Price and Volume Effects of S & P CNX Nifty Index Reorganizations#

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Abstract

This paper considers the effects of changes (both inclusions and exclusions) in the composition of the Nifty and Jr. Nifty index for the period 1996-2003. The study finds no significant price effects on the announcement day. However price effects were observed only for the Nifty index on the effective day averaging around 1.47% which is subsequently reversed by ninth day. Similar results were found for the Nifty deletions too. For the Jr. Nifty no price effects were observed either on announcement day or on the effective day for both inclusions as well as exclusions. However there were no abnormal volumes associated with the price effects for the Nifty index. Also the study finds no significant changes in the liquidity of the stocks that were either included or excluded to/from the Nifty. Since the price effects are confined only to Nifty and were absent for the Jr. Nifty certification effect may be ruled out. There is *prima facie* support for the price pressures hypothesis however the conclusions are not emphatic because of the lack of abnormal volumes in the effective day window.

Key words: Changes in indices, event study, abnormal returns, price and volume effects

JEL Classification: G11, G12 and G14

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1. Introduction

A stock index reflects the mood and direction of the overall market. Apart from being an indicator of the market movements, stock indices also serve as a benchmark for measuring the performance of fund managers. The innovations in the financial markets and the modern portfolio theory had redefined the uses of stock indices for instance the advent of index funds. Stock indices are rarely static; their composition changes so that the objectives behind the construction of indices are served. Of course the changes might also be driven by other reasons like mergers and corporate restructuring that make some of the stocks cease to exist from the market. Although the changes in an index like Nifty are a regular phenomenon, these actions will have implications for markets in general and index funds in particular. When a stock is added (deleted) to the Nifty, index funds will try to include it in their portfolio and these actions may induce buying (selling) pressure and correspondingly the price level is increased (decreased) and the volume levels of both types of stocks are increased. This work attempts to empirically investigate the implications of Nifty revisions over the period 1996-2003.

2. Theoretical backdrop

Theoretical research in this area came up with four important hypotheses to explain the reasons for the uncharacteristic changes in stock prices and trading volumes of the included (excluded) stocks around the revision dates. According to the modern portfolio theory, investors hold a diversified portfolio and the markets can absorb any uninformed demand shock for a stock. Thus the demand curves for a stock will be perfectly horizontal and any demand shocks likely to be associated with an index change should not have any statistically significant price effects. But if stocks are not close substitutes for each other the demand curves will be sloping downwards and the curve will shifts to the right (left), due to demand increases (decreases), permanently effecting stock prices until another event capable of shifting can happen. This hypothesis termed as *downward sloping demand curves (DSDC)* was proposed as an explanation for the index effect by Shliefer (1986). The second hypothesis *price pressure hypothesis (PPH)* posits that the demand curve is only temporarily inelastic. When a stock is included in an index, there is a significant rise (fall) in demand for stocks included (excluded) over a short period due to index fund rebalancing activities. Once the demand from the indexers retreat stock prices will revert and will reflect the long-term equilibrium prices. It may be noted that the difference between PPH and DSDC is whether or not the stock prices exhibit reversal in the short run and both presume that the index revisions are information free events. The *liquidity hypothesis* states that any event leading to improvement in the liquidity of a stock makes the investors pay a premium for those stocks. Index inclusion may lead to increase in liquidity, as the stocks will attract more attention thus reducing the information availability between informed and uninformed traders which may translate into lower costs of trading (see Kim and Verrecchia 1994). The *Information content hypothesis (ICH)* says that new beneficial information is revealed by index inclusion (exclusion) thus

permanently affecting the stock prices. This found support in some studies despite most index management committees (including S & P index committee) affirming that the inclusion (exclusion) isn't any verdict on the investment attractiveness or the future prospects of the stock.

The above hypotheses are debatable and are not mutually exclusive. Each one of them may be present in differing levels. For instance Lynch and Mendenhall (1997)'s work is consistent with both PPH and DSDC while Dhillon and Johnson (1991) found support for ICH and DSDC.

3. Literature Review

A large body of literature examining the effect of stock inclusions (exclusions) to (from) has the S & P 500 as the focal point. The extant literature provides conflicting evidence for the S & P 500 for various reasons. Shliefer (1986) was among the first to investigate the index effect and his study examined price impacts related to changes in S & P 500 between 1966 and 1983. His study found an abnormal price increase of 2.79% and the cumulative returns persisted. The returns are positively related to measures of buying by index funds and the results were attributed to the downward sloping demand curves for stocks.

Harris and Gurel (1986) used almost a similar sample and showed a 3.13% abnormal return resulting from additions to the S & P 500. This increase is almost reversed after two weeks and thus they attributed the abnormal returns to the increased demand from the index funds. Their evidence is consistent with the price pressure hypothesis. Another contemporaneous study by Woolridge and Ghosh (1986) found permanent price increases consistent with downward sloping long, run demand curve. They also document that trading volumes also increased during the event month while relative volumes actually declined in the months following the event and thereby the volume results are consistent with the price pressure hypothesis.

Jain (1987) also found that stocks added to S & P 500 experienced excess returns of 3% on the announcement day and this excess returns are observed for stocks added to S & P supplementary indices too even though index funds do not try to match these indices. His study contested the PPH and DSDC hypothesis and ascribed the excess returns to the information content hypothesis. Another study that supports the ICH was that of Dhillon and Johnson (1991). This study examined only the additions to the S & P 500 index between 1978-88 and found that price levels persisted for around sixty days after the announcement, which is inconsistent with PPH. Also they observed significant increases in returns for options and bonds of firms being included in the index thus lending support to the ICH. However they argued that their results are also consistent with DSDC hypothesis and in this connection they made a simplifying assumption that stocks, bonds and options are all close substitutes for one another. Edmister *et al* (1994) after adjusting for the biases that creep into parameter estimation have reported significant excess returns following a change in the index and the price effects seem to persist.

All the above studies examined the index effect when the announcement and the change are almost simultaneous. However in October 1989 S & P altered this policy and the changes to the index are announced after the close of trading which become effective after a week. Following this change in the regulatory environment Lynch and Mendenhall (1997) published their results of a detailed study of the index effect. Their study indicated a significant positive announcement day returns and the post announcement abnormal returns are only partially reversed following the changes. Their study corroborated the PPH and the DSDC hypotheses.

In a series of articles Beneish and Whaley (1996, 1997, 2002) documented that excess returns associated with index revisions has increased from around 2.79% (during 1976-83) to 5.94% (during 1989-95) to 8% (during 1996-2001) and they attribute this to the growing index fund industry in the U.S. Hegde and McDermott (2003) test for liquidity changes and they found a permanent increase in liquidity measured by decreased effective spreads, increased quote depth and as well as increase in volume.

As can be noted all the studies (atleast till 2000) have examined the index effects for S & P 500 in the U.S. This may be due to the larger size of the index funds tracking S & P 500, but of late there are some studies that examined the index effects in other countries as well. We provide a snapshot of these studies along with the recent studies on S & P 500 in Table 1.

As far as Indian market is concerned Vijaya (2002) has investigated the price effects for the Sensex. Though the study reports a weak permanent price effect for deletions the researchers caution that the study suffers from the problem of assumed announcement dates as BSE did not maintained a record of the exact announcement dates. So the study has rather limited research focus along with uncertain announcement dates. In conclusion we can note that the existing literature is more or less unanimous on the premise that index revisions are associated with price effects but the debate is whether the price effects are temporary or permanent and also there is disagreement on the explanations for these findings.

4. The indices and the selection criteria

S & P CNX Nifty (Nifty hereafter) and CNX Nifty Junior (Jr. Nifty hereafter) belong to IISL (India Index Services & Products Ltd), which computes and maintains these indices, along with other indices. Both indices are portfolios of 50 stocks each, and Nifty represents the large and liquid blue-chip stocks; while Jr. Nifty represents almost the next fifty large and liquid stocks on Indian capital markets. IISL takes care in the maintenance of these indices such that these two indices always represent mutually exclusive sets of stocks. IISL supervises the indices such that Nifty not only reflects the larger market mood but also is a well-diversified portfolio yielding better return-risk ratio relative to other indices and it preserves its superiority as an effective hedge. Nifty is calculated using the market capitalized weighted method and the indices are maintained by Index Maintenance Sub-

Committee, which follows clear and well laid-down criteria like liquidity, market capitalization, and floating stock in selecting the stocks to be part of the indices. The index maintenance committee meets atleast four times a year and each revision takes around six weeks (at present) time before it becomes effective unless the change is warranted by an immediate suspension (for details of index construction and maintenance methodology follow the link http://www.nseindia.com - Home > Indices > IISL Indices > S&P CNX Nifty > Computation, Base Date & Value, Selection Criteria).

5. Motivation for the study

This study contributes to the existing literature in the following ways: a) an exhaustive analysis of the price and volume effects were being reported from an emerging market b) the index effects were investigated for the NIFTY index which is very different to the S & P 500 that is the focus of a large body of literature. Additions to S & P 500 occur irregularly and infrequently but Nifty index revisions are done on a periodic basis. Most of the studies on S & P 500 focus on new additions only, because deletions to S & P 500 are predominantly due to corporate restructuring like mergers but most companies deleted from Nifty continue in business. The selection criteria for the index composition are well defined whereas for S & P 500 the committee follows some guidelines like "leading companies in leading US industries" (Standard & Poor 2000). c) The results of the study will be interesting for index funds and self-indexers, who balance their portfolios in line with the changes in the index, as it will throw light on any hidden transaction costs. One may argue that the size of passive funds is small in Indian market (amounting to approximately Rs 400 Cr. tracking Nifty in 2003) but the index changes affect other portfolio managers whose Funds are benchmarked to Nifty index. Another set of investors who will prefer to invest in index stocks is foreign investors. Therefore majority of the market participants have to schedule their purchases.

6. Data and Methodology

a. The sample

NSE web site provides the complete details of the names and effective dates of all the stocks that were included to the Nifty and Junior Nifty over the period 1996-2003. However the announcement dates were inferred from the date of the circular intimating the change. But as the information is disseminated after the close of trading the trading day immediately after the circular date is considered as the announcement day. The sample size is described in Table 2. Though initial sample size is 36 for Nifty and 62 for the Junior Nifty the final samples are somewhat smaller due to following reasons:

1. Announcement date is not available for *ten* changes in Nifty and *three* changes in Jr. Nifty because these indices were earlier maintained by CRISIL or NSE (source: Press Release of IISL dated Sep 2, 1998 follow the link on NSE Home > Indices > IISL Press Releases > Sep 2, 1998) and not the current organization IISL.

2. Corporate actions (like mergers & amalgamations)
3. Inadequate data to estimate the parameters since in some cases the scrip ceased to trade on the exchange due to suspensions.
4. Due to clustering effect (explained later) individual stocks were formed into portfolios

b. The methodology

In this study the price and volume effects were investigated in the event study framework and the windows employed in the study were depicted in figure 1.The first window is the announcement window starting from tenth day prior to the announcement and ending on tenth day after the announcement. Then the effective window or the implementation window that commences ten days prior to effective date and ends on the tenth day after the change becomes effective. An event study analyzes the impact of an event (a stock's inclusion/exclusion from an index) by studying the asset price returns over relatively short periods of time. This is achieved by using a model to estimate the normal return defined as the stock's return if the event had not occurred. The excess returns, which the event generates, are found as the difference between the actual return and the estimated normal return. There are several models that can be used to estimate the normal returns. We used the market model approach, which was found to be well specified under a variety of conditions when daily returns are used (see Brown and Warner, 1985). For every security, the excess return for each day in the event period is estimated as

$$R_{j,t} = \alpha_j + \beta_j R_{m,t} + \xi_{j,t}$$

where R_j and R_m denote the returns to stock j and the market portfolio on day't' respectively and the excess returns $AR_{j,t}$ are computed as

$$AR_{j,t} = R_{j,t} - \hat{\alpha}_j - \hat{\beta}_j R_{m,t}$$

In order to draw inferences the excess returns were aggregated along two dimensions - along time and across securities. We define Mean Abnormal return (MAR) as the average of the excess returns across the N firms on a day 't'.

$$\text{MAR}_t = \frac{1}{N}\sum_{j=1}^{N} AR_{j,t}$$

In addition, cumulative excess returns were calculated as CAR (T1, T2) and is defined as the sum of all the excess returns over the window of interest.

$$\text{CAR}_{j,t} = \sum_{T1}^{T2} AR_{j,t}$$

The average of the cumulative abnormal returns across the observations which is a measure of the abnormal performance over the event period is defined as

$$\text{MCAR}_t = \frac{1}{N}\sum_{j=1}^{N} CAR_{j,t}$$

We also calculated Mean average abnormal returns (MAAR) defined as the sample average of firm level average abnormal returns i.e., $MAAR(t1,t2) = \frac{1}{N}\sum_{j=1}^{N}\frac{CAR_j(t1,t2)}{n(t1,t2)}$ where n (t1,t2) represents the number of days in the window (t1, t2). The above excess return measures were computed in the following three investigation windows:

I. Pre announcement window starting from AD-51 to AD-1
II. Build up window starting from AD+1 to ED-1
III. Post effective window starting from ED+1 to ED+26

where AD stands for announcement day and ED stands for effective day. It may be noted that the number of trading days between AD+1 to ED-1 may be different for each change because each announcement was not followed by the same number of trading days before implementation.

c) *Test statistics:*

The test statistics are calculated using the time series standard deviation as well as using the cross-sectional standard deviation. The test statistic using time series variance estimator has the advantage of using a sample size that is determined by the time series length and is not constrained by the number of stocks in the sample. The estimator also adjusts for possible auto-correlation between abnormal returns. And the advantage of using the cross-sectional estimator is its robustness to an increase in the variance of stock abnormal returns around the event day i.e. the cross-sectional test is well - specified for event date variance increases (see Asquith 1983). The time series test statistic is computed following Linn and McConnell (1983).

$$Z = \frac{\overline{\overline{AR_t}}}{S(\overline{\overline{AR}})} \quad \text{where} \quad \overline{\overline{AR_t}} = \frac{1}{N}\left(\sum_{j=1}^{N} A\hat{R}_{j,t}\right), \quad S(\overline{\overline{AR}}) = \left(\frac{T-2}{N(T-4)}\right)^{\frac{1}{2}} \quad \text{and} \quad A\hat{R}_{j,t} = \frac{AR_{j,t}}{St(AR_j)}$$

where

$$S\bar{t}(\overline{\overline{AR}}) = \left\{Var(AR_j) + 2\,\text{cov}(AR_{j,t}, AR_{j,t+1})\right\}^{\frac{1}{2}}$$

the standard deviation includes the covariance term to adjust for first order autocorrelation and the test-statistic is approximately unit normal.

For the MCAR, the test statistic is $\frac{MCAR_t}{S(\overline{AR})}$ where $MCAR_t = \frac{1}{N}\sum_{j=1}^{N} C\hat{A}R_{j,t}$ and

$C\hat{A}R_{j,t} = \sum_{t=T1}^{T2} \frac{A\hat{R}_{j,t}}{Q^{\frac{1}{2}}}$ where T1 and T2 denote the starting and the end of the respective windows and Q is the number of trading days between T1 and T2 i.e., Q = T2-T1 +1.

The cross-sectional t – test (T) employing the cross-sectional variance estimator is computed as $\frac{MARt}{S^2/\sqrt{N}}$ where $S^2 = \frac{1}{N}\sum_{i=1}^{N} \frac{(AR_{jt} - MAR_t)^2}{N-1}$.

Initially we estimated the market model for each sample firm using S & P CNX 500 index as the proxy for market portfolio. In order to avoid a possible bias caused by a pre-event estimation period following Edmister *et al* (1994) and Chung and Kryzanowski (1998) we used a post event estimation period (ED+51 to ED+201) to estimate the market model parameters. Also we used a nonparametric sign test, which is based on the sign of the abnormal returns. This requires that the abnormal returns are independent across securities and that the expected proportion of positive abnormal returns under the null hypothesis is 0.5. The test statistic is computed as $\theta = \left[\frac{N^+}{N} - 0.5\right]\frac{\sqrt{N}}{0.5}$ ~ N (0,1) where N is the sample size and N^+ is the number of cases where the abnormal return is positive. Generally nonparametric tests are not used in isolation but in conjunction with parametric tests they provide a check of the robustness of the conclusions based on parametric tests.

c. Methodology for the volume effects

To explore the trading activity changes when a stock is included (excluded) to (from) Nifty trading volumes adjusted for market volume are examined around the event days. Past studies used different measures to examine abnormal trading volumes around the event dates. Lynch and Mendenhall (1987) used the market model approach, wherein turnover of trading values were used. Beneish and Whaley (2002) applied ratio of dollar trading volume to the average dollar volume across sixty days preceding the announcement day. While Elliott and Warr (2003) employed Harris and Gurel's (1986) metric that takes account of market volume and the individual security's volume. In this study we adopt a mean and market adjusted volume measure similar to those of Harris and Gurel (1986), Liu (2000) and Elliott and Warr (2003) to examine abnormal volumes around the event days.

$$VR_{i,t} = \frac{V_{it}/\ V_i}{V_{mt}/\ V_m}$$

where $V_{i,t}$ and $V_{m,t}$ are daily share volume of the stock i and the market respectively and V_i and V_m are the mean trading volume of stock i and the NSE trading volume in the estimation period [AD-

201, AD-51]. This volume ratio that takes into account firm capitalization changes and market volume is expected to have a value of 1 under the null hypothesis. We used a test statistic (T) based on cross-sectional variance estimator.

7. Statistical Issues

In this section we briefly discuss four important statistical issues that crop up in event studies and in this context we draw up on the results of Brown and Warner (1985), Strong (1992) and Corrado and Zivney (1992).

1. *Non-synchronous trading*: The market model requires that daily returns be measured over the same fixed time interval for all securities. If the last trades for different securities occur at different times estimates of market model parameters may be biased and inconsistent due to the first order serial correlation. Brown and Warner (1985) found that methodologies other than OLS though reduced biases in the estimates of beta but resulted in no improvement in either the specification or the power of event studies. Therefore using OLS estimates in this study may not necessarily imply misspecification.
2. *Non-normality of returns*: The daily stock returns of individual securities are fat tailed relative to normal distribution (Fama 1976, Pan and Duffie, 1997). But studies by Brown and Warner (1985) documents that mean excess returns in a cross-section of securities converge to normality as the sample size increases. The test statistics are well specified even when sample size is only *five* despite the *clustering* phenomenon.
3. *Non-stationarity of variances*: If the daily variances are non-stationary test statistics based on variance estimates outside this period are misspecified. Brown and Warner (1985) provide evidence of improvement in the specification of test statistics when auto-correlation adjustments are made to the time-series of mean daily excess returns. Consequently the time series variance estimator used in the study included first order auto correlation adjustments.
4. *Clustering*: Cross-sectional dependence in stock returns data is likely to exist when some of the stock returns have event dates that are identical. This necessitates the calculation of variances by taking into account the covariances across the securities. The problem is exacerbated when the event securities are clustered along other added dimensions like industry. Most revisions to Nifty and Jr. Nifty have a set of stocks being included/excluded rather than one security on a particular date; but only on very few occasions the bunched securities belonging to the same industry were included/excluded. To take care of the few instances of clustering the abnormal returns are aggregated into a portfolio dated using event time and the standard portfolio concepts were applied. Because of this adjustment our sample sizes further shrank, as we have to create portfolios of stocks to account for possible industry correlations.

8. Hypothesized effects of index changes

Nifty is one of those indices that are scientifically managed and the criteria used to include/exclude a stock into the index are well defined. Given the clear selection criteria it may appear that one can possibly predict the changes. But with hundreds of stocks to choose from it will be difficult for the traders to speculate the inclusions consistently, since the candidate stocks after meeting the liquidity and market capitalization criteria they should also make the index representative of the market, well-diversified and retain its hedging effectiveness. So to anticipate the changes over and over again is rather difficult also taking clues from earlier studies by Jain (1987) and Liu (2000) who found no significant excess returns in the pre-announcement window the study sets off with the hypothesis that there is no anticipation prior to the announcement.

H1: There are no excess returns in the pre announcement window

When a stock is selected for inclusion/exclusion in the Nifty index, assuming absence of ideal liquidity conditions excess returns may occur on the effective day due to the activity of the index funds and self-indexing investors. From the DSDC perspective also this holds when stock price move along the less than perfectly elastic demand curve. Given the small size of organized index funds in India we conjecture no excess returns on the effective date.

H2: There are no excess returns on the effective day

The decision to include a particular stock into the index may stimulate the buying interests of the indexers. This demand from them may bring about increased volumes on the implementation day or perhaps few days around the event day depending on the response of the index funds and self-indexers. In line with our preceding hypothesis we presume no excess volumes.

H3: There is no excess trading volume on the effective day

Past studies by Harris and Gurel (1986) have observed that the excess returns observed on the event day are subsequently reversed once the demand from the index funds recedes. While others like Jain (1987), Dhillon and Johnson (1991) have found that there are no reversals after the event date. Consistent with our second hypothesis we premise no excess returns in the post event window.

H4: There are no excess returns in the post event window(ED+1 to ED+25)

Lynch and Mendenhall (1997), Elayan *et al* (2001) have observed excess returns after the announcement of a change and its effective implementation. This is inconsistent with market efficiency and subsequent work by Cusick (2001) on the same sample (with the inclusion of succeeding data) as used by Lynch and Mendenhall found evidence of decreasing returns and increasing efficiency.

H5: There are no excess returns in the build up window

For studying the price and volume effects for Jr. Nifty we follow the same methodology and test statistics but when dealing with deletions from Jr. Nifty we focused on pure deletions only. Since

deletions in Jr. Nifty are of two types those resulting due to the stocks not meeting the selection criteria and those that will be deleted in order to accommodate them in Nifty (since as a matter of policy IISL maintains the sample sets of Nifty and Jr. Nifty mutually exclusive) and these deletions are infact positive for the respective company stocks since they are being promoted to figure in the main index. Hence these deletions are not equivalent to the deletions of the first type and hence we concentrate only pure deletions.

9. Results and Discussions

We begin by presenting the results for the price effects around the announcement day for the Nifty index. Table 3 Panel A reports the same and can be noticed that the excess returns are not statistically significant around the announcement day even though a significant number of firms ended on positive note around the announcement day. From Panel B of Table 3 the MAR on the effective day is 1.47% and is statistically significant and around 60% of the sample firms experience a non-negative price effect on the day. This price effect is almost similar to that reported for Nikkei 500 (Liu, 2000) while it is around half the average price effect reported for S & P 500 additions (Lynch and Mendenhall, 1997). It can also be seen that the MAR is significant on ninth day after the implementation with an opposite sign indicative of a reversal. On this day the number of firms that ended on lower note is also high infact only six firms ended higher than the previous day. Table 5 presents the results for the case of Jr. Nifty and the MARs are not significant on any day either in the announcement window or in the effective day window. The price effects associated with deletions are almost similar to those of additions and can be seen in Table 4 with an effective day MAR of -1.60%, which is statistically significant at 0.05 level. But the effective day reaction is also preceded by a price reaction on ED-3 and ED-1. Again the MARs on eighth and ninth days are significant but in the opposite direction i.e. the prices are reverting almost after seven days. In the case of Jr. Nifty no such significant abnormal price effects were observed in either of the windows. The results for the long windows are depicted in Table 7. We found no significant excess returns in the pre-announcement window (AD-51 to AD-1) either for deletions or additions for both the indices. This may be because of the large number of stocks that may be eligible for selection and traders may find it difficult to speculate the stocks that will be entering the index. But in the case of deletions also the test statistic is not significant which is rather surprising since the stocks that may be the possible candidates for deletions will be few in number and anticipating them is relatively easier than the possible inclusions.

The MAAR in the build up window (AD+1 to ED-1) is not significantly different from zero for both Nifty and Jr. Nifty in the case of additions as well as in deletions. This is in contrast to the findings of Lynch and Mendenhall (1997) where they found significant returns in this window, which is inconsistent with the market efficiency. The MAAR in the post effective window is significant for

both additions and deletions for Nifty while it is not significant for the Jr. Nifty. In terms of our hypotheses, the statistics fail to reject H1, and H5 while we can reject H2 and H4. To wrap up, there is no clear stock price reaction for changes in the Nifty around the announcement day, but there are indications of temporary price pressures around the effective day. While for Jr. Nifty the event days are just like any other days.

Before we attempt to explain the results in the theoretical framework we will present the results for the volume analysis in Tables 8 and 9. No abnormal volumes were observed in any windows for either indices and for both inclusions or exclusions. This is in sharp contrast to the earlier studies wherein volume results are more or less consistent with the price results. Juxtaposing the volume results we can infer that the price reactions around the effective day may be possibly driven by indexers whizzing to buy (sell) up the added (deleted) stock in order to reduce the tracking error but their purchases were spread out since no abnormal volumes were detected around the effective day and in terms of our hypothesis the statistics are not large enough to reject H3.

Given the stock price effects we could possibly rule out the information content hypothesis or the certification effect since the index revisions are routinely carried out at periodic intervals and these are based on well-defined criteria. If the stock price reactions are due to the certification effect then they should be observed on the announcement day and not on effective day since no new information is disclosed on the effective day. Also the certification should be applicable symmetrically to both Nifty and Jr. Nifty since the same committee maintains both the indices and no price effects were observed for Jr. Nifty. Therefore we can infer that price effects around the Nifty revisions were not due to release of new information.

The liquidity hypothesis implies that addition (deletion) to an index results in increased (decreased) liquidity. To investigate this we compared the trading volumes before and after the index change to test whether the sample stocks experience any change in the liquidity. Although trading volume is not the metric used by the Index Maintenance Committee as a measure of Liquidity we used it for the following reasons – quite a few studies addressing the index effect issue used this as the measure of liquidity for instance Liu (2000). We have no data to calculate impact cost the measure used by Index Maintenance Committee. We carried out a paired t-test on the pre revision and post revision mean market adjusted trading volume ratio during the 150 trading days before announcement and after the change becomes effective i.e., mean market adjusted trading volumes (as defined in the volume analysis section) are calculated for the periods AD- 201 to AD – 51 and ED+ 51 to ED + 201. The t- value is 0.093 and is not significant at the conventional levels, while for deletions the t- value is 0.077 and is also not significant. The test statistics fail to reject the hypothesis of no changes in the liquidity for the sample firms. Therefore the observed price effects for Nifty are not due to changes in liquidity.

Given the small sample size the results have to be interpreted with caution. Though there is some evidence of price reversals it is unseemly to explain the results within the framework of PPH. According to PPH any price effects end when all the index funds have completed their trades. Lynch and Mendenhall (1997) following Keim and Madhavan (1996) use a sophisticated methodology and criteria based on trading volume patterns to determine the release-ending day. But employing such criteria is rather unworkable here since no abnormal volumes were detected around the event dates. However the presence of statistically significant negative (positive) MARs after the effective date for inclusions (exclusions) implies that the price reversals may be due to easing of the indexers demand. We further probed this using the long window MAAR i.e. the post effective MAAR is found to be statistically significant and opposite in direction for both additions and deletions and as the same were absent for the Jr. Nifty which is not tracked by the indexers we infer that the price pressures are present and are due to the index funds activities. To conclude, we can say that there are some price pressures but the study is not emphatic about the existence of price pressures in the same form as defined in the works of Harris and Gurel (1986) or Lynch and Mendenhall (1997) since no significant abnormal volumes were detected around the change day.

10. Conclusions

This study is an effort to understand whether the 'index effects' documented for the indices abroad happen for the Nifty and Jr. Nifty indices. We find that the stock prices, on average, increase (decrease) significantly on the effective day for the Nifty index and no such effects were observed for Jr. Nifty index. The prices revert after around a week's time both for additions as well as for deletions. But no abnormal volumes were detected around the effective day. Since no such reactions were observed for Jr. Nifty revisions we can possibly doubt the certification effect and no significant changes in the liquidity were observed. So we can't attribute the price reactions to the expected increase in liquidity. Prima facie there are pointers to support for the price pressure hypothesis that the impact of inclusion/exclusion is simply a transitory event with no permanent valuation effect. However the conclusions are not emphatic because of the lack of abnormal volumes in the effective day window.

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Table 1

Summary of recent works on the index effects

Sl.no.	Study by	Index	Hypothesis supported	Remarks
1	Chung and Kryzanowski (1998)	TSE 300 (Canada)	PPH, LH	
2	Kaul *et al* (2000)	TSE 300 (Canada)	DSDC	Considered index weight adjustments not the index changes
3	Liu (2000)	Nikkei 500 (Japan)	DSDC	
4	Brealey (2000)	FTSE (U.K.)	Price pressures for deletions	
5	Elayan *et al* (2000)	NZSE 40 (New Zealand)	PPH	
6	Chen *et al* (2003)	S & P 500	DSDC	For stock inclusions
7	Wurgler and Zhuravskaya (2002)	S & P 500	DSDC	
8	Chan and Howard (2002)	AOI (Australia)	PPH	
9	Elliott and Warr (2003)	S & P 500	PPH	On effective date

Table 2 (A)

Sample size for Nifty Index

	Additions		Deletions	
	AD	ED	AD	ED
Total available	36	36	36	36
Usable	26 *	36	26 *	36
Corporate actions	Nil	Nil	7	7
Loss due to Clustering effect	6	6	2	2
Add portfolios formed to take care of clustering	3	3	1	1
Net sample size	26-6+3 = 23	36-6+3 = 33	26-7-2+1 = 18	36-7-2+1 = 28

*For the remaining stocks Announcement date is not available

Table 2 (B)

Sample size for Jr. Nifty Index

	Additions		Deletions	
	AD	ED	AD	ED
Total available	62	62	62	62
Usable	59 *	62	39* #	42 * #
Corporate actions	1	1	12	12
Loss due to Clustering effect	12	12	0	0
Add portfolios formed to take care of clustering	5	5	0	0
Net sample size	59-1-12+5 = 51	62-1-12+5 = 54	39-12 = 27	42-12 = 30

*For three stocks Announcement date is not available

only pure deletions considered and deletions due to upgrades (20 nos) to Nifty index were not considered

Table 3

Panel A Price effects (Announcement day) for stocks added to the NIFTY index

The sample size is 23 and AD stands for Announcement Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	-0.05%	-0.10	0.17	-0.05%	-0.10	0.17	10	-0.63
-9	-0.24%	-0.49	-0.65	-0.30%	-0.42	-0.40	15	1.46
-8	0.45%	0.63	0.16	0.15%	0.19	-0.44	15	1.46
-7	0.21%	0.32	1.25	0.36%	0.38	0.14	13	0.63
-6	0.26%	0.67	0.23	0.62%	0.56	0.58	15	1.46
-5	0.24%	0.54	0.80	0.86%	0.83	0.59	12	0.21
-4	-0.60%	-0.64	-0.49	0.26%	0.18	0.45	15	1.46
-3	-0.08%	-0.13	-0.37	0.19%	0.11	0.14	15	1.46
-2	0.73%	1.21	1.15	0.91%	0.66	0.29	17	2.29*
-1	0.90%	1.58	1.78	1.82%	1.14	0.97	16	1.88
AD	0.45%	1.18	0.86	2.27%	1.47	1.16	18	2.71*
1	0.05%	0.07	0.58	0.05%	0.07	0.16	17	2.29*
2	-1.16%	-1.95	-1.69	-1.11%	-1.87	-0.32	9	-1.04
3	0.21%	0.45	0.27	-0.91%	-1.40	-0.25	16	1.88
4	-0.40%	-1.05	-0.41	-1.30%	-1.86	-0.38	15	1.46
5	0.25%	0.80	0.30	-1.05%	-1.40	-0.25	13	0.63
6	0.20%	0.32	0.81	-0.85%	-1.01	-0.07	13	0.63
7	-0.49%	-0.86	-0.57	-1.34%	-1.16	-0.35	11	-0.21
8	0.57%	1.58	0.89	-0.78%	-0.73	-0.14	18	2.71*
9	0.09%	0.17	0.84	-0.69%	-0.55	0.08	14	1.04
10	0.45%	0.49	1.41	-0.24%	-0.25	0.40	14	1.04

* indicate significance at 0.05 levels

Panel B Price effects (Effective day) for stocks added to the NIFTY index

The sample size is 33 and ED stands for Effective Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	0.18%	0.07	0.31	0.18%	0.38	0.31	14	-0.87
-9	-0.52%	-1.02	-1.26	-0.34%	-0.47	-0.67	10	**-2.26***
-8	0.34%	0.85	0.82	0.00%	0.00	-0.08	12	-1.57
-7	0.33%	0.65	0.08	0.33%	0.33	-0.03	15	-0.52
-6	0.32%	0.75	0.42	0.65%	0.52	0.16	16	-0.17
-5	0.56%	0.69	1.03	1.21%	0.79	0.57	15	-0.52
-4	-0.31%	-0.55	-0.70	0.86%	0.57	0.41	13	-1.22
-3	-0.75%	-1.31	-1.49	0.10%	0.07	-0.29	10	**-2.26***
-2	-0.66%	-1.85	-0.40	-0.56%	-0.36	-0.58	13	-1.22

-1	-0.33%	-0.39	-1.18	1.13%	0.74	-0.94	10	**-2.26***
ED	1.47%	**2.60***	**2.23***	2.35%	1.87	1.53	21	1.57
1	-0.78%	-1.67	1.02	-0.78%	-1.67	-1.02	10	**-2.26***
2	0.33%	0.68	0.41	-0.45%	-0.54	0.31	15	-0.52
3	0.69%	1.17	0.38	0.24%	0.20	0.52	19	0.87
4	-0.73%	-1.33	-0.72	-1.01%	-0.83	-0.15	8	**-2.96***
5	0.21%	0.41	-0.07	-0.80%	-0.55	-0.08	14	-0.87
6	-0.58%	-1.13	-0.50	-1.29%	-0.74	-0.44	9	**-2.61***
7	0.05%	0.07	1.06	-1.25%	-0.64	-0.65	13	-1.22
8	0.61%	1.10	1.01	-0.64%	-0.30	-0.37	12	-1.57
9	-1.53%	**-2.10***	**-2.29***	-2.17%	**-1.99***	-1.86	6	**-3.66***
10	-0.25%	-0.54	-0.44	-2.42%	-1.15	-0.27	12	-1.57

* indicate significance at 0.05 levels

Table 4

Panel A Price effects (Announcement day) for stocks deleted from the NIFTY index

The sample size is 18 and AD stands for Announcement Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	-1.05%	-1.36	-1.92	-1.05%	-1.36	-1.92	8	-0.47
-9	-0.16%	-0.27	0.97	-1.21%	-1.26	-0.77	11	0.94
-8	0.57%	0.81	0.50	-0.63%	-0.63	-0.75	12	1.41
-7	-0.90%	-1.93	-1.23	-1.53%	-1.36	-1.38	5	-1.89
-6	-0.44%	-0.65	-1.07	-1.97%	-1.66	-1.80	12	1.41
-5	-0.32%	-0.69	-0.14	-2.30%	-1.60	-1.41	8	-0.47
-4	-0.16%	-0.33	0.15	-2.46%	-1.84	-1.84	11	0.94
-3	0.42%	0.81	0.26	-2.03%	-1.36	-1.09	12	1.41
-2	-0.44%	-0.75	-0.50	-2.47%	-1.44	-0.96	12	1.41
-1	-0.39%	-0.76	-0.64	-2.86%	-1.66	-1.08	9	0.00
AD	-0.46%	-0.74	0.58	-3.32%	-1.68	-0.62	8	-0.47
1	0.31%	0.46	0.03	0.31%	0.46	-0.74	10	0.47
2	-0.58%	-0.85	-1.09	-0.27%	-0.38	-1.33	8	-0.47
3	0.33%	0.79	0.84	0.06%	0.06	-1.06	13	1.89
4	0.05%	0.07	0.40	0.11%	0.11	-0.95	11	0.94
5	0.74%	1.44	0.87	0.85%	0.76	-0.74	10	0.47

6	-0.16%	-0.31	0.24	0.69%	0.51	-0.48	9	0.00
7	0.57%	1.12	0.48	1.26%	0.74	-0.55	10	0.47
8	0.03%	0.04	-1.33	1.28%	0.65	-0.80	9	0.00
9	0.29%	0.50	0.26	1.58%	0.94	0.36	10	0.47
10	-0.50%	-0.84	-0.82	1.08%	0.73	-0.99	11	0.94

* indicate significance at 0.05 levels

Panel B Price effects (Effective day) for stocks deleted from the NIFTY index

The sample size is 28 and ED stands for Effective Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	-0.30%	-0.67	-0.37	-0.30%	-0.67	-0.37	14	0.00
-9	-0.05%	-0.11	-0.67	-0.34%	-0.72	-0.37	12	-0.76
-8	-0.10%	-0.21	-0.46	-0.44%	-0.68	-1.07	12	-0.76
-7	-0.32%	-0.54	-0.59	-0.76%	-0.94	-1.07	10	-1.51
-6	-0.33%	-0.61	-0.33	-1.10%	-1.19	-1.04	9	-1.89
-5	0.23%	0.44	1.04	-0.86%	-0.76	-0.55	14	0.00
-4	-0.47%	-0.81	0.32	-1.33%	-1.11	-0.49	17	1.13
-3	-0.94%	-2.15*	-1.46	-2.27%	-1.81	-0.85	9	-1.89
-2	0.57%	1.14	0.74	-1.70%	-1.35	-0.70	19	1.89
-1	-1.12%	-2.20*	-1.61	-2.83%	-1.77	-1.27	6	-3.02*
ED	-1.60%	-3.14*	-4.37*	-4.42%	-2.71*	-2.24*	7	-2.65*
1	0.21%	0.48	0.48	0.21%	0.48	0.48	14	0.00
2	-0.32%	-0.59	-0.20	-0.11%	-0.18	-1.85	13	-0.38
3	0.58%	0.92	2.39	0.47%	0.50	-1.40	17	1.13
4	-0.28%	-0.77	-0.51	0.19%	0.19	-1.46	12	-0.76
5	0.53%	1.36	1.36	0.71%	0.70	-1.18	13	-0.38
6	0.74%	1.09	1.82	1.45%	1.24	-1.11	18	1.51
7	0.03%	0.06	-0.48	1.48%	1.16	-1.19	11	-1.13
8	1.44%	2.02*	2.15*	2.93%	2.09*	-1.97	20	2.27*
9	0.74%	2.14*	1.96	3.67%	2.57*	-0.28	19	1.89
10	0.57%	0.90	1.68	4.24%	2.70*	-0.06	14	0.00

* indicate significance at 0.05 levels

Table 5

Panel A Price effects (Announcement Day) for stocks added to the Jr. NIFTY index

The sample size is 51 and AD stands for Announcement Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	0.28%	0.51	-0.31	0.28%	0.51	-0.31	26	0.14
-9	-0.57%	-1.12	-0.70	-0.29%	-0.37	-0.71	26	0.14
-8	-0.08%	-0.18	-0.51	-0.37%	-0.38	-0.88	19	-1.82
-7	-0.08%	-0.22	0.03	-0.45%	-0.48	-0.75	24	-0.42
-6	-0.38%	-0.92	-0.87	-0.83%	-0.74	-1.06	20	-1.54
-5	-0.66%	-1.36	-1.09	-1.50%	-1.19	-1.41	24	-0.42
-4	-0.05%	-0.13	0.03	-1.55%	-1.20	-1.29	25	-0.14
-3	-0.41%	-1.14	-0.81	-1.96%	-1.56	-1.50	18	-2.10*
-2	0.06%	0.12	0.03	-1.90%	-1.50	-1.40	24	-0.42
-1	-0.39%	-0.83	-1.18	-2.29%	-1.55	-1.70	17	-2.38*
AD	0.03%	0.08	-0.34	-2.25%	-1.27	-1.73	26	0.14
1	-0.79%	-1.82	-1.28	-0.79%	-1.82	-1.28	15	-2.94*
2	0.59%	1.64	0.90	-0.20%	-0.51	-0.36	27	0.42
3	-0.59%	-1.70	-1.31	-0.79%	-1.13	-0.70	20	-1.54
4	-0.06%	-0.18	-0.27	-0.85%	-1.02	-0.71	26	0.14
5	0.13%	0.28	0.17	-0.72%	-0.98	-0.67	22	-0.98
6	-0.29%	-0.89	-0.62	-1.01%	-1.34	-0.83	17	-2.38*
7	-0.64%	-1.34	-0.98	-1.65%	-1.89	-0.99	18	-2.10*
8	-0.54%	-1.32	-0.86	-2.18%	-2.41*	-1.15	20	-1.54
9	0.13%	0.34	-0.11	-2.05%	-1.98	-1.15	28	0.70
10	0.83%	1.76	0.70	-1.21%	-1.74	-1.18	31	1.54

* indicate significance at 0.05 levels

Panel B Price effects (Effective day) for stocks added to the Jr. NIFTY index

The sample size is 54 and ED stands for Effective Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T)

are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	-0.25%	-0.65	-0.56	-0.25%	-0.64	-0.56	18	-2.45*
-9	0.13%	0.25	0.06	-0.12%	-0.18	-0.44	23	-1.09
-8	-0.50%	-1.17	-0.92	-0.63%	-0.65	-0.84	20	-1.91
-7	-0.80%	-1.62	-1.09	-1.43%	-1.29	-1.35	17	-2.72*
-6	-0.86%	-1.82	-0.95	-2.29%	-1.81	-1.61	15	-3.27*
-5	0.85%	1.76	1.69	-1.44%	-0.90	-0.86	27	0.00
-4	0.35%	0.72	0.91	-1.09%	-0.55	-0.42	21	-1.63
-3	-0.33%	-0.65	-1.14	-1.42%	-0.97	-0.86	19	-2.18*
-2	-0.58%	-1.52	-0.99	-2.00%	-1.31	-1.19	22	-1.36
-1	0.28%	0.71	0.55	-1.72%	-0.92	-0.84	27	0.00
ED	0.23%	0.48	0.76	-1.49%	-0.76	-0.46	29	0.54
1	0.07%	0.16	-0.10	0.07%	0.13	0.07	23	-1.09
2	0.03%	0.07	0.05	0.09%	0.19	0.15	30	0.82
3	0.77%	1.64	1.15	0.86%	-1.36	-0.32	11	-4.35*
4	-0.38%	-0.75	-0.26	0.49%	-1.49	-0.30	22	-1.36
5	0.88%	1.43	1.27	1.37%	-0.60	-0.03	31	1.09
6	0.01%	0.02	-0.13	1.38%	-0.53	-0.15	23	-1.09
7	0.38%	0.79	0.03	1.75%	-0.17	-0.22	27	0.00
8	0.34%	0.89	1.17	2.09%	1.02	-0.83	29	0.54
9	-0.06%	-0.15	-0.15	2.04%	1.10	-0.91	29	0.54
10	0.47%	1.03	0.87	2.51%	1.42	1.10	25	-0.54

Table 6

Panel A Price effects (Announcement day) for stocks deleted from the Jr. NIFTY index (only pure deletions)

The sample size is 27 and AD stands for Announcement Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	-0.13%	-0.28	-0.68	-0.13%	-0.28	-0.68	9	-1.73
-9	-1.06%	-1.12	-1.38	-1.19%	-1.06	-1.16	2	-4.43*
-8	1.16%	1.68	1.20	-0.03%	-1.94	-1.07	12	-0.58
-7	0.70%	1.71	1.32	0.67%	-0.04	-0.27	13	-0.19
-6	0.18%	0.20	0.02	0.84%	0.11	-0.23	10	-1.35
-5	0.10%	0.21	0.08	0.94%	0.17	-0.18	10	-1.35
-4	0.47%	0.71	0.66	1.41%	0.41	0.08	11	-0.96
-3	0.07%	0.12	-0.23	1.48%	0.41	0.00	10	-1.35
-2	0.67%	1.69	1.47	2.15%	1.01	0.48	15	0.58
-1	-1.09%	-1.65	-1.26	1.06%	0.48	0.06	7	-2.50*
AD	-0.71%	-1.26	-0.81	0.35%	0.15	-0.19	5	-3.27*
1	-0.52%	-0.88	-0.38	-0.52%	-0.88	0.16	9	-1.73
2	0.23%	0.42	0.53	-0.29%	-0.46	0.29	10	-1.35
3	0.27%	0.51	0.37	-0.02%	-0.03	0.38	11	-0.96
4	-0.68%	-1.03	-0.93	-0.70%	-0.67	0.13	6	-2.89*
5	0.44%	0.68	0.36	-0.26%	-0.18	0.22	9	-1.73
6	0.83%	1.11	1.14	0.56%	0.31	0.49	12	-0.58
7	0.48%	0.99	0.59	1.04%	0.52	0.61	11	-0.96
8	-0.31%	-0.89	-0.50	0.73%	0.38	0.48	10	-1.35
9	0.33%	0.68	0.14	1.06%	0.57	0.50	9	-1.73
10	-1.04%	-1.83	-1.55	0.02%	0.01	0.15	7	-2.50*

* indicate significance at 0.05 levels

Panel B Price effects (Effective day) for stocks deleted from the Jr. NIFTY index (only pure deletions)

The sample size is 30 and ED stands for Effective Day. MAR – mean abnormal return for the day and is the average of the sample firms' abnormal returns on day t. MCAR is the mean cumulative abnormal returns across observations and measures the abnormal performance over the event period. T_{MAR} and T_{MCAR} use the cross sectional variance estimator and Z_{MAR} and Z_{MCAR} use the time series variance estimator as explained in methodology section. The cross sectional test statistics (T) are distributed Student's *t* with (N-1) degrees of freedom and the time series statistics Z are approximately normally distributed. N (Positive) stand for number of firms with positive abnormal returns and theta is the nonparametric test statistic that tests whether the number of positive returns is different from the number of negative returns the test statistic is normally distributed and the test statistic computations are explained in methodology section 6(b).

	MAR	T_{MAR}	Z_{MAR}	MCAR	T_{MCAR}	Z_{MCAR}	N (Positive)	theta
-10	0.42%	0.60	0.37	0.42%	0.60	0.37	8	-2.56*
-9	-0.42%	-1.05	-0.36	0.00%	0.00	0.00	8	-2.56*
-8	-0.52%	-1.16	-0.79	-0.52%	-0.65	-0.45	9	-2.19*
-7	0.33%	0.64	0.51	-0.19%	-0.17	-0.14	11	-1.46
-6	0.45%	0.88	0.73	0.26%	0.21	0.20	10	-1.83
-5	0.34%	0.45	0.88	0.60%	0.35	0.54	10	-1.83
-4	0.75%	1.01	1.07	1.35%	0.64	0.91	13	-0.73
-3	-0.15%	-0.18	-0.62	1.20%	0.55	0.63	11	-1.46

-2	-0.38%	-0.41	-0.41	0.82%	0.49	0.46	7	-2.92*
-1	0.61%	0.97	0.73	1.43%	0.76	0.66	11	-1.46
ED	-0.79%	-0.71	-0.68	0.64%	0.38	0.43	7	-2.92*
1	0.19%	0.35	-0.19	0.19%	0.35	-0.19	8	-2.56*
2	-0.92%	-1.48	-0.84	-0.73%	-1.07	-0.21	8	-2.56*
3	-0.42%	-0.75	-0.64	-1.15%	-1.50	-0.37	7	-2.92*
4	-0.47%	-1.25	-0.54	-1.62%	-1.76	-0.50	10	-1.83
5	-0.72%	-0.83	-0.53	-2.34%	-2.57*	-0.62	8	-2.56*
6	0.80%	0.66	0.35	-1.53%	-1.05	-0.51	11	-1.46
7	-0.63%	-1.23	-1.26	-2.17%	-1.78	-0.80	9	-2.19*
8	-0.24%	-0.34	-0.29	-2.41%	-1.18	-0.84	8	-2.56*
9	2.21%	1.68	2.07	-0.19%	-0.73	-0.36	13	-0.73
10	-0.49%	-0.65	-0.79	-0.68%	-1.12	-0.52	4	-4.02*

* indicate significance at 0.05 levels

Table 7

Long window statistics

The sample sizes are described in Table 2 (A) and (B). Build up window is from AD+1 to ED-1 and Pan stands for pre announcement window starting from AD-51 to AD-1 while Post effective window is from ED+1 to ED+26. MAAR is defined as sample average of firm level average abnormal returns and the test statistic uses time series variance estimator and the statistics are distributed Student's *t* with (N-1) degrees of freedom.

Window	NIFTY				Jr. Nifty			
	Additions		Deletions		Additions		Deletions	
	MAAR (%)	T_{MAAR}	MAAR (%)	T_{MAAR}	MAAR (%)	T_{MAAR}	MAAR (%)	T_{MAAR}
Build up	0.18	1.00	-0.10	-1.03	-0.08	-0.82	0.13	1.39
PAN	-0.04	-0.49	-0.11	-1.38	0.04	0.67	-0.19	-1.89
Post effective	-0.22	-2.06*	0.38	3.46*	0.04	0.27	0.89	1.34

* indicate significance at 0.05 levels

Table 8

Trading volume effects for stocks added/deleted to Nifty index

MVR stands for Mean volume ratio on each day and was calculated as the cross sectional average of volume ratios on the same day. The expected MVR is 1 under the null hypothesis of no volume effects. The test statistic T is calculated using the cross sectional variance estimator and the test statistics are distributed Student's *t* with (N-1) degrees of freedom.

	Additions				*Deletions*			
	Announcement day		*Effective Day*		*Announcement day*		*Effective Day*	
	MVR	*T*	*MVR*	*T*	*MVR*	*T*	*MVR*	*T*
-10	0.93	1.14	0.82	0.95	1.09	1.03	0.83	0.80
-9	0.79	1.15	1.12	0.95	1.72	0.53	0.85	0.51
-8	1.29	1.19	1.49	0.72	1.81	0.48	1.38	0.72
-7	1.10	1.21	1.67	0.66	1.53	0.62	0.91	0.79
-6	1.05	1.07	1.41	0.77	1.28	0.50	0.74	0.99

-5	1.45	0.48	1.10	1.00	1.63	0.58	0.89	0.91
-4	1.02	0.66	1.78	0.68	1.29	0.69	1.48	0.64
-3	0.94	0.91	1.36	0.78	0.99	0.96	1.04	0.56
-2	0.88	1.10	1.41	0.83	1.37	0.41	1.03	0.80
-1	1.00	0.81	1.57	1.08	1.13	0.49	1.66	0.72
0	1.04	0.95	1.33	1.18	0.96	0.67	1.23	0.88
1	1.06	0.75	1.33	0.95	1.10	0.55	1.42	0.70
2	1.05	1.20	1.18	0.94	1.06	0.75	1.08	0.95
3	1.11	0.84	1.18	1.02	0.79	0.62	1.36	0.63
4	1.48	0.51	1.22	0.91	1.21	0.51	1.69	0.51
5	1.38	0.68	1.11	0.82	0.92	0.60	1.31	0.60
6	0.84	0.97	1.18	0.81	0.59	0.77	2.22	0.60
7	0.89	1.01	0.96	0.94	0.66	1.12	1.60	0.95
8	1.20	0.87	0.88	0.85	0.59	0.83	1.33	0.90
9	1.11	0.68	1.16	0.72	0.53	1.00	1.23	0.91
10	1.16	0.76	0.94	0.76	0.67	0.68	1.05	0.65

Table 9

Trading volume effects for stocks added/deleted to Jr. nifty index

MVR stands for Mean volume ratio on each day and was calculated as the cross sectional average of volume ratios on the same day. The expected MVR is 1 under the null hypothesis of no volume effects. The test statistic T is calculated using the cross sectional variance estimator and the test statistics are distributed Student's *t* with (N-1) degrees of freedom.

	Additions				*Deletions*			
	Announcement day		*Effective Day*		*Announcement day*		*Effective Day*	
	MVR	*T*	*MVR*	*T*	*MVR*	*T*	*MVR*	*T*
-10	1.08	0.93	1.06	1.04	1.04	0.80	0.82	0.37
-9	1.20	1.01	1.12	0.79	0.58	0.53	0.96	0.37
-8	1.16	1.14	1.22	0.61	1.17	0.57	1.12	0.35
-7	0.96	1.02	1.21	0.65	0.93	1.05	1.23	0.48
-6	1.01	1.06	1.03	0.63	0.74	0.48	1.04	0.42
-5	1.09	0.84	1.15	0.83	1.43	0.44	1.79	0.48
-4	1.18	1.00	1.08	0.78	1.27	0.35	0.94	0.43
-3	1.19	0.91	1.17	0.73	0.97	0.33	0.78	0.45
-2	1.30	1.02	1.07	0.81	1.31	0.42	0.88	0.53
-1	1.34	1.04	1.28	0.71	1.10	0.41	0.90	0.39
0	1.07	1.12	1.33	0.78	0.90	0.36	0.64	0.41
1	1.07	1.31	1.35	0.62	1.48	0.47	0.58	0.43
2	0.95	1.02	1.36	0.84	0.69	0.44	1.09	0.40
3	0.93	0.98	1.08	0.79	0.76	0.49	0.57	0.47
4	1.12	0.87	1.12	0.80	1.07	0.49	0.58	0.43
5	1.11	0.62	1.31	0.84	0.94	0.42	0.93	0.39
6	1.06	0.97	1.15	0.79	1.30	0.52	0.98	0.41
7	1.05	0.97	1.21	0.83	1.04	0.68	0.38	0.47
8	1.19	0.83	1.18	1.07	1.06	0.63	0.57	0.52
9	1.44	0.70	1.13	1.02	0.92	0.57	0.63	0.46
10	1.17	0.84	1.19	0.93	0.58	0.40	1.51	0.52

Figure 1

AD stands for *Announcement day* and ED stands for *Effective day*