MONEY LEFT ON THE TABLE – PASSIVE INVESTING AND THE EFFECTS OF RECONSTITUTION

White Paper

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EXECUTIVE SUMMARY

In this paper, we seek to address the impact of reconstitution that index trackers suffer at the time of reconstitution. We observed material excess return from advance reconstitution across different months of a year and in various size segments, attributing to not only stock additions/deletions but also to pure weight changes of the components of the underlying index. Therefore, highly cost-conscious index investors should reckon with this impact of reconstitution as it generates a noteworthy drag on performance.

HIGHLIGHTS OF THE PAPER

Based on our simplistic model that measures the impact of reconstitution as the excess return of a hypothetical portfolio that reconstitutes in advance of the underlying index, we observed:

> historically, the impact of reconstitution was statistically significant in the majority of months for all size segments with four-week advance reconstitution of the hypothetical portfolio

> large-cap segment exhibited the lowest impact of reconstitution whereas the small-cap segment had the highest impact

> apart from stock additions and deletions, pure weight changes of the other constituents also caused a material impact on the reconstitution of the underlying index

WHY THE CURRENT SITUATION IS FAR FROM IDEAL?

The proverb, "the early bird catches the worm," is relevant in financial markets as well. Investors today compete relentlessly to be at the forefront, digging out every chance of profit-making ahead of their peers. With passively managed funds taking up half of the market [Reference 1], the reconstitution of the underlying indices leading to massive turnover in the capital market is gaining more attention from market participants. By anticipating the upcoming changes in the underlying indices, market participants buy (sell) expected additions (deletions) much before the announcement from the index providers. As a result of such trades, index funds suffer from buying (selling) at a relatively higher (lower) price around the index reconstitution date. This negative impact of trading beforehand is what we call the hidden 'Impact of Reconstitution' at the cost of closely tracking the index.

Former researches found an implicit cost of more than 20 basis points annually from advance buying/selling of additions/deletions with the US large-cap stock index [Reference 2] and 12-36 basis points with the European blue-chip index [Reference 3], which cannot be disregarded. Nevertheless, if stock additions and deletions are predictable, the weight changes of other compositions of the indices also follow naturally. An investigation into a world index showed that the overall performance drag amounted to 44 basis points annually in the wake of advanced trading [Reference 4].

As a periodic rule-based re-evaluation of the market index, reconstitution is distinguished from general rebalancing, which also reflects a wider scope of weight adjustments owing to corporate actions, etc. In this paper, we mainly focus on regular index reconstitution instead of broader rebalancing practices. We first define a simple model for evaluating the impact of reconstitution. We then study the magnitude of impact and show a comparison across reconstitutions in different months of a year and various size segments. Finally, we present the attribution of this impact from stock additions/deletions and weight changes of other components of the underlying index. Although taxes and transaction costs are also significant in the context of reconstitution, we will not delve into those costs since a simple generalization is not indicative of the precise costs, which can vary substantially for different funds.

HOW WE EXAMINE THE ISSUE

There are two parts to this section. In the first part, we describe how we measure the impact of reconstitution. In the second part, we illustrate various indices we simulated historically to study the impact in detail for each month of a year in each size segment.

MEASURING THE IMPACT OF RECONSTITUTION

We assume a hypothetical portfolio tracks the index all-round the year, but it reconstitutes in advance of the actual underlying index reconstitution. Due to this advance reconstitution, the hypothetical portfolio will generate an excess return. We measure this excess return and call it the 'Impact of Reconstitution'. Ideally, it is desirable to have a very low impact on reconstitution.

In our simplistic model, there are three underlying assumptions. First, the portfolio manager of the hypothetical portfolio can predict the upcoming changes in the index with 100% accuracy and can trade the desired quantity of shares at the closing price on any given day. Second, on the actual reconstitution date of the underlying index, the portfolio manager will match the index weights to have zero tracking error after the index has reconstituted. Third, the hypothetical portfolio manager incurs no other costs, such as transaction costs or taxes.

If the above assumptions hold true, and the hypothetical portfolio reconstitutes 'N' days before the actual index reconstitution, then the excess return or the impact of reconstitution will be equal to the sum of the difference in the hypothetical portfolio and the index security weights multiplied by the respective security return in those N days. Mathematically, it can be written as follows:

$$\text{Impact of Reconstitution} \quad = \quad \sum (W_R - W_C)R_s$$

where:

W_R = Reconstituted weight of the stocks in the underlying index at the actual index reconstitution date

W_C = Close weight of the stocks in the underlying index N days before the actual index reconstitution date

R_S = Return of the stocks in those N days

The impact of reconstitution can be dissected into four different components: excess return from stock additions/deletions and excess return from pure weight changes (see Exhibit 1). Mathematically, these components of the impact can be expressed as follows:
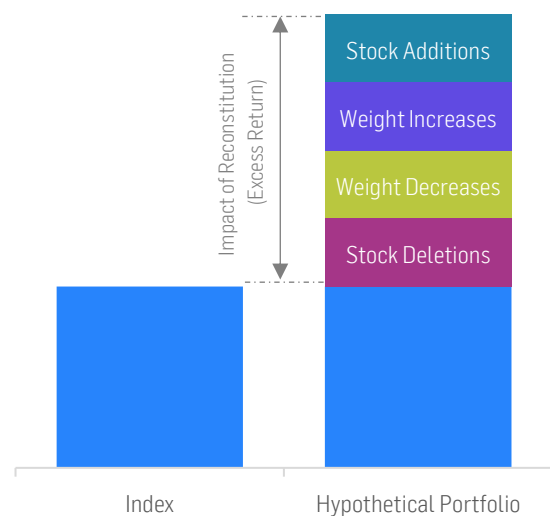
$$\text{Stock Additions} \quad = \quad \sum (W_R - W_C)R_s \quad \forall \quad W_C = 0$$

$$\text{Weight Increases} \quad = \quad \sum (W_R - W_C)R_s \quad \forall \quad W_R > W_C$$

$$\text{Weight Decreases} \quad = \quad \sum (W_R - W_C)R_s \quad \forall \quad W_R < W_C$$

$$\text{Stock Deletions} \quad = \quad \sum (W_R - W_C)R_s \quad \forall \quad W_R = 0$$

Exhibit 1: Components of Excess Return due to Advance Reconstitution of the Hypothetical Portfolio

Source: Solactive. Chart is provided for illustrative purposes.

OUR INDEX SIMULATIONS

We formed the universe of US companies for our historical simulations in two steps. First, we took all the companies headquartered and incorporated in the US and listed on NYSE and/or NASDAQ. Second, we excluded the companies ranking within the bottom 2.5% of by cumulative market capitalization coverage from step one, to avoid the inclusion of very small companies. While excluding the bottom 2.5% companies, we also applied a buffer of 0.5% to prevent excessive turnover of the small cap companies.

We defined the size segments based on the companies' cumulative market capitalization rank within the universe formed above. The top 70% were classified as large-cap. The next 15% were categorized as mid-cap, and the last 15% were grouped into small-cap companies. While classifying the companies into size segments, we applied a buffer of 2.5% to prevent excessive turnover within the size segments. The application of buffers is a very common method for controlling excessive turnover.

To measure the impact of reconstitution in different months and size segments, we calculated 12 x 3 = 36 indexes representing each month of a year for each size segment. The indices were reconstituted annually after the close of business on third Friday of the respective index month with the selection date as last the trading date of the previous month. The indices were also adjusted for float changes after the close of business on the third Friday of every the third, sixth, and ninth month from their respective annual reconstitution month. All the indices were float market capitalization weighted.

For example, the April Mid-Cap index was reconstituted after the close of business on the third Friday of April each year, with the selection date as of the end of March each year, respectively. It was adjusted for float changes after the close of

business on the third Friday of July, October, and January each year.

We also calculated an average index for each size segment by taking the average of the index levels of each monthly index belonging to the respective size segment to measure the average impact of reconstitution. For example, the Large-Cap Average index was the average of all the 12 monthly Large-Cap indices.

We calculated the weekly index total returns from December 27, 2002, to December 27, 2019, for all our analysis throughout this paper.

We would like to acknowledge that various permutations and combinations, of cumulative weight cutoff limits for the initial universe, size segments, buffers, as well as the dates of reconstitution and selection, are possible, and could be a subject of exploration in future research studies.

HISTORICAL OBSERVATIONS

In this section, we present the magnitude of the impact of reconstitution and present the attribution from stock additions/deletions and pure weight changes of other components of the underlying index.

A SIGNIFICANT MAGNITUDE OF IMPACT

Historically, we observed the impact of reconstitution became statistically significant in the majority of months for all the size segments when the hypothetical portfolios reconstituted four weeks before the actual reconstitution of the underlying indices (see Exhibit 2).

Shorter advance reconstitution periods also had some impact, but the magnitude was not statistically significant for the majority of the hypothetical portfolios (see Exhibits 4, 5, and 6).

Therefore, market participants who acted early impacted the reconstitutions of the underlying indices considerably.

Exhibit 2: Annualized Impact of Reconstitution when Hypothetical Portfolio Reconstituted Four Weeks Before Actual Underlying Index Reconstitution
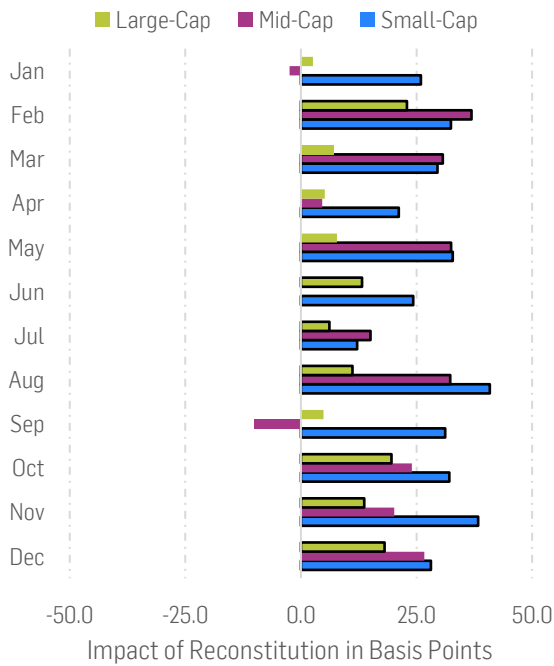
The annualized Impact of Reconstitution was calculated by subtracting the annualized total return of the underlying index from the annualized total return of the hypothetical portfolio over the entire back-tested period.
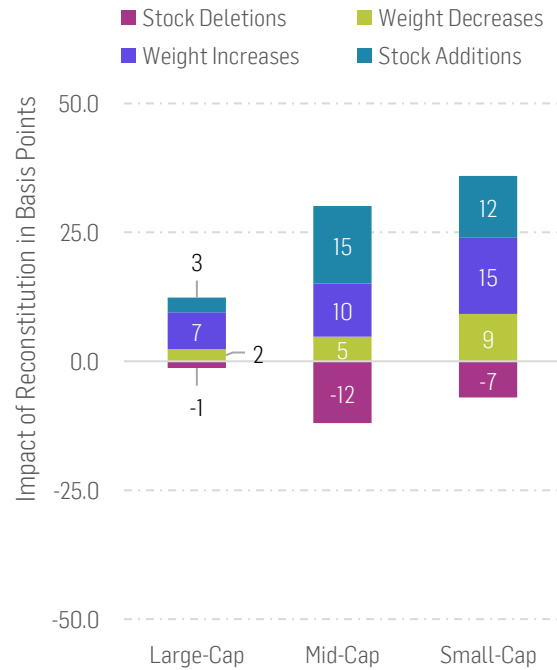
Source: Solactive and FactSet. Data from December 27, 2002 to December 27, 2019 in USD. Chart is provided for illustrative purposes. Past performance is no guarantee of future results.

WHAT EXACTLY MAKES THE IMPACT?

Although the stock additions/deletions impacted the reconstitutions of the underlying indices substantially over a longer advance reconstitution period, pure weight changes of the other components also created material impact (see Exhibit 3). The Large-Cap segment had the lowest impact, while the small-cap segment had the highest impact. On average, stock deletion led to a reduction in the impact of reconstitution over longer lookback periods across all the size segments in our sample data.

The average impact in Exhibit 3 was calculated and attributed to stock additions/deletions and pure weight changes of other components using the average index of each size segment.

Exhibit 3: Attribution of Average Annualized Impact of Reconstitution when Hypothetical Portfolios Reconstituted Four Weeks Before Their Actual Underlying Index Reconstitution

The annualized Impact of Reconstitution was calculated by subtracting the annualized total return of the underlying index from the annualized total return of the hypothetical portfolio over the entire back-tested period. The attribution was also calculated by cumulating the excess return from stock addition/deletion and pure weight changes over the entire back-tested period.

Source: Solactive and FactSet. Data from December 27, 2002 to December 27, 2019 in USD. Chart is provided for illustrative purposes. Past performance is no guarantee of future results.

SIGNIFICANT IMPACT – CONCLUSION

In this paper, we attempted to study the impact of reconstitution across different months of a year and in various size segments. We defined the impact of reconstitution as the excess return that a hypothetical portfolio will generate if it reconstitutes in advance of the actual underlying index reconstitution.

We observed the impact of reconstitution became significant in the majority of months for all the size segments when the hypothetical portfolios reconstituted four weeks before the actual reconstitution of the underlying indices. Therefore, market participants, who acted early, created a considerable impact on the reconstitutions.

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We further noticed that apart from stock additions/deletions, pure weight changes of the other components also created material impact on the reconstitution of the underlying index.

Since the impact of reconstitution can have a sizeable effect on the performance of the underlying index, ways to lower it could be explored as a future research topic.

REFERENCES

[1]   Morningstar Fund Flows August 2019

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        m/marketing/shared/pdfs/Research/Fund
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[2]   The Hidden Costs of Index Tracking –
        Winton

        https://www.winton.com/research/the-
        hidden-costs-of-index-tracking

[3]   Index Turnover Costs – Solactive Research

        https://www.solactive.com/wp-
        content/uploads/2018/04/Solactive-Index-
        Turnover-Costs.pdf

[4]   The Index Effect in Factor Benchmarks –
        PGGM

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        sis_vba_rk_final.pdf

APPENDIX

The upper limits of the magnitude of impact of reconstitution over one-week advance reconstitution period were 8, 10, and 6 basis points for large-, mid-, and small-cap segments, respectively (see Exhibit 4).

Exhibit 4: Annualized Impact of Reconstitution when Hypothetical Portfolio Reconstituted One Week Before Actual Underlying Index Reconstitution
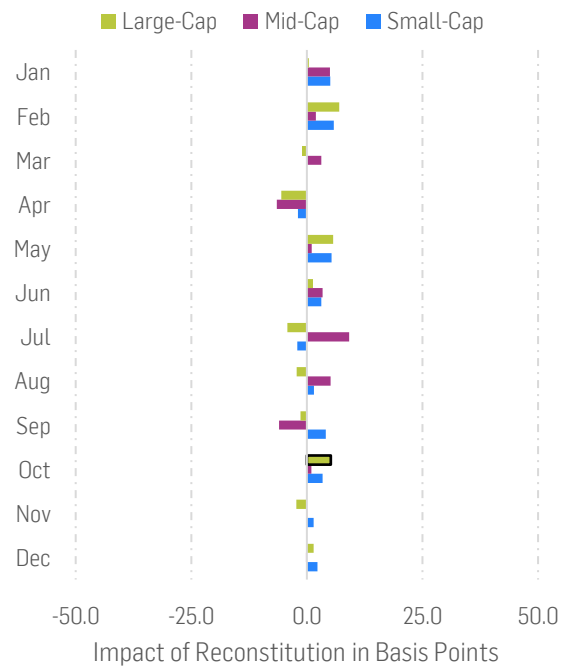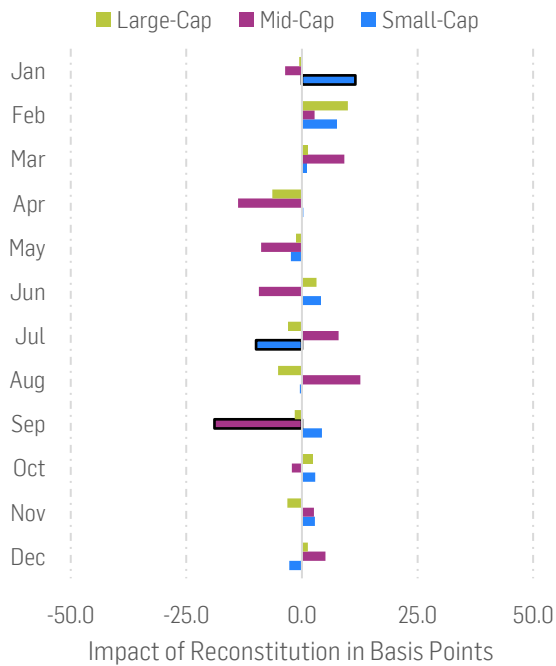

Statistically significant (p-value < 5%)

The annualized Impact of Reconstitution was calculated by subtracting the annualized total return of the underlying index from the annualized total return of the hypothetical portfolio over the entire back-tested period.

Source: Solactive and FactSet. Data from December 27, 2002 to December 27, 2019 in USD. Chart is provided for illustrative purposes. Past performance is no guarantee of future results.

The upper limits of magnitude of impact of reconstitution over two-week advance reconstitution period were 10, 19, and 12 basis points for large-, mid-, and small-cap segments, respectively (see exhibit 5).
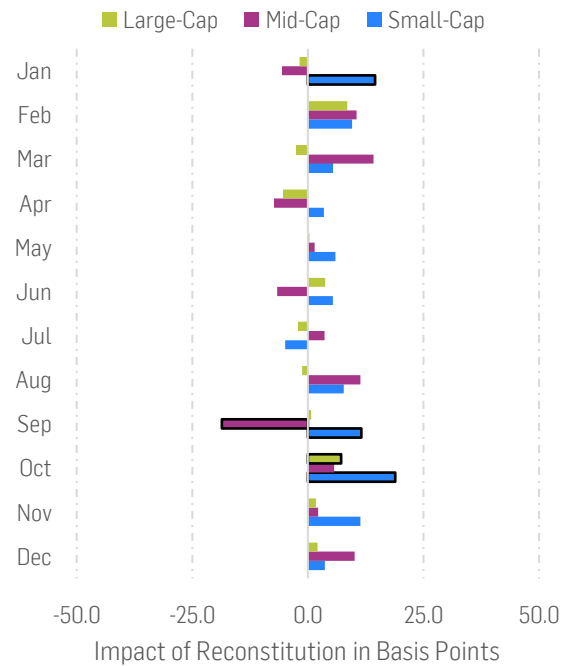
Exhibit 5: Annualized Impact of Reconstitution when Hypothetical Portfolio Reconstituted Two Weeks Before Actual Underlying Index Reconstitution

Statistically significant (p-value < 5%)
The annualized Impact of Reconstitution was calculated by subtracting the annualized total return of the underlying index from the annualized total return of the hypothetical portfolio over the entire back-tested period.
Source: Solactive and FactSet. Data from December 27, 2002 to December 27, 2019 in USD. Chart is provided for illustrative purposes. Past performance is no guarantee of future results.

The upper limits of magnitude of impact of reconstitution over three-week advance reconstitution period were 9, 19, and 19 basis points for large-, mid-, and small-cap segments, respectively (see Exhibit 6).

Exhibit 6: Annualized Impact of Reconstitution when Hypothetical Portfolio Reconstituted Three Weeks Before Actual Underlying Index Reconstitution

Statistically significant (p-value < 5%)
The annualized Impact of Reconstitution was calculated by subtracting the annualized total return of the underlying index from the annualized total return of the hypothetical portfolio over the entire back-tested period.
Source: Solactive and FactSet. Data from December 27, 2002 to December 27, 2019 in USD. Chart is provided for illustrative purposes. Past performance is no guarantee of future results.

DISCLAIMER

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