Dimensional

Measuring the Costs of Index Reconstitution: Evidence Outside the US

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KEY TAKEAWAYS

- Index funds try to limit tracking error versus indices. This can lead to trading costs that hurt returns when indices undergo reconstitution.
- Our analysis examines the reconstitution costs for five widely tracked indices outside the US from 2014 to 2023.
- Overall, we find that spikes in trading volume and price pressure around reconstitution events are prevalent for each index.

While index funds offer some advantages that investors often find appealing, such as low expense ratios and broad diversification, their objective of minimizing tracking error versus an index can lead to implementation costs that hurt returns.

In *recent research* by Dimensional, we examine the trading costs that arise from volume and price pressure around index reconstitution for 10 widely tracked US equity asset class indices over the most recent decade. Our research finds that nonmigrating stocks added to or deleted from the indices saw abnormally high trading volume on reconstitution day, with much of that increase concentrated near market close. We also find that, leading into reconstitution, nonmigrating index additions tend to outperform and deletions tend to underperform their respective indices, while both exhibit reversals following reconstitution.

The index reconstitution effects persist outside of the US. This is not surprising given that the growth of indexing is global: In 2023, passive equity fund assets surpassed active equity fund assets globally.[1] In this analysis, we examine the costs of index reconstitution from 2014 to 2023 for five widely tracked indices outside the US: FTSE 100, S&P/TSX 60, S&P/ASX 300, EURO STOXX 50, and Nikkei 225.[2]

Price Pressure

Consistent with our US analysis, we find that index additions exhibit positive excess return patterns and deletions exhibit negative excess return patterns before reconstitutions, while both exhibit reversals after reconstitutions.[3] **Panel A** of **Exhibit 1** plots average cumulative excess returns from 20 trading days before to 20 days after the effective date of reconstitution, with the line marking the effective date. The cumulative excess return for each stock on day *t* is the sum of the excess returns from day *t*–20 to day *t*, with returns of deletions multiplied by –1 to present additions and deletions together. For each index, we form a value-weighted average cumulative excess return, with weights proportional to the market capitalizations of the adds and deletes as of the month-end before reconstitution. Then we take the equal-weighted average of the cumulative excess returns across the five indices.

The cumulative excess return to additions and deletions is 3.5%, on average, in the 20 days leading up to reconstitution. Over the 20 trading days following reconstitution, additions and deletions see a reversal of around 1.9%, on average.

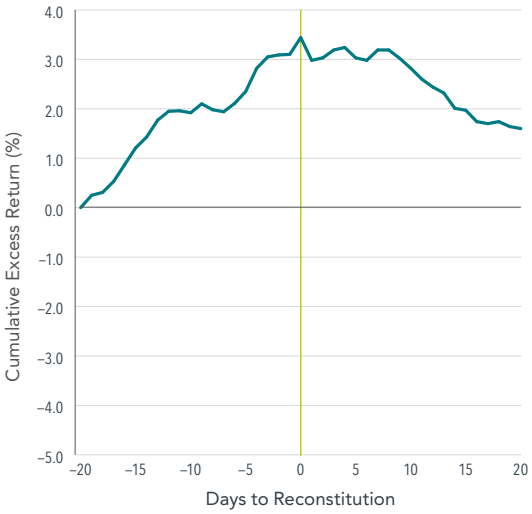
1. For global assets, as of December 2023, passive equity funds' net assets totaled $15.1 trillion while active funds' net assets totaled $14.3 trillion. For more information, see Patturaja Murugaboopathy, "Global Passive Equity Funds' Assets Eclipsed Active in 2023 for First Time," *Reuters*, February 1, 2024.
2. The FTSE 100 represents the largest 100 stocks by market capitalization that trade on the London Stock Exchange, subject to liquidity and size screening. The FTSE 100 has a quarterly reconstitution schedule. The TSX 60 is a large cap index representing 60 of the largest stocks on the Toronto Stock Exchange. The TSX 60 reconstitutes on an as-needed basis as determined by the Index Committee. The ASX 300 provides exposure to Australian large, mid, and small cap companies. It is composed of up to 300 of the largest stocks on the Australian Securities Exchange and has a semiannual reconstitution schedule with occasional as-needed changes. The EURO STOXX 50 typically comprises 50 blue-chip stocks in the eurozone and has an annual reconstitution schedule. The Nikkei 225 represents the top 225 blue-chip stocks traded on the Tokyo Stock Exchange and has a semiannual reconstitution schedule, with occasional off-schedule events.
3. We do not exclude migrating additions and deletions, i.e., securities that are deleted from (added to) an index and on the same day added to (deleted from) another index in the same index family, due to few instances of widely tracked adjacent indices likely to result in conflicting trading pressure. Due to lack of available constituent data for the EURO STOXX 50 and Nikkei 225 indices, we identify adds and deletes to those indices using the holdings of large ETFs tracking those indices.

In **Panel B**, we confirm that the pattern is a mirror image for additions and deletions. The cumulative excess return of additions is 3.2% over the 20 trading days leading up to reconstitution, with a reversal of –1.8%. For deletions, the cumulative excess return ahead of reconstitution is –4.4%, with a reversal of 2.6%.

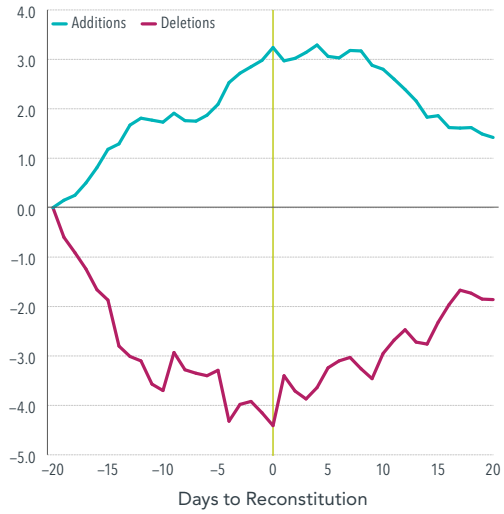
Panel C shows the cumulative price pressure from *t*–20 to reconstitution day and from reconstitution day to *t*+20. We see a consistent pattern across the indices, with the ASX 300, Nikkei 225, and TSX 60 exhibiting the strongest price pressure.

EXHIBIT 1: Average Cumulative Excess Return of Additions and Deletions, *January 2014–December 2023*

Panel A: Average of All Indices



Panel B: Average of All Indices by Additions and Deletions



Panel C: Average Cumulative Excess Return by Index (%)

Index	*t*–20 to *t*	*t* to *t*+20
FTSE 100	1.7	–1.5
S&P/TSX 60	4.6	–1.6
S&P/ASX 300	8.0	–2.2
EURO STOXX 50	0.8	–0.4
Nikkei 225	2.0	–3.5

Past performance is no guarantee of future results. Indices are not available for direct investment.

Cumulative excess returns (CERs) are calculated as the cumulative sum of the daily excess returns for an individual security versus its respective index from market close 20 trading days before reconstitution. Cumulative excess returns for deletions are multiplied by –1 before being averaged with cumulative excess returns of additions. Value-weighted average CERs are calculated by weighting the sets of CERs on a day by the securities' respective free-float market capitalizations as of the most recent month prior to reconstitution. All returns are converted to USD. Indices are not available for direct investment; therefore their performance does not reflect the expenses associated with the management of an actual fund.

Intraday Price Pressure

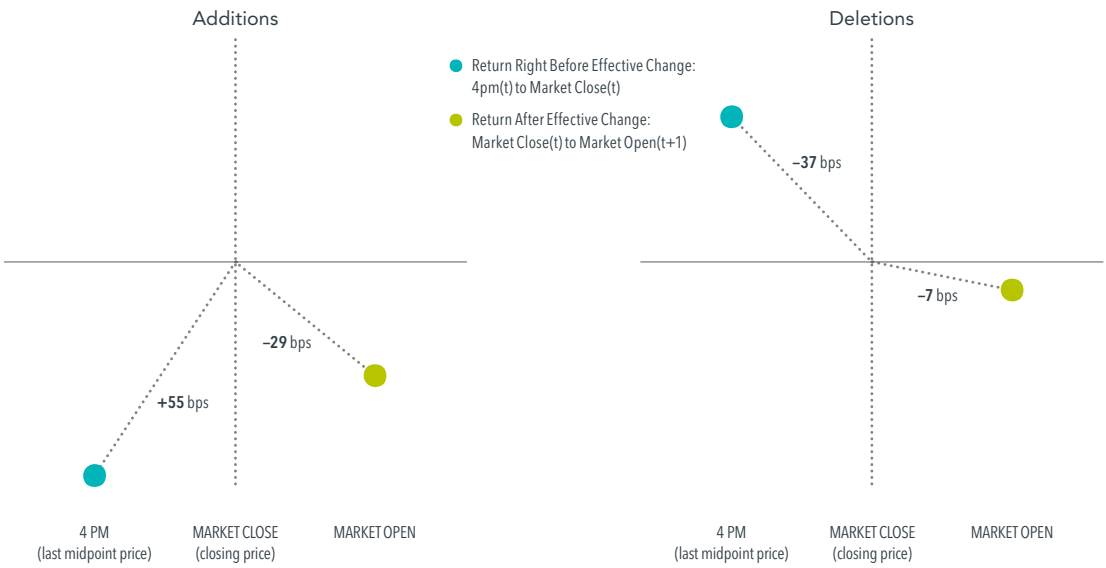
When index fund managers attempt to match the indices they are tracking, it is not enough to just trade the same stocks on reconstitution day; they also want to match the price the indices apply when adding or deleting stocks, which is set in or near the closing auction. This demand for immediacy at market close comes with a cost. In **Exhibit 2**, using high-frequency trading data available over the past five years, we quantify this cost by regressing the return of additions or deletions from the last midpoint price of the continuous trading session on reconstitution day to the closing auction price (blue circles) and from that closing auction price to the market open price on the following day (green circles) on flags indicating if a stock is added or deleted that day.[4] The regressions include all stocks in the markets we are assessing with trading data on that day, not just the index changes. This allows us to have more power when testing the statistical reliability of the abnormal addition and deletion returns. We include date fixed effects and cluster standard errors by date and stock.

On average, the price of additions increases by 55 basis points (bps) relative to the price of nonrebalanced stocks from the last midpoint price of the continuous trading session on reconstitution day to the closing auction price, meaning the index "buys higher." The opposite is true for deletions, which see an average decrease in price of 37 bps relative to the price of nonrebalanced stocks over that same time horizon, meaning the index "sells lower." By market open on the day following reconstitution, the price of additions reverses downward by 29 bps, while deletions continue their downward trend by 7 bps. Unlike the other three estimates, the reversal estimate of 7 bps for deletions is not statistically reliable and flips to a positive 2 bps when excluding one outlier.[5] We confirm the observed return patterns are not due to the bid-ask bounce by running regressions adjusting the closing auction price by adding (subtracting) half the bid-ask spread for trades made below (above) the last midpoint price of continuous trading; results are omitted for brevity.

4. Returns from market close on reconstitution day to market open the following trading day are adjusted by market return, where market return is calculated as the market-capitalization-weighted average of all stocks traded in the respective countries.

5. The outlier is the Kingfisher deletion from the FTSE 100 on March 20, 2020, which saw a –19.9% return (in GBP) from market close on reconstitution day to market open the following trading day.

EXHIBIT 2: Price Movement Around Market Close on Index Reconstitution Date, *January 2019–December 2023*



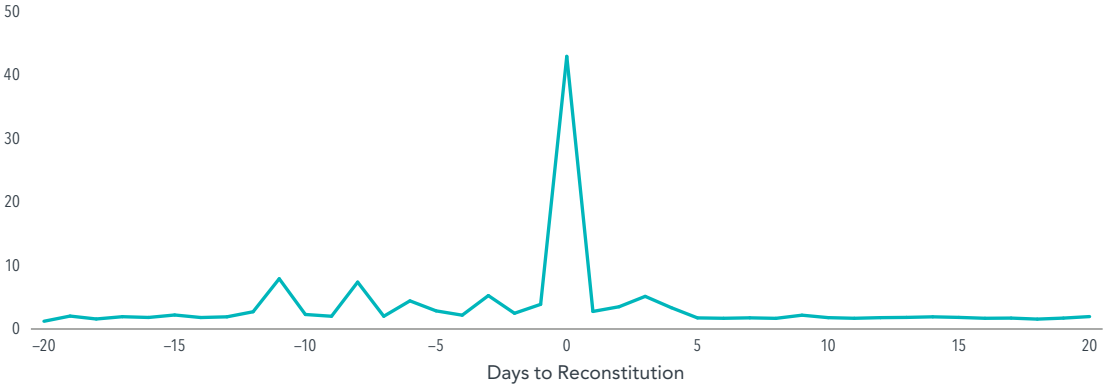
Past performance is no guarantee of future results.

Regression specification for the price pressure into closing auction is: $Ret_{LastMid}^{Auc} = a + b * Additions + c * Deletions + e_T$, *where* $Ret_{LastMid}^{Auc}$ *is the gross return (in bps) from the last midpoint price of the continuous session on T, to the closing auction price. Regression specification for the overnight reversal is:* $Ret_{Auc\,T}^{Open,T+1} = a + b * Additions + c * Deletions + e_T$, *where* $Ret_{Auc\,T}^{Open,T+1}$ *is the market-adjusted return (in bps) from the closing auction price on T, to the open auction price on T+1.* $Additions$ *is an indicator variable with 1 for index additions and 0 for other stocks.* $Deletions$ *is an indicator variable with 1 for index deletions and 0 for other stocks. Day fixed effects are included. The blue circles and green circles represent the coefficient estimates for the* $Additions$ *and* $Deletions$ *indicators in the former and latter model, respectively. Samples include all index addition and deletion events, as well as all other stocks traded in the same country on the same index reconstitution days. All returns are in local currency. Indices are not available for direct investment; therefore, their performance does not reflect the expenses associated with the management of an actual fund.*

Volume Pressure

Another way to assess if index fund managers are lacking flexibility in their approach to mirroring index reconstitution events is to examine if there are abnormal spikes in trading volume around reconstitution. **Exhibit 3** presents the average trading volume in additions and deletions from 20 trading days prior to reconstitution day, *t*–20, through 20 trading days following reconstitution, *t*+20, reported as a multiple of the stocks' volume on day *t*–20 and aggregated across all five indices. We see that average trading volume multiples meaningfully increase on reconstitution day, ranging from about 12x for the FTSE 100 to 149x for the ASX 300, with an average of nearly 43x across all the indices.

EXHIBIT 3: Average Trading Volume Multiples for Index Additions and Deletions on Reconstitution Day vs. 20 Days Prior
January 2014–December 2023



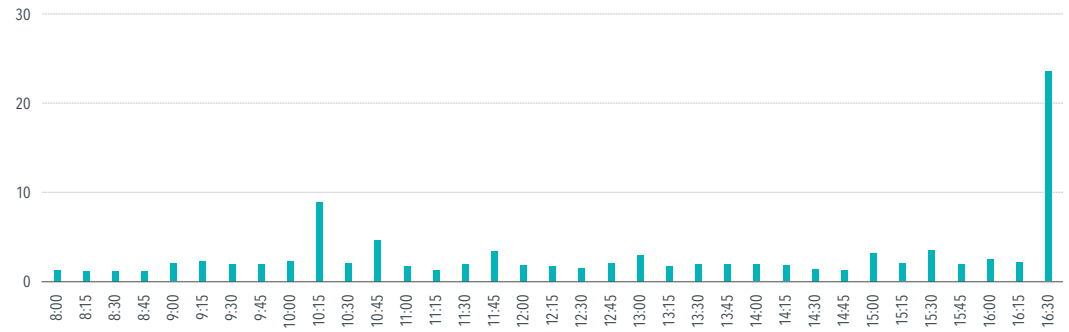
Trading volume multiples are calculated as the USD trading volume of a security on a given day divided by its trading volume 20 days prior to reconstitution; the value-weighted average trading volume multiple is calculated by weighting the set of trading volume multiples on a day by the securities' respective free-float market capitalizations, which are month-end values from the most recent month prior to the reconstitution date; the graph presents an equal-weighted average of value-weighted trading volume multiples across additions and deletions of the FTSE 100, S&P/TSX 60, S&P/ASX 300 indices, EURO STOXX 50, and Nikkei 225 indices.

Intraday Volume Pressure

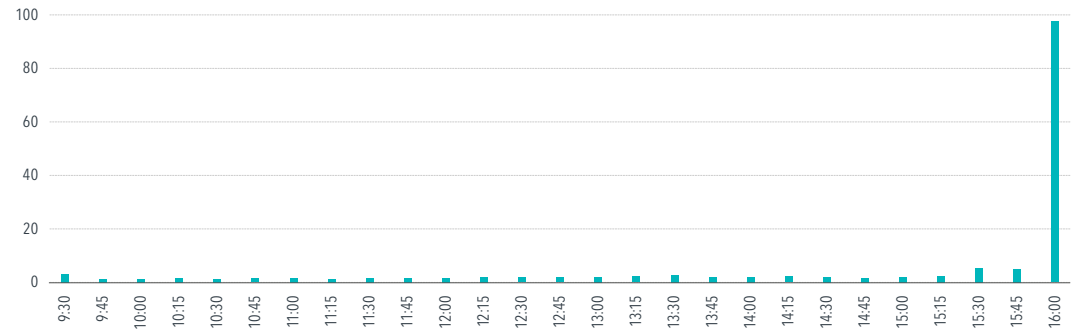
Given index fund managers attempt to match the price that indices get when adding or deleting securities, which is typically a market closing price, we expect the increase in trading volume not only to take place on reconstitution day, but also to be concentrated near market close. To examine this, we compare the intraday trading volume over 15-minute intervals on the reconstitution date to the average volume within the same 15-minute intervals in the same stock over the previous 30 calendar days, or about 20 trading days. The sample period for this analysis is 2019–2023, again due to the availability of high-frequency-trading data. **Exhibit 4** shows that the increase in volume for additions and deletions is concentrated on reconstitution day in the 15-minute interval containing the closing auction. Abnormal trading volume ranges from about 24x to 130x across the indices, with FTSE 100 additions and deletions seeing the smallest increase while ASX 300 rebalanced stocks see the largest. Due to the EURO STOXX 50 including securities across the eurozone, we present in the same graph the average trading volume multiples for the three different sets of markets with different market close intervals. The 11:30am spike in volume for the Nikkei 225 (Panel E) is driven by the closing auction of the morning trading session.

EXHIBIT 4: Average Intraday Trading Volume Multiples for Index Additions and Deletions During Reconstitution Day vs. 20 Days Prior
January 2019–December 2023

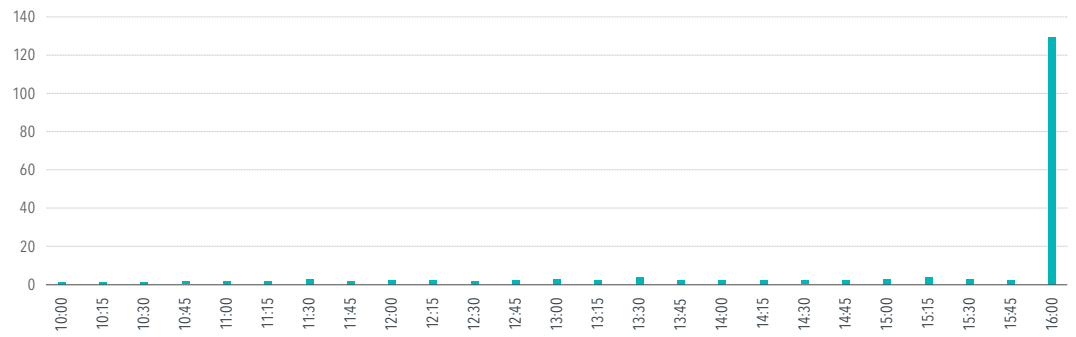
Panel A: FTSE 100



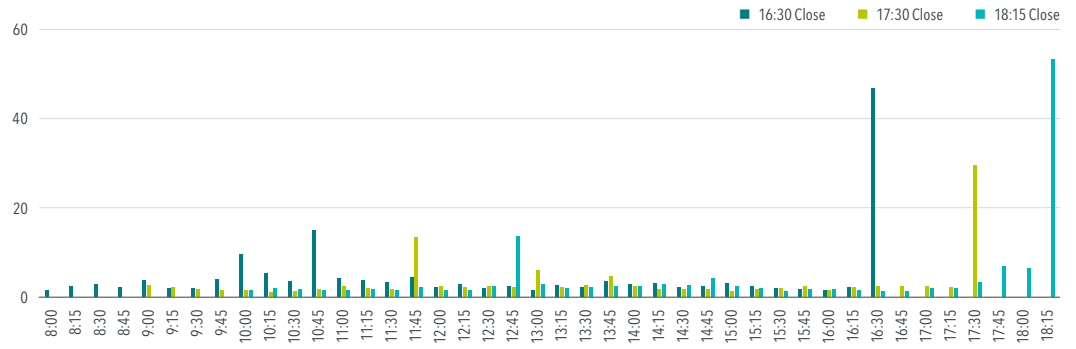
Panel B: TSX 60



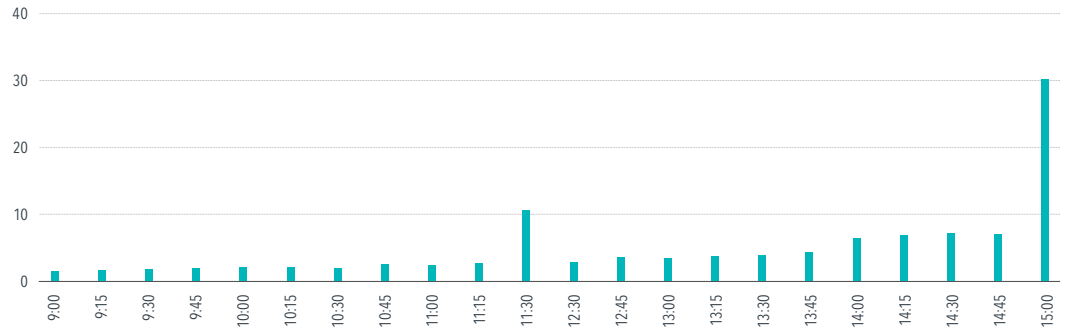
Panel C: ASX 300



Panel D: EURO STOXX 50



Panel E: Nikkei 225



Intraday trading data are from January 2019 through December 2023. The security-day-level intraday volume multiple is based on the ratio of observed intraday volume levels on the index reconstitution date relative to the observed equal-weighted average intraday volume over the 30-calendar-day period (or about 20 trading days) prior to the reconstitution date. The EURO STOXX 50 Index includes markets with three distinct closing auction time periods; 16:30 Close corresponds to UK and Ireland, 17:30 Close corresponds to Germany, Spain, France, Italy, Netherlands; and 18:15 Close corresponds to Finland, Sweden. Close of trading in maturing EURO STOXX 50 options occurs on reconstitution day at 12:00 CET, which aligns with the smaller spikes in volume for each set of markets earlier in the day. Value-weighted intraday volume multiples are calculated across all securities and reconstitution days for each index, using securities' respective free-float market capitalizations, which are month-end values from the most recent month before the reconstitution date.

Beyond Indexing

Overall, we find that spikes in trading volume and price pressure around reconstitution events are prevalent in the most recent 10 years for five widely tracked ex US indices that span the globe. The rigidity of having to trade specific securities in specific amounts on specific days forces index funds to demand immediacy, which comes at a cost. This cost is not reflected in expense ratios of index funds but detracts from their returns because it's priced into the returns of the indices.

A better approach to portfolio design and management would be a daily process that uses information from market prices every day and spreads turnover across all trading days in the year, with flexibility across stocks, quantities, and time. Such an approach can help investors target higher expected returns while also managing risks and costs in the global opportunity set.

Appendix

APPENDIX 1: Assets Invested in Index-Tracking Funds, *as of December 31, 2023*

	FTSE 100 Index	S&P/TSX 60 Index	S&P/ASX 300 Index	EURO STOXX 50 Index	Nikkei 225 Index
Index-Tracking Assets (USD Billion)	29	12	37	36	181
Total Market Capitalization (USD Billion)	2,455	1,827	1,720	3,507	3,475
Percentage of Market Cap in Index Funds	1.2%	0.7%	2.1%	1.0%	5.2%

Total assets indexed are proxied by AUM of index-tracking funds, obtained from Morningstar. Percentage of market capitalization in index funds for each index is calculated as the index-tracking asset values divided by the estimated total market capitalization of companies in the index. Companies' market capitalizations are defined as free-float market capitalizations for all indices, sourced from Bloomberg.

APPENDIX 2: Average Index Weights (%) of Additions and Deletions, *January 2014–December 2023*

	FTSE 100 Index	S&P/TSX 60 Index	S&P/ASX 300 Index	EURO STOXX 50 Index	Nikkei 225 Index
Panel A: Average Index Weight by Reconstitution Event					
All Additions and Deletions	0.66	1.07	0.37	3.71	0.43
Panel B: Average Index Weight by Calendar Year					
All Additions and Deletions	3.75	2.39	1.22	3.71	1.15

Index weights are calculated at each reconstitution event as the sum of index weights of both additions and deletions. In Panel B, the index weights are then aggregated across all reconstitution events during a calendar year. Average index weight by reconstitution event includes regularly scheduled events and off-schedule events.

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