The Hidden Costs of Changing Indices

Terrence Hendershott

Haas School of Business, UC Berkeley

Summary

If a large amount of capital is linked to an index, changes to the index impact realized fund returns even when fund returns match 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 potential costs for Vanguard's transition for its Emerging Markets ETF (VWO) from the MSCI Emerging Markets Index to the FTSE Emerging Index. A standard approach to estimating trading costs yields an expected performance impact to investors of 27 basis points. Investors should expect to bear these costs even if the VWO portfolio perfectly tracks the FTSE Emerging Transition Index. This cost estimate is lower than the costs found in previous studies, so investors' costs may be substantially higher than the prospective estimate herein.

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. The 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 VWO transition has yet to occur so the transitory price effects are not yet visible as in past studies. Therefore, the most natural approach to estimating the cost of the 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
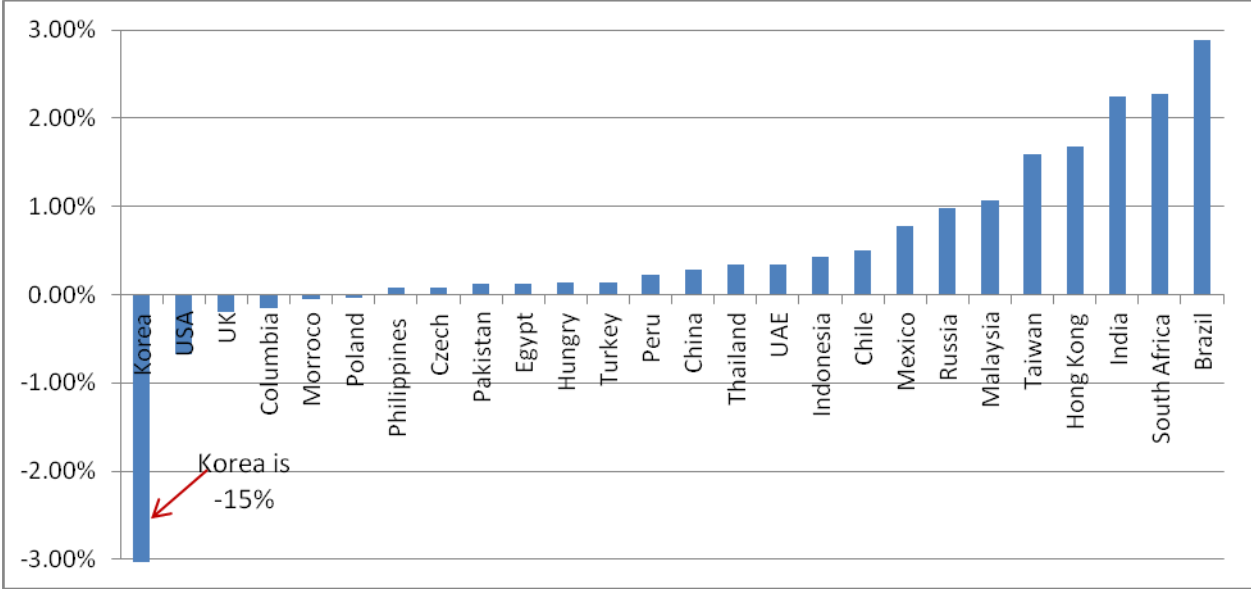
To estimate the amount of trading required for the VWO transition I obtain the constituent weights for both the MSCI Emerging Markets and the FTSE Emerging indices on October 31, 2012. This was done via FactSet which obtains its information directly from the index providers. The above figure shows the 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

---

[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.

is made of each security in the two indices to determine the amount to be bought or sold for a transition 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 57.7 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 5.77 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 165 basis points. Averaged across the entire portfolio for all

---

[4] This is less than the sum of the positive and negative bars in the figure because of 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 at 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.

securities the price impact of an immediate transition is 49 basis points. I expect this number significantly 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. Accordingly, I assume 4% of the transition trading happens when the transition index changes. This implies that $1/25^{th}$ 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.

Other considerations

The estimate of 27 basis points is far below the costs measured in previous studies cited above of index transitions. Even the immediate transition price impact estimate of 49 basis points is quite low by historical experience. This raises the issue of what other factors might increase the costs of the VWO transition. The first concern is that knowing such a large trade is going to occur invites front running by other investors. Investors planning on reducing their exposure to South Korea would be wise to do so before the VWO transition begins. Similarly, arbitrageurs have an incentive to sell stocks that will be sold in the transition in advance. These arbitrageurs then can cover their positions at presumably lower prices and the sustained VWO transition selling drives the prices of the stocks down. Stocks to be bought in the VWO transition will likely experience a temporary increase in price as speculators position themselves in these stocks so they can sell during and after the transition.

The awareness that buying or selling will persist for 25 consecutive weeks is likely to cause trading to have a persistent impact on prices. The above calculation assumes that the price impact from the previous week's trading has no impact on the price by the time the next week's trading occurs. Almgren at al. (2005) estimate the persistence across days to be roughly 50%. Incorporating the magnitude of the persistent price impact from a 25-week long transition would be speculative. However, the direction of the effect is not, any persistent price impact raises the transition cost.

The above transaction cost model assumes trading throughout the day, which is why average daily trading volume is used. To reduce track error due to intraday price movements, index funds have been known to do all their trading at the close. This eliminates tracking error, but reduces the liquidity available and increases price impact. This illustrates an important tradeoff in the hidden costs on index changes, the lower the tracking error during the index change, the higher the hidden costs. Cushing and Madhavan (2000) provide a study of the costs of trading at the closing price.

The VWO transition involves substantial currency trading in addition to the stock trading. If the flows are sufficiently large they may have a price impact on the relevant currencies, particularly the Korean Won. For the redefinition of the MSCI Global Equity Index Hau, Massa, and Peress (2010) find that "the announcement event caused a systematic exchange rate appreciation for (relatively) upweighted countries. Over an 8-trading day window around the announcement event, the 16 most upweighted currencies appreciated relative to the 17

---

[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.

most downweighted countries on average by more than 2%." Such currency effect may occur during the VWO transition and increase its cost to buy-and-hold investors.

Conclusion

While index investing has desirable properties, past experience clearly indicates that index changes can induce significant hidden costs for buy-and-hold investors. There is no reason to believe that these will not occur in the VWO transition. I conservatively estimate the costs will be at least 27 basis points, a number many times smaller than the costs of past changes to indices. While changing indices may enable funds to reduce their management fees by a few basis points in the future, past experience suggests that the immediate performance drag for buy-and-hold investors may be measured in percentage points. It is important to note that these costs cannot be measured by comparing VWO to its transitional benchmark index because the performance reduction is also present in the transitional index itself.

The author gratefully acknowledges financial support for this research from BlackRock, Inc.

References

Almgren, Robert, Chee Thum, Emmanuel Hauptmann, and Hong Li. 2005. Equity market impact. Risk July: 57–62.

Cushing, David, and Ananth Madhavan. 2000. Stock Returns and Trading at the Close. Journal of Financial Markets 3: 45–67.

Greenwood, Robin. 2005. Short- and Long-term Demand Curves for Stocks: Theory and Evidence on the Dynamics of Arbitrage. Journal of Financial Economics 75: 607–649.

Grinold, Richard, and Ronald Kahn. 1999. Active Portfolio Management.

Harris, Lawrence, and Eiten Gurel. 1986. Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures. Journal of Finance 41: 815–29.

Hau, Harald. 2007. A Generalized Portfolio Approach to Limited Risk Arbitrage: Evidence from the MSCI Global Index Change. Working paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=965186.

Hau, Harald, Massimo Massa, and Joel Peress. 2010. Do Demand Curves for Currencies Slope Down? Evidence from the MSCI Global Index Change. Review of Financial Studies 23: 1681–1717.

Madhavan, Ananth. 2003. The Russell Reconstitution Effect. Financial Analysts Journal 59: 51–64

Rashkovich, Vlad, and Arun Verma. 2012. Trade Cost: Handicapping on PAR. Journal of Trading 7: 47–54.

Appendix: Analysis of Vanguard 2003 Index Transition from S&P 400 to MSCI US Mid Cap 450

Vanguard announced that the transition to the new MSCI benchmark was expected to occur between April 20 and September 30, 2003. After the close of trading on Friday, May 16, 2003 it was announced that the mid cap transition had occurred. Therefore, the benchmark index was the S&P MidCap 400 index (the legacy index) through May 16 and beginning on May 19 the benchmark had transitioned to the MSCI Mid Cap 450 index (the target index). The below table provides the cumulative monthly returns differences for each of these relative to the Vanguard fund: the returns on the fund minus the target index, the returns on the fund minus the legacy index, and the returns on the fund minus the benchmark index. Return data for the S&P and MSCI indices is from Morningstar and the Vanguard fund performance is taken from its website. The returns show that the legacy and benchmark indices perform similar to the fund through April 2003 with the fund underperforming by 8 basis points. However, beginning in May the fund outperforms the benchmark while underperforming relative to the legacy index. By the end of the year the fund has outperformed the benchmark by 84 basis points while the fund underperformed the legacy index by 1.30%. Why is this underperformance not visible relative to the

benchmark? Presumably because Vanguard's selling temporarily depresses the legacy index prior to the transition on May 16. Afterwards the legacy rebounds causing the legacy to outperform the benchmark. The underperformance relative to the target index is even worse at 4.10%, most of which occurs in May. The somewhat different patterns in fund performance relative to the target and legacy indices could arise from the stock market rising rapidly during May as the legacy and target indices rose by 8.29% and 10.06%. Buying into such a rising market is generally much more costly than selling.

Table 2. Cumulative monthly returns in 2003 for the Vanguard midcap mutual fund relative to the legacy index (S&P 400 MidCap), target index (MSCI Mid Cap 450), and benchmark index (S&P 400, then MSCI).

	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03
Target	-0.42%	-1.22%	-1.01%	-1.22%	-3.66%	-3.62%	-3.67%	-3.88%	-3.72%	-4.05%	-4.03%	-4.10%
Legacy	-0.01%	-0.02%	-0.01%	-0.08%	-0.60%	-1.20%	-1.85%	-1.69%	-1.54%	-1.81%	-2.56%	-1.30%
Benchmark	-0.01%	-0.02%	-0.01%	-0.08%	0.41%	0.48%	0.55%	0.54%	0.64%	0.63%	0.78%	0.84%

The below figure examines the detailed dynamics of the relative performance of the legacy and target indices around the May 16 transition. The figure graphs the daily cumulative difference in returns between the legacy and target indices. The difference becomes negative approaching May 16 which could arise from Vanguard beginning to sell the legacy and accumulate the target beforehand. On May 16 the legacy index falls 1.29% relative to the target, consistent with Vanguard heavily selling the legacy and buying the target that day. The partial reversion on Monday May 19 of the return spread could be due to Vanguard's announcement of the transition which enabled the market to realize the buying and selling pressures on May 16 were due to the transition. The underperformance of the legacy index remains relatively constant over the rest of the month at close to 2%.

Figure 2. Cumulative daily returns difference in May 2003 between the legacy index (S&P 400 MidCap) and the target index (MSCI Mid Cap 450).
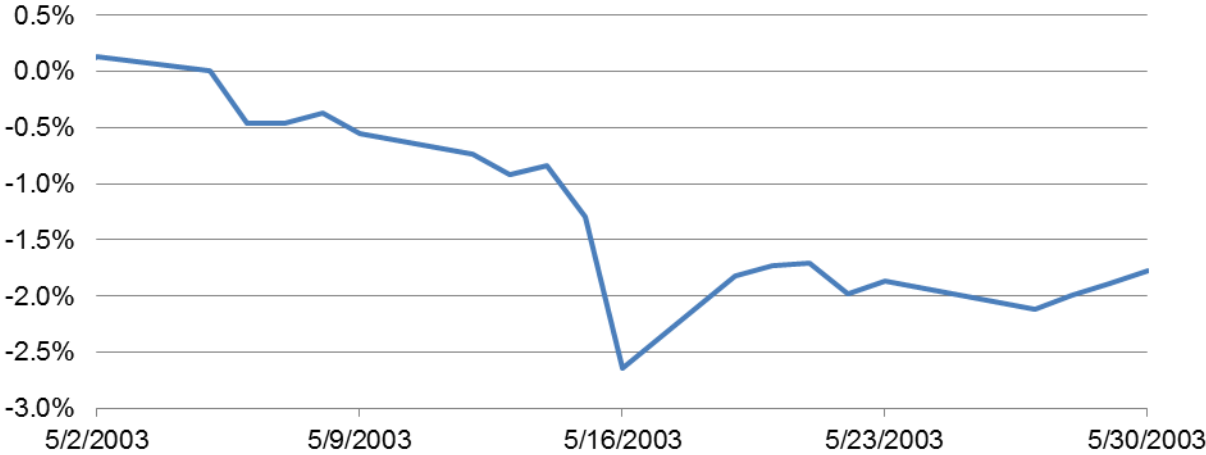
The full year and month of May analysis for the Vanguard mid cap mutual fund transition are consistent with changing indices being costly and a benchmark index being unreliable for measuring underperformance.