

The Hidden Costs of Changing Indices

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Summary

If a large amount of capital is linked to an index, changes to the index impact realized fund returns even when fund returns track the index. These hidden costs occur because funds benchmarked to the index all trade in predictable ways, i.e., buy securities whose weights increase and sell securities whose weights decrease. This trading lowers the returns of the index itself. Numerous studies following index changes find these costs can be significant. This research note examines the costs for Vanguard's 2013 transition for its Emerging Markets ETF (VWO) from the MSCI Emerging Markets Index to the FTSE Emerging Index. Prior to the transition a standard transaction costs model estimates an expected performance impact to investors of 27 basis points. After the fact analysis suggests actual transition costs of at least 51 basis points, and many times that if one believes the August 2013 South Korean returns are due to the transition's previous heavy selling.

Introduction

Passive index investing enables investors to construct a diversified portfolio with the desired risk exposures and low management fees. While index investing has many attractive features, if funds with significant assets under management are benchmarked to indices then changes to indices can impact investors' realized returns even when funds perfectly track an index. These hidden costs occur because changes to the index impact the value of the index itself through the trading of funds benchmarked to the index. This problem has been known since Harris and Gurel (1986) studied additions to the S&P 500 index. They find that prices for additions increase upon announcement and then are nearly fully reversed after 2 weeks. Funds tracking the index exhibit no underperformance relative to the index because the benchmark index incorporates these same inferior prices. However, these funds underperform relative to adjusting their portfolio prior to the change in the index, i.e., a fund buying the additions before the change would have higher returns than the index. While stocks are added and deleted from the S&P 500 occasionally, other indices are periodically adjusted. Madhavan (2003) examines the reconstitution of the Russell indices and finds large temporary price effects of nearly 6 percent for additions. As with the S&P additions these significant price effects can be hidden when comparing the performance of funds to the Russell indices because both the funds' returns and the index returns are negatively impacted by these temporarily high prices.

A number of indices have been redefined on a one time basis. To the extent that index trading induces inefficient prices, these events represent profit opportunities to arbitrageurs and losses to buy-and-hold index fund investors. Greenwood (2005) studies the redefinition of the Nikkei 225. He finds that the event caused very large transitory price effects that lasted at least 10 weeks and "transferred more than ¥300 billion to arbitrageurs." This represents a cost of more than 10 percent of assets under his "assumption that index-linked assets total ¥2,430 billion." This change was so costly and disruptive that "following the redefinition, the popularity of the Nikkei 225 as a benchmark declined..." Hau, Massa, and Peress (2010) study a redefinition of the MSCI Global Equity Index based on the freely floating proportion of a stock's capitalization instead of the market capitalization itself. Stocks with higher free floats were given higher weights while stocks with smaller floats had their index weights reduced. They found that "a strategy that buys a stock upweighted by one standard deviation and sells a stock downweighted by the same amount yields an average abnormal return of 1.18%." Hau (2007) extends this analysis by examining the returns to an arbitrage strategy around the index change. He finds that the arbitrage portfolio outperforms the old MSCI index by 7.99%." This difference in relative performance represents a loss incurred by buy-and-hold investors in the index fund.

The above academic literature suggests that redefining indices can be very costly for buy-and-hold investors. Transitioning the benchmark for a fund poses similar problems for investors, especially when the assets are in less liquid, more difficult to trade securities. Buy-and-hold investors can expect poor performance due to trading and transitory price effects associated with changing indices. These costs are not visible if performance is compared to a benchmark equally affected by the change. Rather the costs should be measured relative to a performance benchmark unassociated with the index change. This is the approach the above academic studies try to perform following an index change. Unfortunately for buy-and-hold investors these costs are only visible after the costs have been incurred.

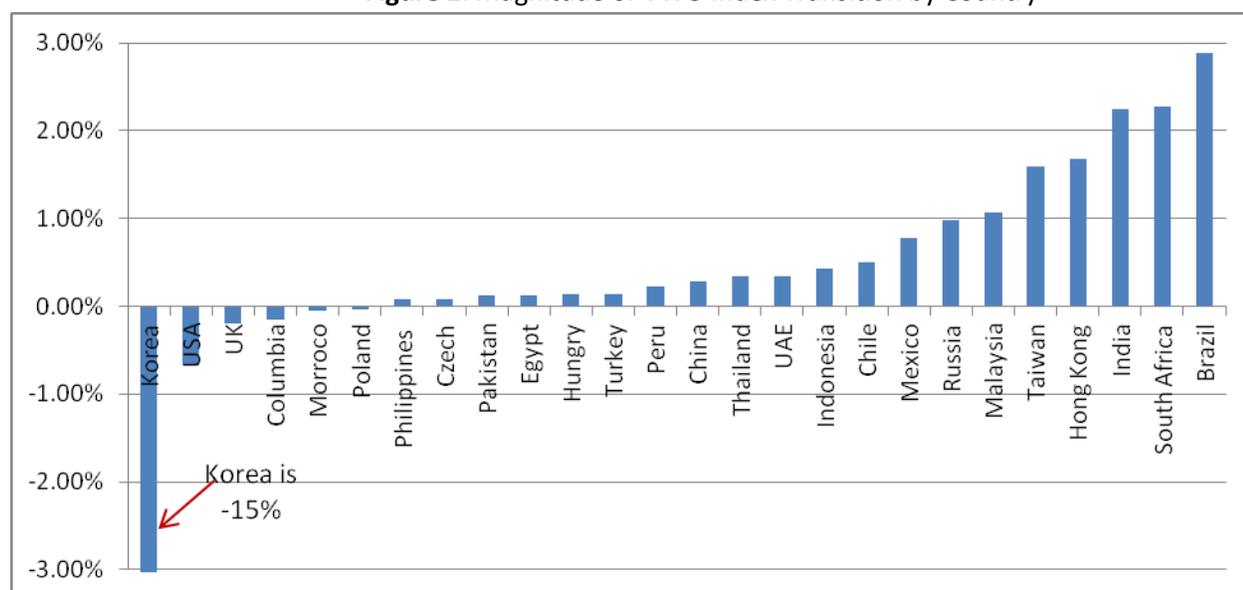
The transition for Vanguard's Emerging Markets ETF (VWO) to the FTSE Emerging Index is very similar to the above index redefinitions as securities in the MSCI index that are not in the FTSE index will be sold and securities not in the MSCI index that are in the FTSE index will be bought. Something along these lines occurred on May 16, 2003 with Vanguard's transition of its mid-cap index mutual fund with \$3.3 billion in assets from the S&P 400 MidCap Index to the MSCI U.S. Mid Cap 450 Index. An online appendix provides details on the returns of the

Vanguard fund, the legacy index (S&P 400), the target index (MSCI Mid Cap 450), and the benchmark index (S&P 400 through May 16 and MSCI afterwards). Vanguard’s fund outperformed the benchmark index by 0.84% over the entire 2003 year. Despite this the fund underperformed the target index by 4.10% and the legacy index by 1.30%. How could the fund beat the benchmark, yet underperform relative to the two indices composing the benchmark? Based on the academic studies the answer is the fund’s selling temporarily depressed the legacy index and the fund’s buying temporarily inflated the target index on the exact day the benchmark transitioned between the two indices.

Estimating the size of the VWO transition

The most natural approach to estimating the cost of a transition is to use standard industry models for transaction costs to estimate the costs of each trade required to complete the transition.¹ The aggregation of the costs for these transactions represents the expected costs to buy-and-hold investors due to the transition.

Figure 1. Magnitude of VWO Index Transition by Country



To estimate the amount of trading required for the VWO transition I obtain the constituent weights for both the MSCI Emerging Markets and the FTSE Emerging indices on October 31, 2012. This was done via FactSet which obtains its information directly from the index providers. The above figure shows the changes in country weights between the two indices.² There are just over 1,000 stocks in the two indices. The largest difference in weight for an individual stock is for Samsung, which represents 3.69% of the MSCI index and like all South Korean stocks is not present in the FTSE index. Given Vanguard’s stated total net assets for VWO of \$71.7 billion,³ the change in Samsung’s weight represents \$2.65 billion dollars in stock to be sold. The same calculation is made of each security in the two indices to determine the amount to be bought or sold for a transition

¹ Another approach could use past index redefinitions as a guide. Based on prior studies this would likely produce very high cost estimates and would not account for changes in market structure and trading since the prior events. Therefore, I prefer a more conservative approach based on estimating the costs of individual trades based on the most recent information.

² The FTSE website states that “Effective March 2013, FTSE will reclassify P Chips from Hong Kong to China in the FTSE Global Equity Index Series and all derived indicies [sic].” Therefore, I include these securities in the FTSE index and assume there is no trading in them. The USA and UK selling are due to foreign listings, ADRs, and GDRs traded in those countries that represent emerging-market firms.

³ Total net assets include the ETF and all mutual fund share classes as of 10/31/12. These define the aggregate size of the portfolio which determines the amount of trading needed for the transition between indices.

between the indices. The amount bought and sold is 20.51% of the portfolio value,⁴ implying \$14.67 billion of securities must be sold from the MSCI index and purchased in the FTSE index to transition between the indices.

Estimating the cost of the VWO transition

After constructing the amount of trading needed in each security I turn to estimating the costs for each trade. I use the basic trading cost model from Grinold and Kahn (1999, p.452):

$$Cost = taxes + commission + \% spread + k \times \sigma \times \sqrt{\frac{TradeSize}{AvgDailyVolume}}$$

The final term in the cost equation is referred to as the price impact of a trade. It is the only cost term that is affected by how quickly an index transition is accomplished. Intuitively the price impact is a function of the risk a market maker facilitating the trade would bear on his inventory position. The σ represents the stock's daily volatility and incorporates the risk to a market maker. The price impact is also affected by the stock's liquidity as measured by average daily trading volume. The ratio of the trade size to average daily volume is an estimate of how long a market maker would need to hold a position. The square root is motivated by empirical observation of trading costs.⁵ k is a constant which aggregates the risk and size of a trade in the market maker's risk/return tradeoff. I use $k=0.3$. To illustrate the reasonableness of this k and the price impact equation Samsung's characteristics are used to calculate the amount of market impact. Samsung's daily volatility estimate from BARRA is 1.9%, implying that a trade size of average daily volume would have a price impact of 57 basis points. Samsung's average daily trading volume for October 2012 from Bloomberg is \$323 million. Therefore a \$3.23 million sale of Samsung would have a price impact of 5.7 basis points. These modest numbers illustrate the conservative choices made for the cost calculations.

The first 3 terms in the cost equation are costs constant in the amount traded. This implies that transaction taxes, commissions, and spreads are independent of the time period over which the transition from one index to another occurs. Table 1 below reports the estimates of these cost components in basis points.⁶ The fixed costs represent 9 basis points of performance drag with close to half of that coming from taxes.

Table 1. Estimate of Trading Costs (Performance Drag) for VWO Index Transition in Basis Points

Fixed Costs			Price Impact			Total
Taxes	Commissions	Spread	Immediate	Very Slow	Expected	Expected Cost
4	3	2	49	0	18	27

Calculating the price impact for the transition is more complex because it depends on the time period over which the transition is accomplished. If the transition were done immediately (in one day) costs would be the highest. To calculate the price impact from such an immediate transition the amount of the change in index weight times the \$71.7 billion fund size is calculated for each security and used as the TradeSize in the trading cost equation's price impact term. For Samsung this would yield a one-day sale of 8.18 times average daily trading volume which yields a price impact of 163 basis points. Averaged across the entire portfolio for all securities the price impact of an immediate transition is 49 basis points. I expect this number significantly

⁴ This is less than the sum of the positive and negative bars in the figure because within country buys and sells cancel out.

⁵ More recent work suggests that the square root is too small an exponent on the ratio of trade size to daily volume. For example, Almgren et al. (2005) suggest a 3/5 power as opposed to the 1/2 from a square root. Rashkovich and Verma (2012) suggest a power of 0.81. The square root function provides the most conservative estimate and is utilized here.

⁶ BlackRock's trading desk provided the exact fixed cost estimates for each security. The commission figure in Table 1 is lower than published emerging market averages. Similarly, the total cost estimate is also low relative to published emerging market costs. See ITG's Global Cost Review 2012/Q2 for details.

underestimates the cost of a one-day transition because the price impact is unlikely to follow the square function when many times average daily trading volume is bought or sold in a single day. If the transition were done very slowly over the course of many years the price impact could be close to zero.

Vanguard recognizes that an immediate transition between indices would be costly and FTSE announced a transition index with a 25 week transition period from January to June 2013. Accordingly, I assume 4% of the transition trading happens when the transition index changes. This implies that 1/25th of each security's buying and selling occurs on the day the transition index changes.⁷ That fraction is used as TradeSize in the price impact term in the cost equation. This yields an expected price impact of 18 basis points. Adding this to the 9 basis points from the fixed costs gives a total expected cost of 27 basis points.⁸

The actual transition costs

The above estimate of 27 basis points is below the costs of prior index transitions. Vanguard's choice of a long transition period may reflect learning from its costly 2003 MidCap transition, which could reduce the transitions costs. To analyze the 2013 emerging market transition the below table provides the cumulative monthly returns over the transition period for each of the following portfolios: the target FTSE index, the legacy MSCI index, Vanguard's transition benchmark index, and Vanguard's VWO fund. The transition benchmark portfolio is a weighted average of the legacy and target portfolio returns with the weights on the legacy declining from one to zero over the course of the transition.

Table 2. Cumulative 2013 monthly returns for the legacy index (MSCI Emerging Markets index), target index (FTSE Emerging index), benchmark index (MSCI, then FTSE), and Vanguard emerging fund (VWO). Returns are from Bloomberg (legacy and target), FTSE (transition benchmark), and Vanguard (VWO fund).

	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13
Legacy (MSCI)	1.39%	0.09%	-1.64%	-0.89%	-3.44%	-9.59%	-8.63%
Target (FTSE)	2.24%	-0.21%	-1.60%	-0.19%	-3.22%	-9.22%	-8.69%
Benchmark	1.39%	-0.20%	-1.77%	-0.63%	-3.58%	-9.57%	-9.05%
Fund (VWO)	1.37%	-0.33%	-1.98%	-0.77%	-3.90%	-9.86%	-9.30%

Emerging markets performed poorly over the January through July transition period with all of the portfolios being down about 9 percent. Given that the transition ended in June 2013 it is natural to look at returns through July to allow some time for the transition's impact to attenuate. Consistent with the transition impacting the benchmark itself, the transition benchmark portfolio underperforms both the legacy and target indices by 42 and 36 basis points, respectively. The VWO fund underperforms the benchmark by another 25 basis points of which approximate 10 basis points is management fees. Hence, the fund underperforms the legacy and target

⁷ Vanguard could choose to incur some tracking error by trading throughout the week rather than entirely on the index transition day. This seems unlikely as there is no reason the FTSE transition index should change every Wednesday rather than more frequently, e.g., daily. Also, trading each day allows the market less time to digest the prior transaction leading to a persistent price impact discussed below. For the weekly trading modeled here the persistent price impact is assumed to be zero.

⁸ The above estimate of cost of transition was done in December 2012 and written about in January 2013 (<http://blogs.barrons.com/focusonfunds/2013/01/25/quantifying-the-cost-of-vanguards-emerging-markets-index-shift/>).

indices by 67 and 61 basis points, respectively. Removing the management fees, which are unrelated to the transition, suggests transition costs between 57 and 51 basis points.

If the transition's impact on the legacy and target portfolios continues beyond the end of the July, the 46-52 basis point cost estimate understates the true cost. In August 2013 the legacy index (MSCI) outperforms the target (FTSE) index by 1.17%, -1.70% versus -2.87%. This is consistent with transition selling and buying temporarily depressing legacy portfolio returns and raising target portfolio returns through July. Much of the difference in the August portfolio returns comes from South Korea's 2.56% return. As Figure 1 shows South Korea is the largest selling component of the transition. If the transition's selling approximately \$11 billion in South Korea temporarily lowers returns through July which then recover, the 1.17% August return difference between the legacy and target portfolios should be included in estimating the transition's cost. However, ruling out that South Korea's performance in August is due to other factors is not possible.

Conclusion

While index investing has desirable properties, evidence clearly indicates that index changes can induce significant hidden costs for buy-and-hold investors. Prior to Vanguard's 2013 emerging market transition I estimate expected costs of 27 basis points. Retrospective analysis of the transition shows costs of at least 51 basis points, and many times that if one believes the August 2013 South Korean returns are due to the transition's previous heavy selling. While changing indices may enable funds to reduce their management fees by a few basis points in the future, past evidence and Vanguard's 2013 emerging market transition suggest that the immediate performance drag for buy-and-hold investors is substantially higher. It is important to note that these costs cannot be measured by comparing funds to their transitional benchmark index because the performance reduction is also present in the transitional index itself.

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