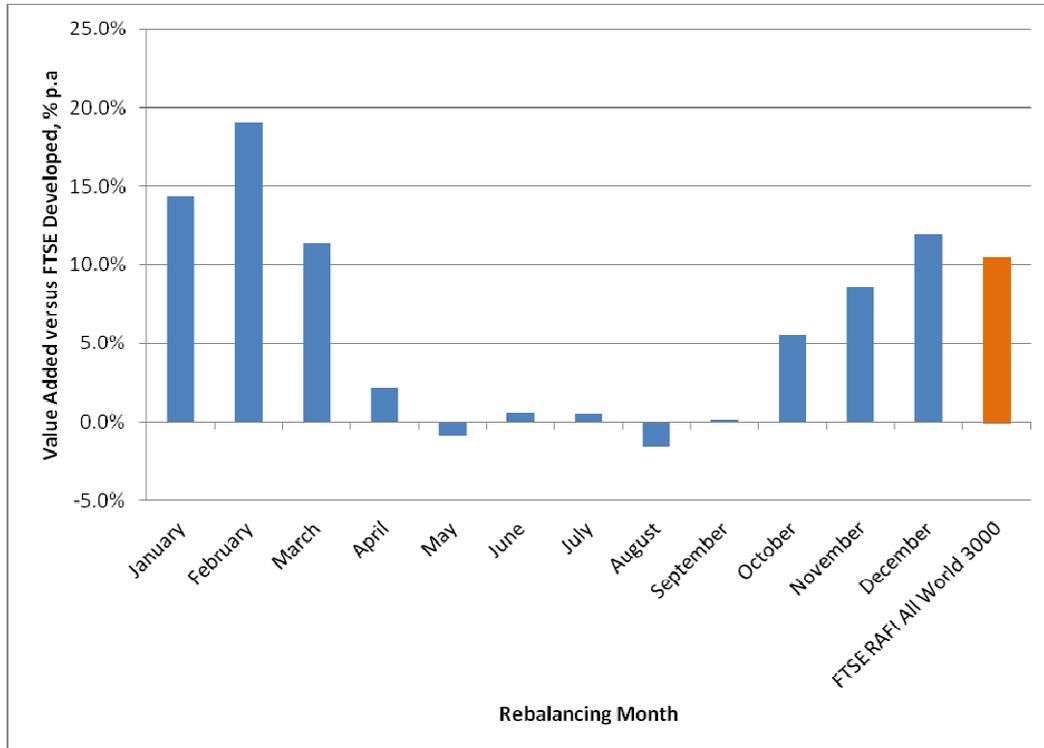
Source: Research Affiliates, LLC.

Figure A2. Performance of Best and Worst Annual Rebalance Months Versus the Average Annual Outcome — FTSERAFI All World 3000
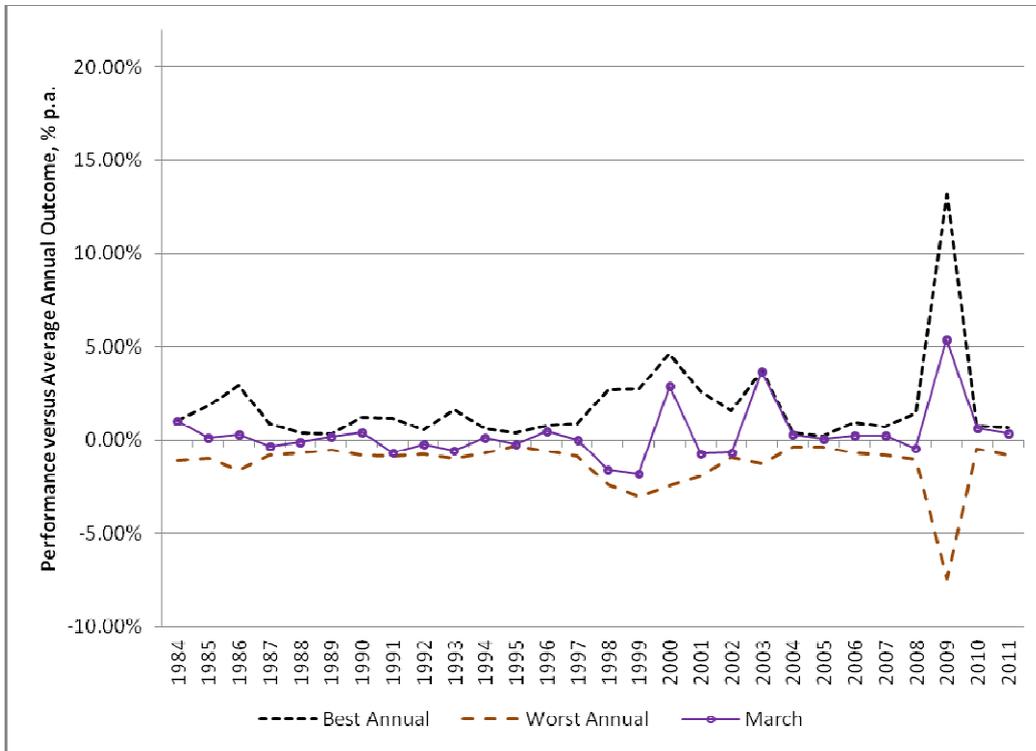
Source: Research Affiliates, LLC.

Figure A3. Performance Versus FTSE RAFI All World 3000 By Rebalance Month — Average Outcome 1984–2011
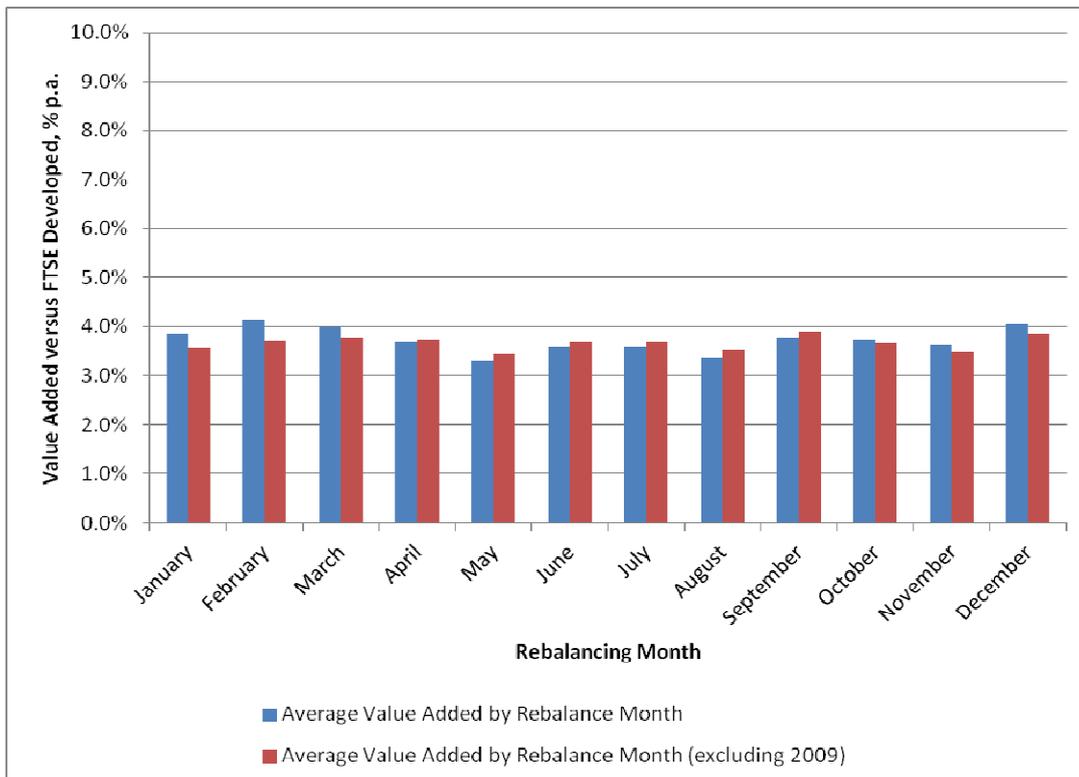
Source: Research Affiliates, LLC.

Figure A4. Annual, Semi-annual and Quarterly: Best and Worst Rebalance Outcomes vs. the Average of the Matching Frequency — FTSE RAFI All World 3000
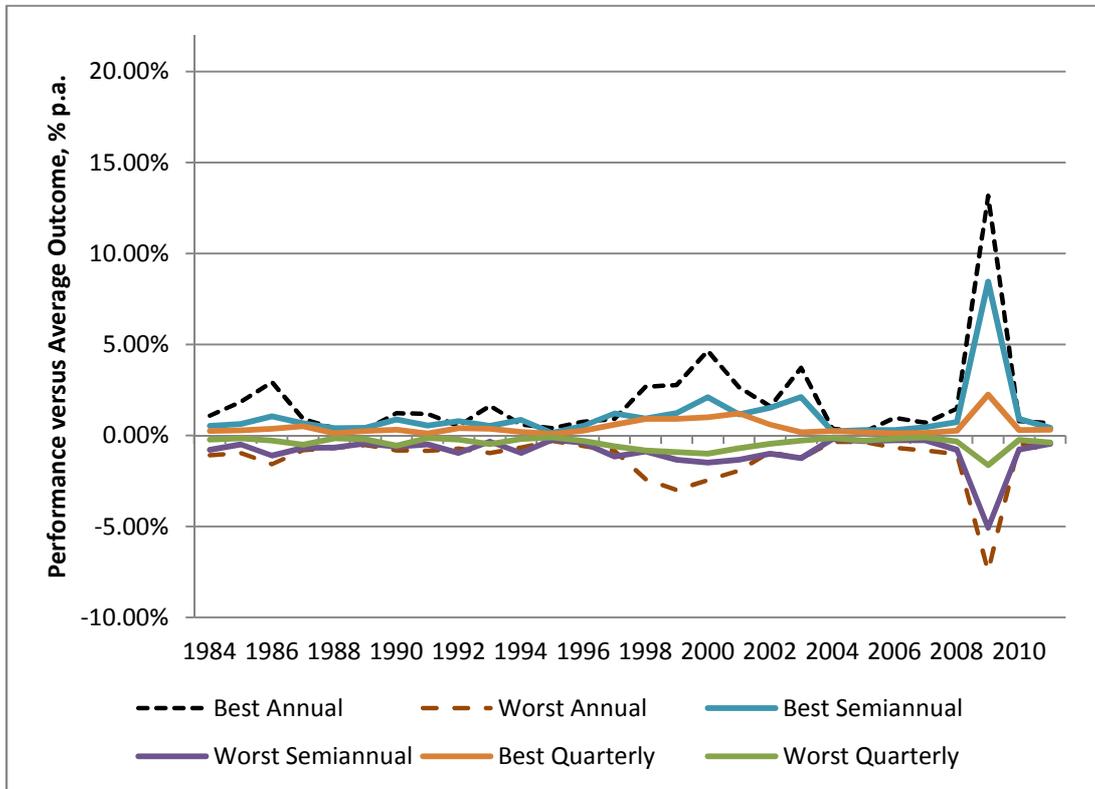
Figure A5.   Annual and Staggered: Best and Worst Outcomes versus the Average of the Matching Frequency — FTSE RAFI All World 3000
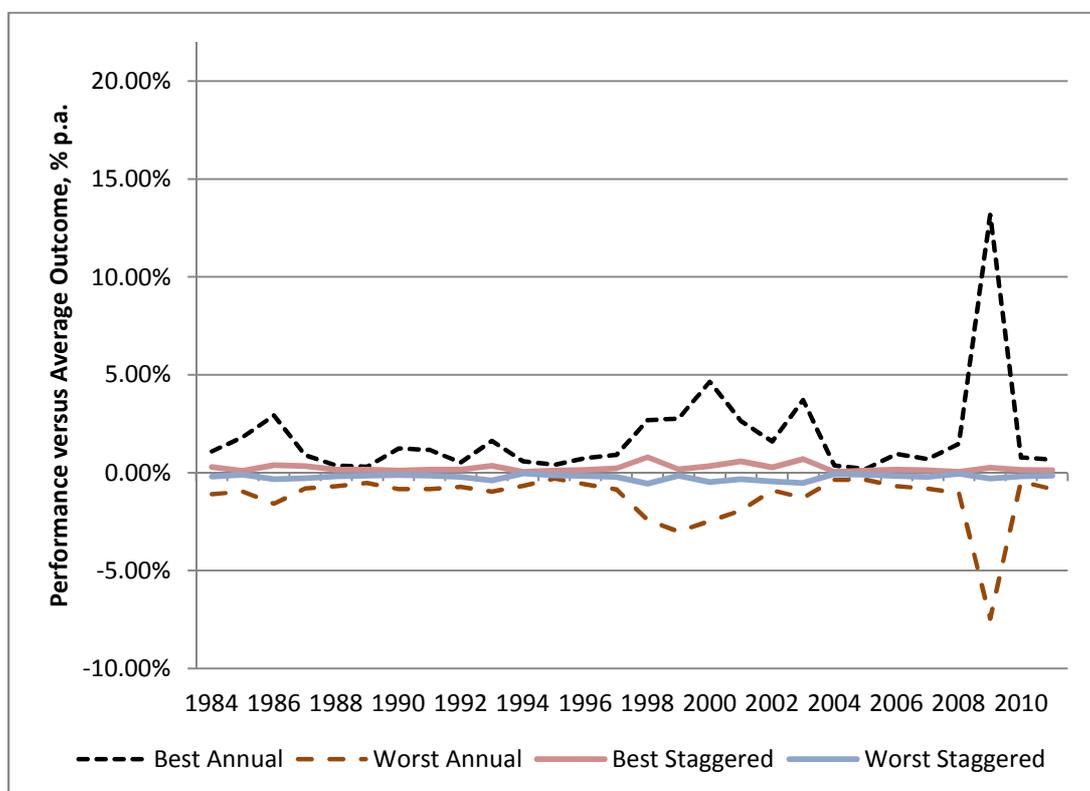
Table A1.   Performance and Turnover as a Function of Rebalance Frequency — All World (1984–2011)

Frequency Statistics	Annually[a]	Semi-annually[b]	Quarterly[c]	Staggered Rebalancing[d]
Average Value-Add (Annualized 1984-2011)	3.74%	3.80%	3.89%	3.74%
Average Turnover (Annualized 1984-2011)	13.61%	18.61%	25.55%	13.82%

[a] Average of the 12 annually rebalanced indices each rebalanced it a difference month-end.
[b] Average of the 6 semi-annually rebalanced indices.
[c] Average of the 3 quarterly rebalanced indices.
[d] Average of the 3 rebalanced indices each rebalanced it a difference quarter-end.

APPENDIX B. Emerging Market Results

Figure B1.   Value Added of FTSE RAFI Emerging Relative to FTSE Emerging by Rebalance Month, Calendar Year 2009
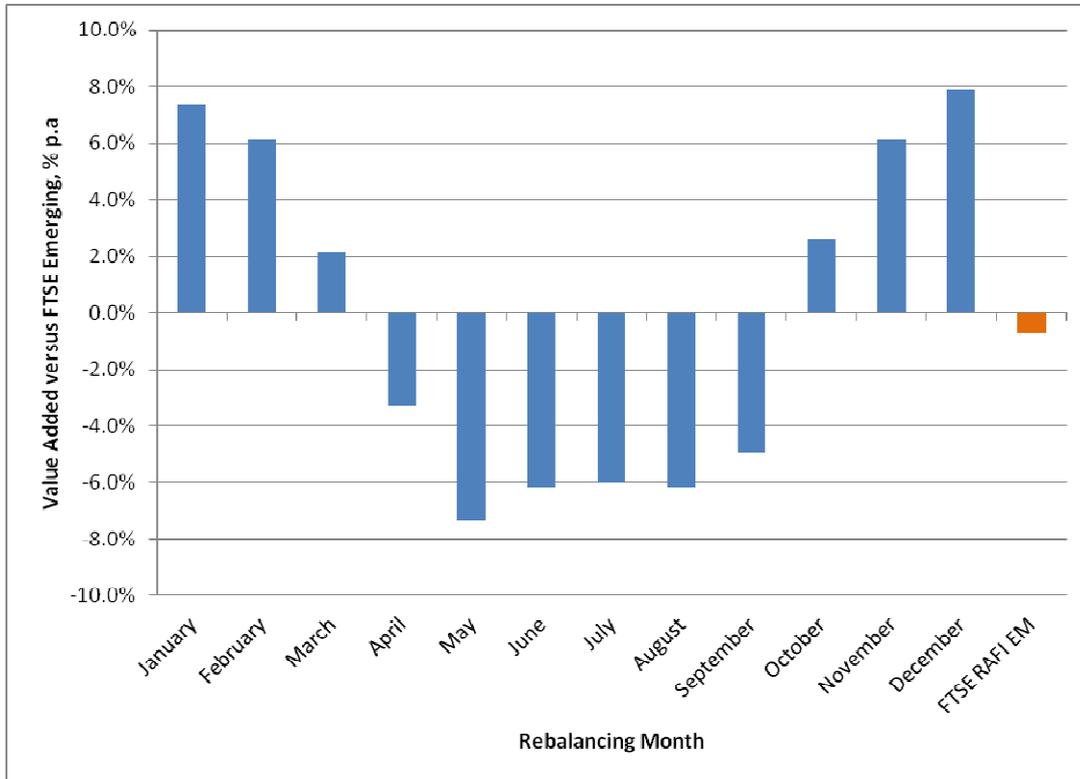
Source: Research Affiliates, LLC.

Figure B2.   Performance of Best and Worst Annual Rebalance Months Versus the Average Annual Outcome — FTSE RAFI Emerging
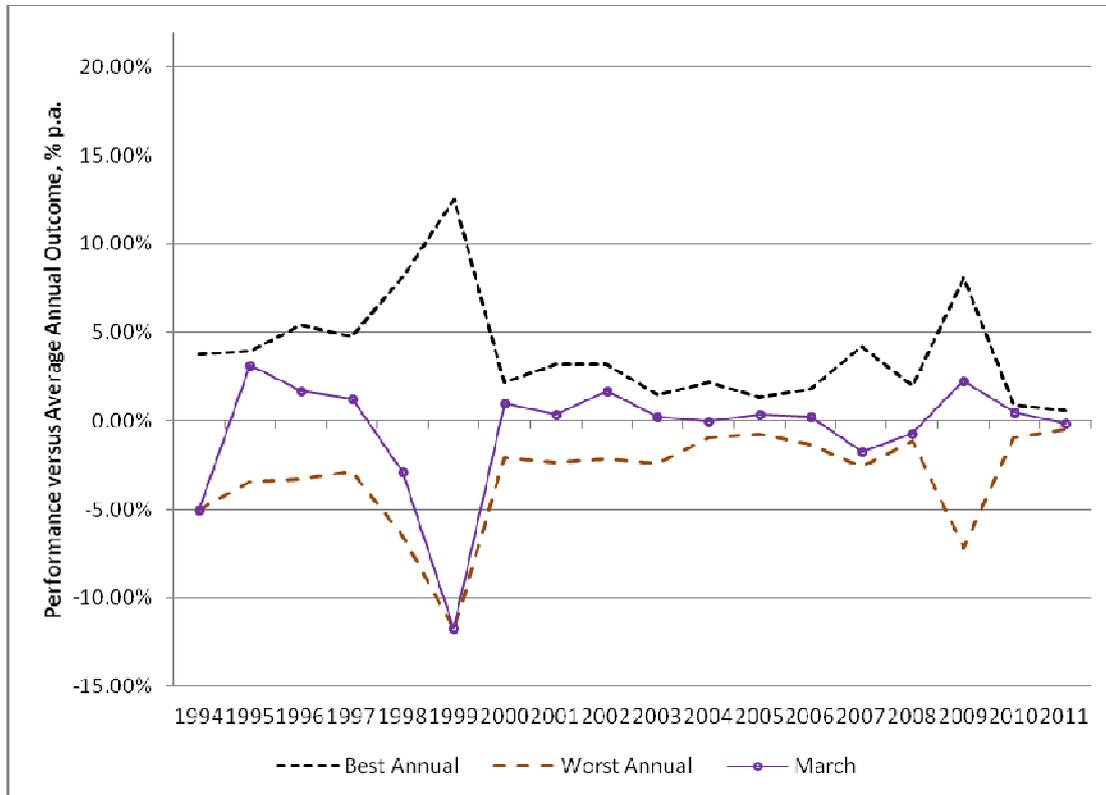
Source: Research Affiliates, LLC.

Figure B3.   Performance Versus FTSE Emerging By Rebalance Month, Average Outcome 1984–2011
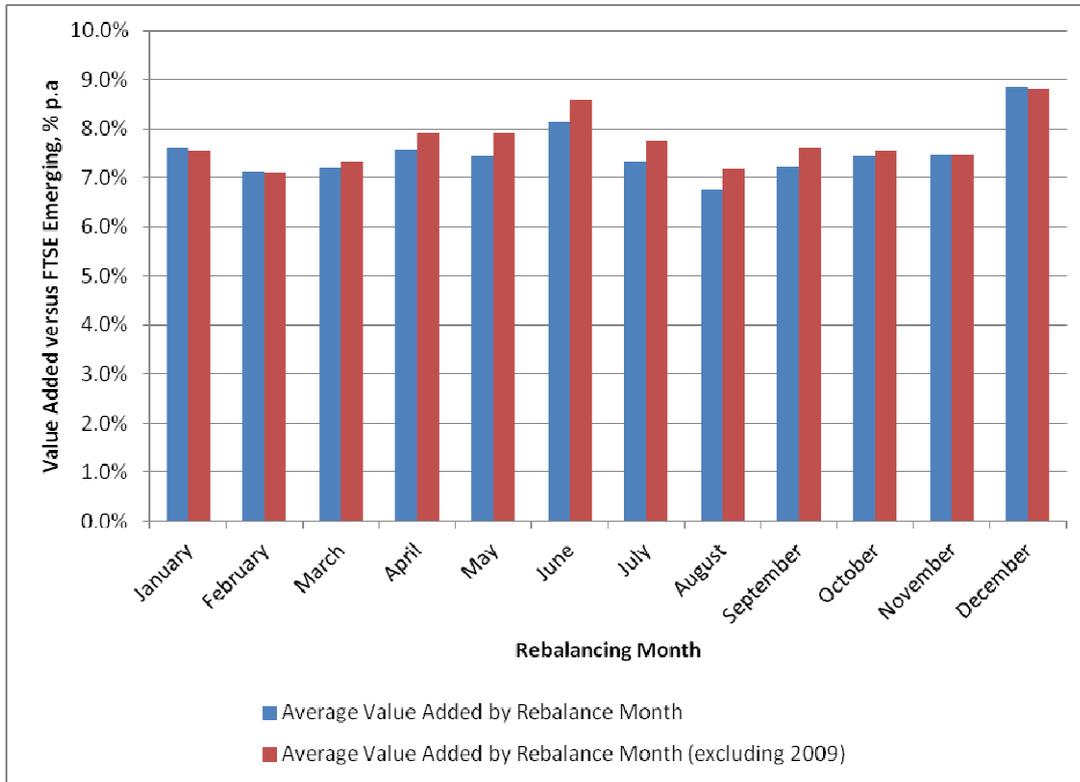
Source: Research Affiliates, LLC.

Figure B4.   Annual, Semi-annual and Quarterly: Best and Worst Rebalance Outcomes vs. the Average of the Matching Frequency — FTSE RAFI Emerging
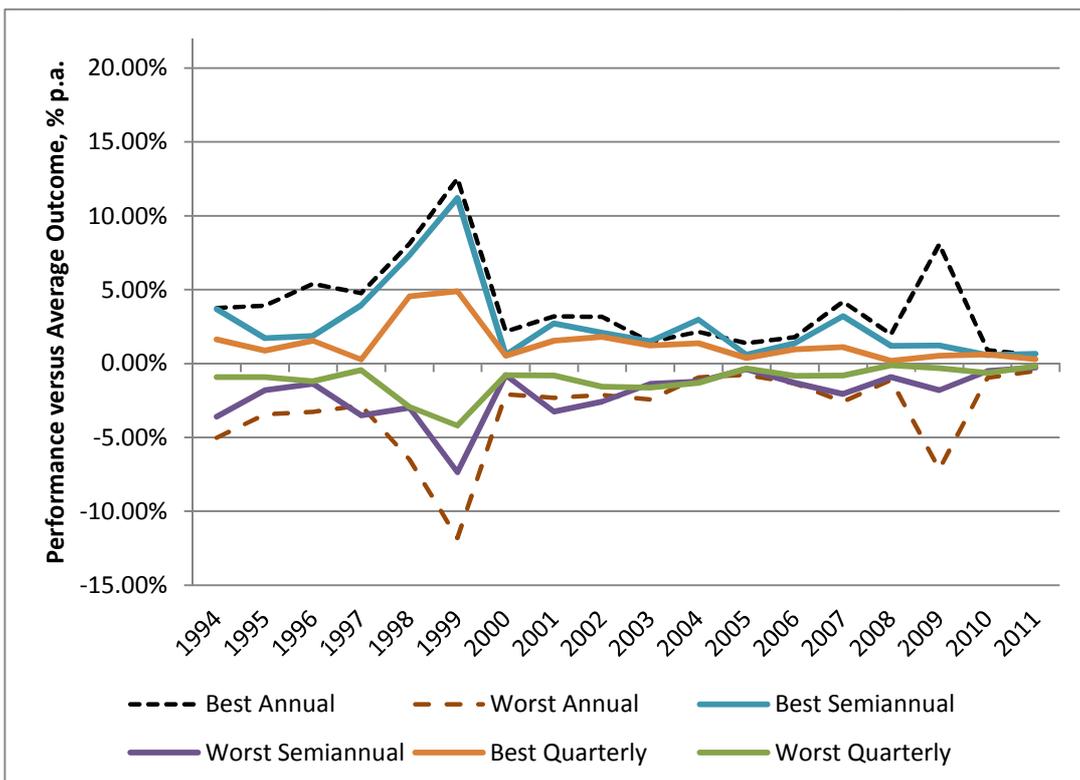
Source: Research Affiliates, LLC.

Figure B5. Annual and Staggered: Best and Worst Outcomes versus the Average of the Matching Frequency — FTSE RAFI Emerging

Source: Research Affiliates, LLC.

Table B1. Performance and Turnover as a Function of Rebalance Frequency, Emerging Markets (1994-2011)

Frequency / Statistics	Annually[a]	Semi-annually[b]	Quarterly[c]	Staggered Rebalancing[d]
Average Value-Add (Annualized 1994-2011)	7.54%	8.22%	8.42%	7.55%
Average Turnover (Annualized 1994-2011)	22.13%	29.13%	38.94%	22.26%

a Average of the 12 annually rebalanced indices each rebalanced it a difference month-end.
b Average of the 6 semi-annually rebalanced indices.
c Average of the3 quarterly rebalanced indices .
d Average of the 3 rebalanced indices each rebalanced it a difference quarter-end.
Source: Research Affiliates, LLC.

APPENDIX C. Fundamental Index Strategy

What is the Fundamental Index strategy?

The RAFI® (Research Affiliates Fundamental Index®) methodology involves selecting and weighting securities by fundamental measures of company size, as opposed to market capitalization. The methodology captures many of the benefits of passive investing—such as transparency, objectivity, broad economic representation, and diversification—with less exposure to pricing errors and fads.

The RAFI methodology is designed to work in inefficient markets. Security prices contain errors and they revert back to fair value over time. Using fundamental measures of company size, such as sales and dividends, the RAFI methodology represents a company's economic footprint, not constantly shifting market expectations, bubbles and anti-bubbles reflected in its share price.

Cap-weighted indices are measures of the market, and thus are generally viewed as good benchmarks of market performance. As the basis for an investment strategy, however, cap weighting results in overweighting overpriced securities and underweighting underpriced securities. When the overvalued stocks decline, or when undervalued stocks rebound, Fundamental Index investors benefit. In fact, contra-trading against the market's excesses and speculations is a significant source of added value for the Fundamental Index methodology.

According to our research, the Fundamental Index approach has generated added value of about 2% per year over cap-weighted indexes for large company stocks in developed markets. The opportunity to add value is greater in less efficient parts of the market, such as emerging market equities or small companies. The research was first published in the *Financial Analysts Journal* by Arnott, Hsu and Moore in March/April 2005.

Why does the Fundamental Index approach rebalance?

By construction, a cap-weighted index has low turnover: changing prices automatically track the changing capitalizations. Any non-cap-weighted portfolio will experience somewhat higher turnover than a cap-weighted index. This turnover is necessary to rebalance against the price movements.

Generally, the Fundamental Index strategy has two sources of turnover: 1) rebalancing against recent price movements; 2) rebalancing to reflect new fundamental weights. To minimize turnover, the FTSE RAFI Index Series uses an average of fundamental measures: five-year averages for three sales, cash flow, and dividends plus current book value. Using long-term averages helps reduce the changes in portfolio reconstitution and rebalancing..

A large portion of each FTSE RAFI rebalancing involves selling stocks that have gone up in price and buying stocks prices have declined. This process often means buying stocks that are feared by the market and selling stocks loved by the market. This contra-trading is a major contributor to the Fundamental Index strategy's added value over the cap-weighted benchmark.

APPENDIX D. FTSE RAFI QSR Index Series Methodology Details

What is the Fundamental Index strategy?

Figure D1 illustrates the mechanics of a staggered rebalance approach implemented in FTSE RAFI QSR index series. The new fundamental weights are computed in March of each year. Before the first rebalancing, the existing portfolio is divided into four identical tranches, where each tranche is a quarter of the total portfolio. In March the first tranche is rebalanced to the new fundamental weights. Between March and June the tranches are drifting with the prices. Since the first tranche is different from tranches two, three and four, by June their weights will deviate from 25% in the total portfolio. In June the four tranches are rebalanced to 25% each and then the second tranche is rebalanced to the fundamental weights determined in March. Similarly in September and December the tranches are first equalized to 25% each and then the third tranche is rebalanced to fundamental weights in September and the fourth is rebalanced to fundamental weights in December. After the last rebalancing in December the four tranches are combined into a single portfolio. Between March and December the four tranches contain different constituents and weightings, they will diverge in value. The staggered index consists of the aggregate position across all four tranches.

Figure D1. Mechanics of Staggered Rebalancing in FTSE RAFI QSR Index Series
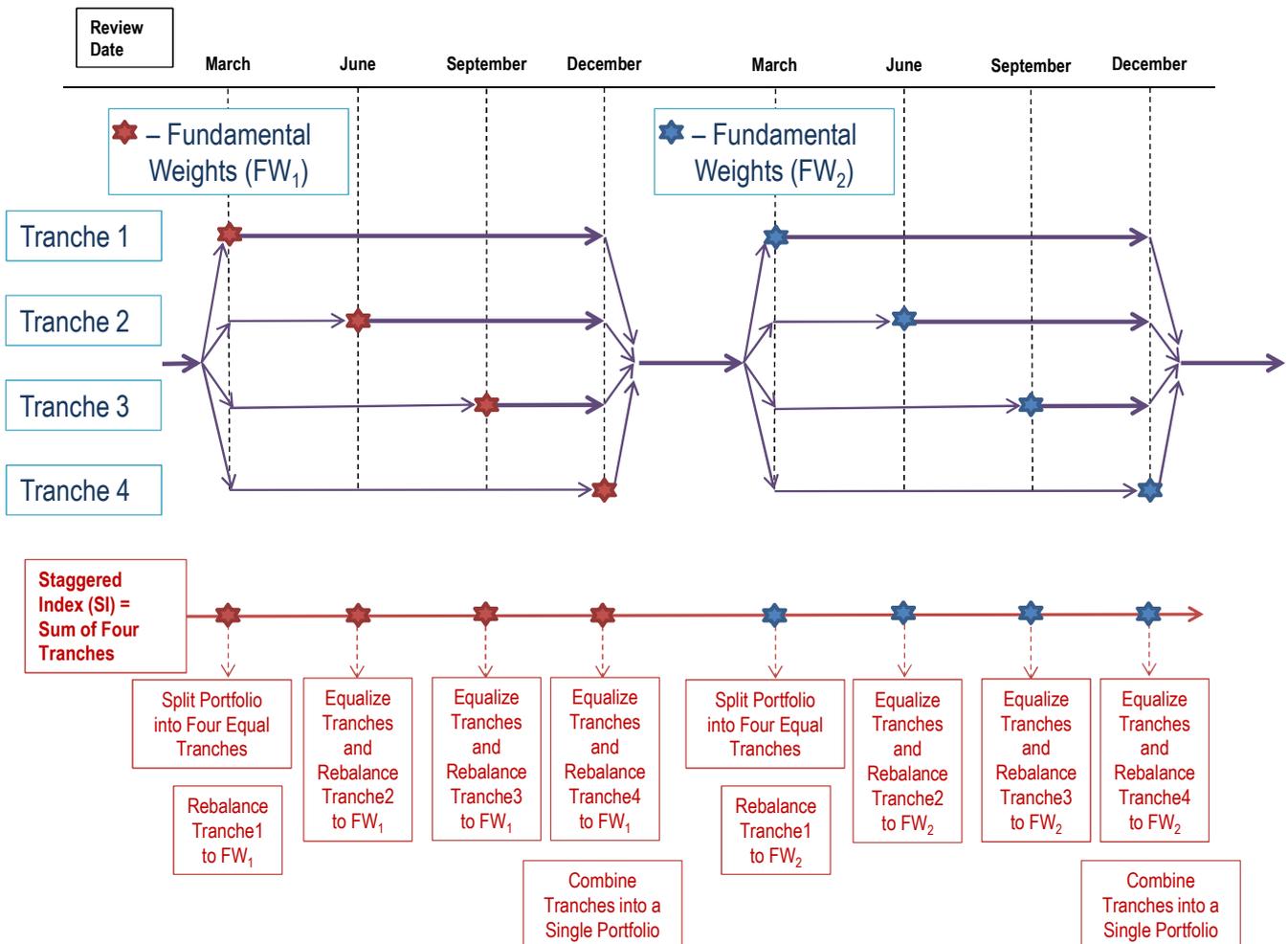
Source: Research Affiliates, LLC.

Table D1.   Performance and Turnover as a Function of Rebalance Frequency Compared with Regular and FTSE RAFI QSR Staggered methods

Frequency / Statistics	Annually[a]	Semi-annually[b]	Quarterly[c]	Staggered Rebalancing[d]	FTSE RAFI QSR Staggered
Average Value-Add (US-1000) (Annualized 1963-2011)	1.67%	1.64%	1.66%	1.67%	1.77%
Average Turnover (US-1000) (Annualized 1963-2011)	11.13%	15.62%	21.42%	11.25%	11.20%
Average Value-Add (All World-3000) (Annualized 1994-2011)	7.54%	8.22%	8.42%	7.55%	3.64%
Average Turnover (All World-3000) (Annualized 1994-2011)	22.13%	29.13%	38.94%	22.26%	13.80%

Figure 6   Annual and Staggered: Best and Worst Outcomes versus the Average of the Matching Frequency — FTSE RAFI QSR US 1000 Index
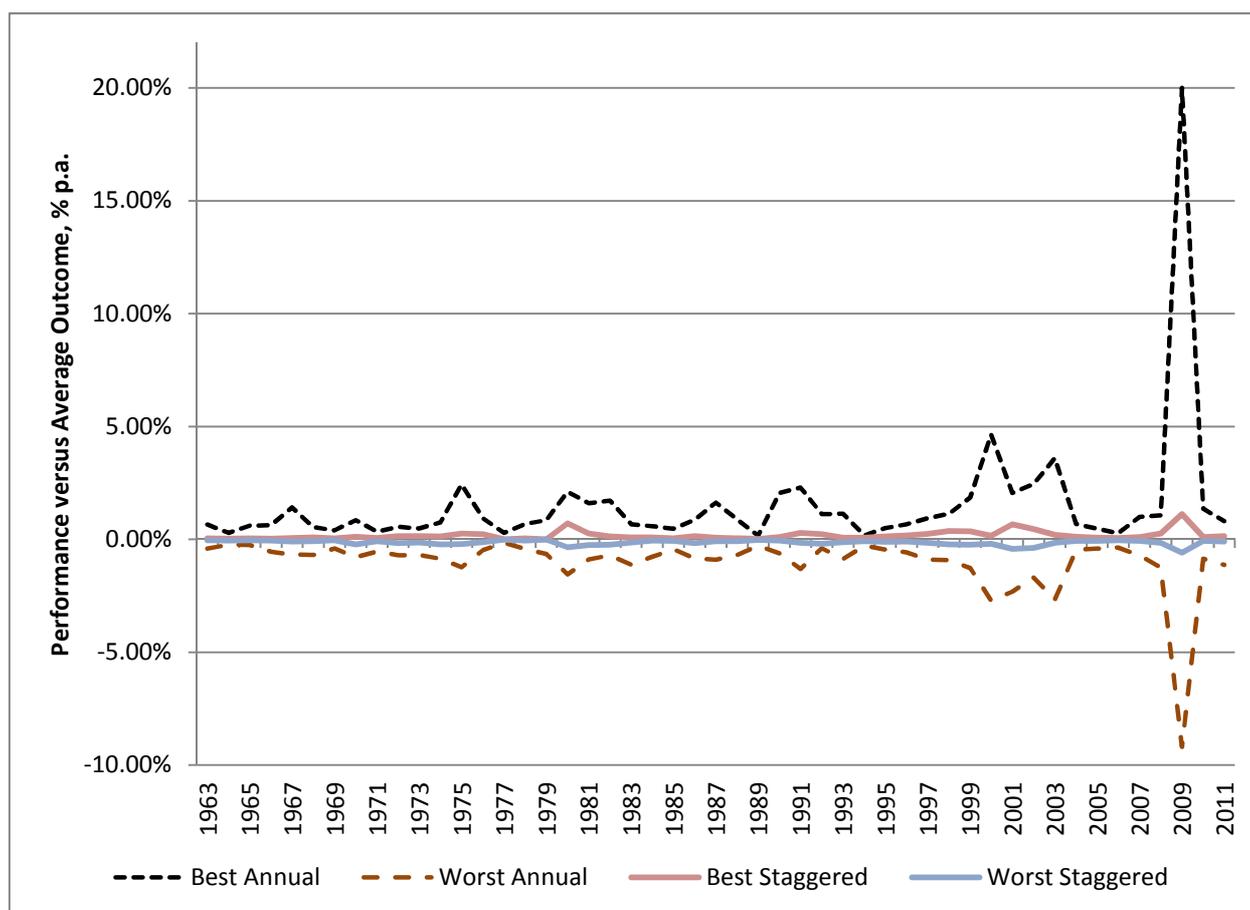
Source: Research Affiliates, LLC.

Figure D2. Annual and Staggered: Best and Worst Outcomes versus the Average of the Matching Frequency — FTSE RAFI QSR All World 3000
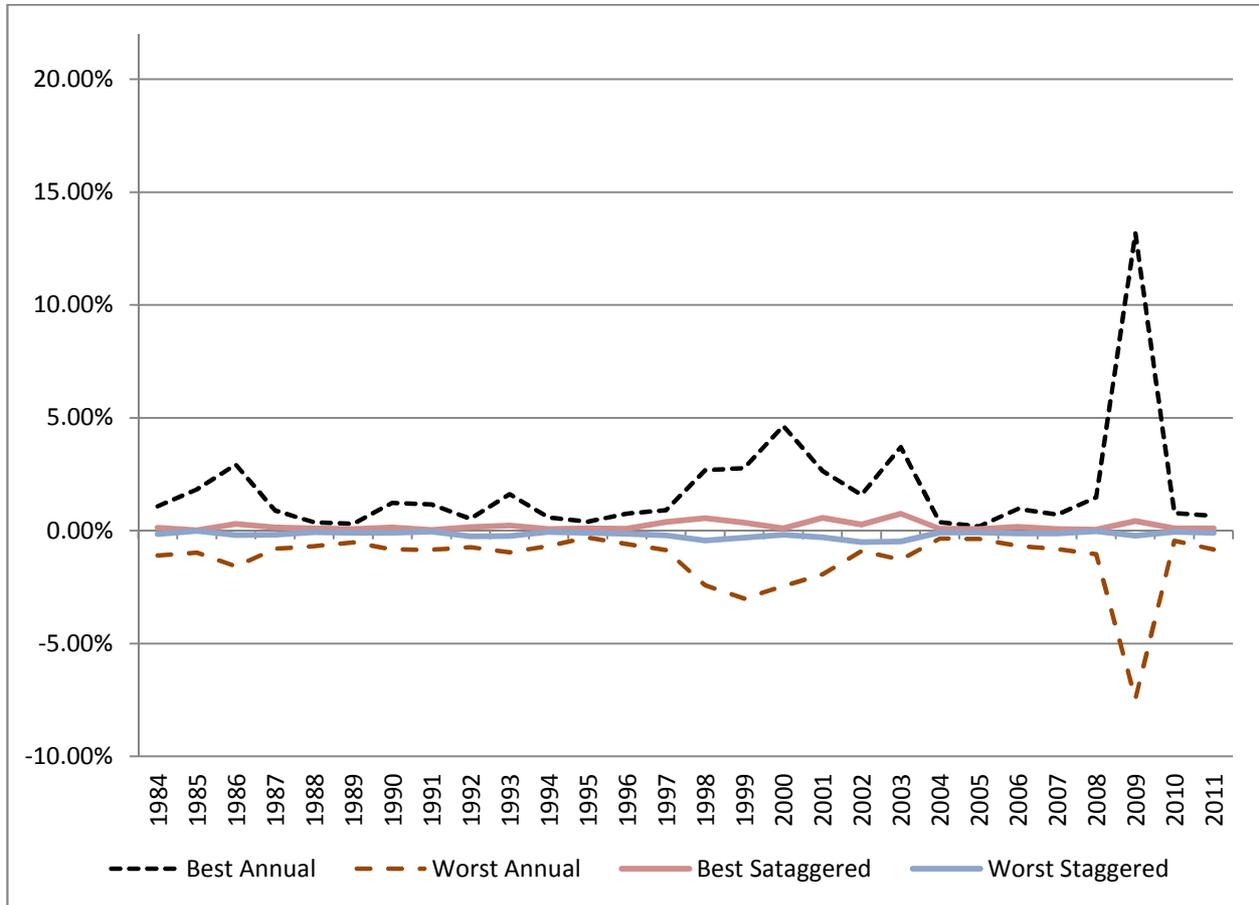
Source: Research Affiliates, LLC.

Disclaimer

"FTSE®" is a trade mark of the London Stock Exchange Group companies and is used by FTSE International Limited ("FTSE") under licence.

"Fundamental Index®" and/or "Research Affiliates Fundamental Index®" and/or "RAFI" and/or all other RA trademarks, trade names, patented and patent-pending concepts are the exclusive property of Research Affiliates, LLC ("RA") ("Partner").   The FTSE Research Affiliates Fundamental Indices ("FTSE/RAFI Indices") are calculated by FTSE RA. All rights in and to the FTSE/RAFI Indices vest in FTSE and/or its relevant Partner(s).

All information is provided for information purposes only. Every effort is made to ensure that all information given in this publication is accurate, but no responsibility or liability can be accepted by FTSE, Partner or their licensors for any errors or for any loss from use of this publication. Neither FTSE, Partner nor any of their licensors makes any claim, prediction, warranty or representation whatsoever, expressly or impliedly, either as to the results to be obtained from the use of the name of the Index set out above or the fitness or suitability of the Index for any particular purpose to which it might be put. No part of this information may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of FTSE. Distribution of FTSE index values and the use of FTSE indices to create financial products requires a licence with FTSE and/or its licensors.

THE INDEX DATA PUBLISHED HEREIN IS SIMULATED, UNMANAGED AND CANNOT BE INVESTED IN DIRECTLY. PAST SIMULATED PERFORMANCE IS NO GUARANTEE OF FUTURE PERFORMANCE AND IS NOT INDICATIVE OF ANY SPECIFIC INVESTMENT. ACTUAL INVESTMENT RESULTS MAY DIFFER. The simulated data contained herein is based on the patented non-capitalization weighted indexing system, method and computer program product (see Robert D. Arnott, Jason Hsu and Philip Moore. 2005. "Fundamental Indexation." *Financial Analysts Journal* [March/April]:83-99).

Any information and data pertaining to indexes contained in this document relates only to the index itself and not to any asset management product based on the index. No allowance has been made for trading costs, management fees, or other costs associated with asset management as the information provided relates only to the index itself. With the exception of the data on Research Affiliates Fundamental Index, all other information and data are based on information and data available from public sources.

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.

The trade names Fundamental Index®, RAFI®, the RAFI logo, and the Research Affiliates corporate name and logo are registered trademarks and 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 marks.

Fundamental Index®, the non-capitalization method for creating and weighting of an index of securities, is patented and patent-pending proprietary intellectual property of Research Affiliates, LLC (US Patent No. 7,620,577; 7,747,502; 7,792,719; 7,778,905; and 8,005,740; Patent Pending Publ. Nos. US-2007-0055598-A1, US-2008-0288416-A1, US-2010-0191628, US-2010-0262563, WO 2005/076812, WO 2007/078399 A2, WO 2008/118372, EPN 1733352, and HK1099110).