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Are the CNX 100 Index Replacement Effects Permanent or Temporary?

Abdul Rahman and Prabina Rajib

Abstract

Stock index revisions to major stock indices usually bring in changes to the price and volume patterns of stocks getting added/deleted to and from the index. The current study analyzes stock index revisions of companies added (deleted) to and from the CNX 100 index by testing DSDC hypothesis and the PPH from 2004 to 2011. The results show that the price and volume effect is permanent for inclusions and exclusions of CNX 100 index. Hence, this has led to the support of the Downward Sloping Demand Curve hypothesis.

Keywords*: Stock index, Replacements, DSDC, PPH*

1. Introduction

Stock index revisions to major stock indices usually bring in changes to the price and volume patterns of stocks getting added/deleted to and from the index. They also reveal some kind of information about the impact of this index effect on companies. This fact has been widely discussed in financial literature, and hypotheses in association with these index revisions have been tested by the researchers. Most of the international studies to date have focused their choice on the revision effects of the S&P 500 index, where as some of the studies have also emphasized on the indices of emerging countries like India and China. The rebalancing of index funds by the fund managers is often assumed to be the reason behind such effects.

The increased popularity of using indices as benchmarks of the economy has given rise to the prodigy of index effect. The stocks getting added/deleted to and from an index experience abnormal returns and abnormal volumes, and it is a form of market inefficiency. The effect of index revision can be positive as well as negative. The buying of newly added stocks to a benchmark index leads to a price appreciation, and also the other reason for higher prices might be the index addition leads to increased attention from the potential investors, increased availability of information and increased liquidity. The opposite of this happens due to index deletions. Moreover, the index effect for additions

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and deletions can be long-term (permanent) which means that the prices and volume will remain even or odd for **a** long time after the shock, and can be short-term (temporary) which means that the prices and volume will reverse within a short-span after the shock.

The hypotheses that study the index revision effect includes Downward Sloping Demand Curve hypothesis (DSDC), Price Pressure Hypothesis (PPH), Liquidity Cost Hypothesis (LCH), Information Content Hypothesis (ICH), and Investor Recognition Hypothesis (IRH).

The Downward Sloping Demand Curve (hence forth DSDC) hypothesis says that, as per the investor's knowledge, there are no close substitutes for different stocks. When a particular stock experiences rise or fall in demand for a stock, then the price and volume of that stock tend to move upward or downward to a new equilibrium. Hence, a permanent increase (decrease) is expected post index revision. The Price Pressure Hypothesis (hence forth PPH) assumes that, the increase (decrease) in price and volume due to index change is for a short-term and immediate reversal would follow. However, the DSDC hypothesis differs from the PPH based on the duration of addition/deletion effect on price and volume. The Liquidity Cost Hypothesis states that, stocks added to the index become economical for investors to trade due to increase in liquidity, and decrease in transaction costs, while the deletion causes the reverse. The Information Content Hypothesis says that, index addition or deletion conveys good information that is beneficial to the investors, which in turn affects the stock prices permanently. The Investor Recognition Hypothesis posits that, new competent investors are drawn towards the firm by market attracted information leading to a permanent stock price appreciation. When the addition of stock takes place, there is an opportunity for a new competent investor group which leads to a positive price effect permanently. The reverse is invalid for deletions since investors are still acquainted with these stocks. This hypothesis does not hold any presumption regarding trading volume changes.

The significance of emerging markets in the world has intensely grown in the past two decades. The emerging market nations are tangibly strong in exports and capital spending that is crucial to dynamic rates of economic growth. There are a small number of studies on stock index revisions in the emerging markets like India. The hypotheses cited earlier have been tested comprehensively in a global perspective, while they are in brief in the Indian context.

Index funds provide broad and low-cost exposure to the rapidly moving emerging markets, and also these funds change in line with the developments in the underlying markets when indices rebalance. Also enormous amounts of investment have been evidenced on indices in the form of index funds in India, which mimics the constitution of the index in terms of investment weights. Thus, index rebalances leads to the change in the portfolio holdings of index funds. Hence, contemplating to these index funds, it would be rational to study the impact of index revisions on the price and volume of the stocks getting revised.

The Indian stock market has graduated to a better position akin to the securities markets in developed and other emerging markets. Moreover, India ranked 9th in terms of market capitalization in the international markets.

The analysis of the impact of stock index revision of a particular stock is of interest, because it is an event that should be independent on information that is public at that time. Moreover, changes in the composition of CNX 100 index are purely based on the relative market float capitalization of the corresponding firms. Hence, if index revision leads to a change in demand, then the nature of the price effects observed around index revisions casts light on the specific determinants of the price effects. Considering the studies undertaken in testing the index effects of different global stock indices, it is essential to examine such effects in the Indian circumstances.

In view of the above discussions, the objective of this study is to test the long-term effect on the price and volume of stocks due to index revisions with the help of DSDC hypothesis, and to test the short-term effect of the same with the help of PPH for index changes on CNX 100.

The paper is arranged as follows. The next section briefly explains about the construction and review policy of CNX 100. The following section discusses about the effects of index revision disclosed in the existing literature. Section 4 explains the data and methodology, and finally, Section 5 presents the observations of the paper and concludes.

2. Index Review Policy of CNX 100

The CNX 100 Index is based on the stocks listed and traded on the National Stock Exchange (NSE), and maintained by the Indian Index Services & Products Limited (IISL). The CNX 100 index would comprise of the securities which are constituents of CNX Nifty and CNX Nifty Junior. Any changes, i.e. addition and deletion of securities in the above mentioned two indices would be automatically represented in this index. The CNX 100 tracks the behavior of combined portfolios of two indices. It is a diversified 100 stock index accounting for 38 sectors of the economy. It represents about 82.84% of the free float market capitalization.

3. Past Research on Index Effects

There is a considerable amount of literature studying the stock index revisions on the price and volume of stocks added or deleted to and from an index. The fact that the stocks added (deleted) from a popular index shows significant positive (negative) abnormal returns, and abnormal volume of stocks is positively affected by the event. The competing hypotheses that are preferred to explain the effects of stock index revisions are explained below.

3.1 Downward Sloping Demand Curve (DSDC) Hypothesis

The DSDC hypothesis holds that stocks are imperfect substitutes, and the rise in demand of stocks added (deleted) to and from the index raise or deteriorates the prices permanently. A body of literature examining the effect of DSDC hypothesis due to stock index revisions is explained below.

Shleifer (1986) was the first person to study the price and volume effects for additions to S&P 500, where he documented a positive abnormal return of 2.79% around the announcement. Similarly, Lynch and Mendenhall (1997) who studied the effect of addition (deletion) on S&P 500 reported 3.81% and -12.7% abnormal returns around the announcement date. Deininger et al (2000) found strong abnormal returns on the day of the announcement, and these returns seem to be persistent for a long period for the German stock index replacements. A flat demand curve for the stocks with close substitutes was reported by testing the estimations of price responses of the stock sadded to S&P 500 index by Wurgler and Zhuravskya (2002). Denis et al (2003) documented additions to the index as a non-information free event by observing investors' earnings expectations on S&P 500 index additions. A permanent decline in price supplemented by significant abnormal volume was established by studying the effect of demand on stock prices of TIPs 35 and TIPs 100 by Biktimirov (2004).

Further, Park and Lee (2004) reported the demand curve sloping downward for both additions and deletions of Kospi 200 index. Chakrabarti et al (2005) found a positive abnormal return of 3.4% one day after the announcement, and also these returns got reversed after 10 days following the effective date for the MSCI index additions. The ARCH adjusted abnormal returns evidenced permanent price effect for FTSE 100 index revisions, whereas the OLS based abnormal returns indicated temporary price effect as reported by Mazaouz and Saadouni (2007). Lastly, Liu (2011) reported a permanent price hike for the additions to the Nikkei 225 index.

3.2 Price Pressure Hypothesis (PPH)

The argument that the rise in returns is caused by index fund purchases and a reversal of these returns in the post effective period would provide evidence in support of the price pressure hypothesis. Some of the research studies of the past, examining the aforesaid hypothesis for stock index revisions are explained below.

Harris and Gurel (1986) reported a positive abnormal return of 3.13%, which has reversed almost after two weeks for additions to the S&P 500 index, whereas the temporary movement of stock prices from their equilibrium values, and the reversal of abnormal returns around the announcement date were observed by Chung and Kryzanowski (1998). Similarly, Madhavan (2003) documented significant abnormal returns around the reconstitution of Russell 2000 and 3000 indexes to be attributable to temporary price pressure. The temporary positive and negative effects for additions and deletions of S&P 500 index were reported by Peterson (2004). Biktimirov (2004) observed temporary significant changes in prices, trading volume, and institutional ownership for stock index revisions of the Russell 2000 index. An increase (decrease) in stock prices on the announcement and effective dates for the Nifty index, and a reversal of those prices after a week was reported by Kumar (2007). Shanker and Miller (2006) evidenced temporary price and volume effects during the post-announcement period, and also a corresponding change in the institutional ownership for the index revisions of the S&P Small Cap index.

Further, significant positive abnormal returns of 2.58% that reversed within five days after the effective date were reported by Kerl and Walter (2007), whereas temporary positive (negative) volume effects besides the price for index revisions of ISE index were documented by Bildik and Gulay (2008). Hrazdil (2009) evidenced temporary price and volume effects around the change date for the revisions of S&P 500 index additions. Schmidt et al (2011) found significant positive (negative) effects around the announcement date for the S&P/ASX 200 index revisions. Selvam et al (2012) reported a temporary negative effect around the announcement and effective dates for the stocks added and deleted from the Nifty index. Rahman and Prabina (2014) reported significant positive (negative) abnormal returns around the effective change date, and a reversal of those returns within 5 and 7 days for additions and deletions to and from the Nifty index. Joshipura and Janakiramanan (2015) reported no significant price effect for the Nifty index inclusions on the announcement day, while the exclusions experienced a negative effect. Further, a temporary positive (negative) price effect was observed by them on the effective day for inclusions (exclusions). They observed no significant change in trading volume following Nifty index revisions. Their study supported the price pressure hypothesis.

The stock index revision effect on the price and volume has been studied by many researchers from all over the world, and these effects have been ascribed to the change in the demand from the index funds.

Therefore, a very few research works on the index revision context can be experienced in India. Kumar (2007) has examined the stock index revision effect during 1996 to 2003. Therefore, many significant changes in terms of listing of new companies, investment in FIIs and DIIs, increase in number of index funds, changes in monetary and fiscal policies might have materialized. Parthasarathy (2010) investigated the index revisions of Nifty, and found no support to either DSDC hypothesis nor for Price Pressure Hypothesis, instead he concentrated on conveying information to investors. Further, Selvam et al (2012) reported only the price effects around the index revisions of Nifty, but has not accounted the volume effect. Rahman and Prabina (2014) and Joshipura and Janakiramanan (2015) have studied and reported the price and volume effects for index revisions of Nifty index.

Thus, research work concerned to the stock replacements to the CNX 100 is lacking. Furthermore, the research studies undertaken by the aforesaid Indian researchers contradict with the results of the current study. Therefore, the current study fills this gap by studying associated effects of changes in the index composition of CNX 100 index.

The findings of this research might be of use to the investors and to the fund managers. If the study supports DSDC hypothesis, the investors with a long-term horizon should buy the shares of the added companies immediately following the day of the announcement without waiting for the actual change date to come, and it is at the discretion of the investors to hold or sell the shares of the deleted companies soon after the announcement happens as the share prices fall and trading volume also goes down. Similarly, if PPH gets supported, then the investors with a short-term horizon should rush to buy the shares in case of additions, and also rush to sell the shares of the deleted companies as the prices will fall after deletion

4. Data and Methodology

The list of stocks added and deleted to and from the CNX 100 index as well as the Effective Date of change is available on the NSE website. However, the date of the announcement has been collected from the past archives of IISL press release.

The sample period for this study is 2004 – 2011. The daily data is used to calculate the daily return and daily volume. During this period 77 companies have been added to as well as 88 companies have been deleted from the index. Of these companies 12 from the addition list and 13 from the deletion list are not part of this study due to insufficient data. This leaves with 65 additions and 75 deletions. Further, another 10 companies which are part of the deletion list are removed as these companies were part of M&A activities. Therefore, the final sample has 65 additions and 65 deletions.

To study the price and volume effect, event windows around the Announcement Date (AD) and Effective Date (ED) are identified. AD is the date when the additions (deletions) are announced by the index revision committee, whereas ED is the date when the new company will be actually added (deleted) to and from the index.

The company specific daily price-volume data and the CNX 100 index data have been taken from the NSE's website's (www.nseindia.com) archive. Following the previous research works of different researchers, the current study has used 60 days after the ED to test the DSDC hypothesis and 30 days after the ED to test the PPH.

The null hypothesis is that, the daily Mean Cumulative Abnormal Returns (MCARs) should be equal to zero, and the daily Mean Cumulative Abnormal Volume (MCAV) should be equal to one during the event period for all the testable hypotheses.

4.1. Calculation of Abnormal Return

The index change effect is analyzed by studying the abnormal returns around the AD and the ED. The daily abnormal returns are calculated as the stock's excess return on day 't' over the index return. For calculating the daily return, the adjusted prices are taken. The Daily Return R_t is calculated in the following manner:

$$R_t = \left[\frac{P_t}{P_t - P_{t-1}} \right] * 100 \qquad (1)$$

Where Pt is the stock/index adjusted closing price at time 't' and Pt-1is the stock/index adjusted closing price at time t-1. The returns are calculated by estimating a regression using Ordinary Least Squares method. The data is stationary at the first difference.

$$R_{i,t} = \alpha_{i,j} + \beta_{i,j} R_{m,t} + e_{i,t} \qquad (2)$$

The parameters of the OLS estimates $\alpha_{i,j}$ and $\beta_{i,j}$ in Eq. (2) are based on the assumption that the error term is homoskedastic with a mean zero and a constant variance. The standard GARCH (1, 1) model is employed to deal with the ARCH effect in the residuals of the model, since the ARCH effect is shown to affect the efficiency of estimators jointly with the magnitude and the statistical significance of the abnormal returns associated with a given event (Mazouz and Saadouni, 2007).

Under the GARCH (1, 1) specification as explained by Bollerslev (1987), the conditional variance of the error term in Eq. (3) $\sigma^2_{i,t}$ is modeled as follows:

$$\sigma^2_{i,t} = \varphi_{i,j} + \delta_{i,j1} \varepsilon_i{}^2_{t-1} + \theta_{i,j1} \sigma^2_{i,t-1} \qquad (3)$$

where the indicator j is the estimated period i.e. 150 days; $\varphi_{i,j}$ is the permanent conditional variance component; $\delta_{i,j1}$ is the ARCH term, and can be interpreted as information about the previous periods' volatility; $\theta_{i,j1}$ is the GARCH term, which is the previous periods' forecasted variance. The abnormal returns are calculated by substituting the parameters given in Eq. (4).

$$AR_{i,t} = R_{i,t} - (\alpha_{i,j} + \beta_{i,j} R_{mt}) \qquad (4)$$

The daily average abnormal returns, and the MCARs, which are specified in Eq. (4) above measures the price effect. The standard t-statistic is applied to test the OLS abnormal return estimates, but applying the same method for GARCH-based abnormal returns to test the significance different from zero may not be reliable. Hence, GARCH-based statistic of Savickas's (2003) was adopted by the current study which was also adopted by Mazouz and Saadouni (2007), to test whether the cumulative abnormal returns are significantly different from zero. The GARCH-based statistic can be explained as follows:

$$GARCH-test=\frac{\sum_{i-1}^{N}\frac{S_{i,s}}{N}}{\sqrt{\left(\frac{1}{N(N-1)}\right)\sum_{i-1}^{N}\left(S_{i,s}\sum_{i-1}^{N}\frac{S_{i,s}}{N}\right)^{2}}} \quad (5)$$

$$S_{i,s}=\frac{\sum_{t-1}^{s}\frac{AR_{i,t}}{S}}{\sqrt{\sum_{t-1}^{s}\frac{\hat{h}_{i,t}}{S}}} \quad (6)$$

N= 65, S = window length

The GARCH-test follows the student's t distribution with N-1 degrees of freedom. This test statistic informs whether the average abnormal return observed over a window of length s is significant.

4.2. Abnormal Volume

Abnormal trading volume was computed using the market model approach, following the methodology used by Biktimirov et al (2004), Shanker and Miller (2006) which was initially proposed by Campbell and Wasley (1996).

The expected level of volume is calculated using the market model, the estimation period is similar to that of abnormal return analysis, i.e. comprising of 150 days extending from -21 to day -170. Furthermore, the CNX 100 index is employed as a proxy for the market portfolio. The market model equation is as follows.

$$V_{i,t}=\alpha_i+\beta_i R_{mt}+\xi_i \quad (7)$$

where

$$V_{i,t}=\ln\left[\frac{100*n_{i,t}}{S_{i,t}}+0.00025\right] \quad (8)$$

$n_{i,t}$ = the number of shares traded for firm i on day t

$S_{i,t}$ = the number shares outstanding for firm i on day t

In order to account for days on which a firm's stock was not traded 0.00025 is added to the ratio of shares traded over shares trading. The log transformation is used to approximate a normal distribution (Ajinkya Jain, 1989).

$$V_{m,t}=\frac{1}{N}\sum_{i=1}^{N}V_{i,t} \quad (9)$$

N = the number of firms comprising the market index.

$$AV_{i,t} = V_{i,t} - (\alpha_i + \beta_i R_{mt}) \tag{10}$$

Now the Cross-sectional means (MAV_t) are computed by taking the average of AV_{it} values of all the stocks for the 't' th day. The mean value is 0 if there is no change in volume during the event period.

$$MAV_t = \frac{1}{N} \sum AV_{i,t} \tag{11}$$

The mean of MAV_t is used to test whether the average volume ratio is significantly different from 0 in an event window of length s.

$$MCAV_s = \frac{\sum_{t_1}^{t_2} MAV_t}{s} \tag{12}$$

To test the statistical significance of MCAVs, two tailed t-tests.

4.3 The Event and the Event Windows

The current study examines the CNX 100 additions and deletions. The two important event dates are the AD and the ED for addition and deletion. The number of days between AD and ED varies from 1 to 46 trading days. The mean trading days between AD and ED are 35, and that of the median is 38.The MCARs and the MCAVs in the current study are reported over five different event windows.

1. AD-22 to AD-2: Pre-announcement window
2. AD-1 to AD+1: Announcement Date window
3. AD+2 to ED-1: Post-announcement window
4. ED to ED+30: Short-term post-change window (To test PPH)
5. ED to ED+60: Long-term post-change window (To test DSDC)

5. Empirical Results

Price effects of stock index revisions

The daily MCARs for the stocks added and deleted to and from the CNX 100 index around the AD and ED are shown in Table 1.

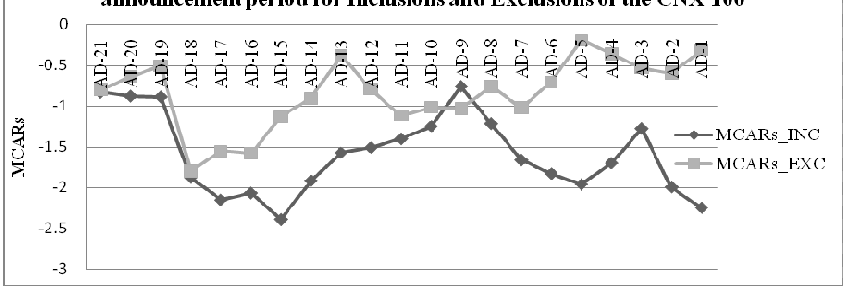
Table 1: Mean Cumulative Abnormal Returns (MCARs) for Inclusions and Exclusions of the CNX 100 Index

Interval	Inclusions		Exclusions	
	MCARs	t-statistic	MCARs	t-statistic
AD-21 to AD-2	-2.24	-14.77*	-0.31	-8.97*
AD-1 to AD+1	-0.06	0.35	-1.35	-3.34**
AD+2 to ED-1	0.92	0.42	0.38	0.85
ED to ED+30	2.74	5.87*	-0.86	-2.65**
ED to ED+60	3.42	12.18*	2.13	0.13

*** Significant at 0.05 level.*
** Significant at 0.10 level.*

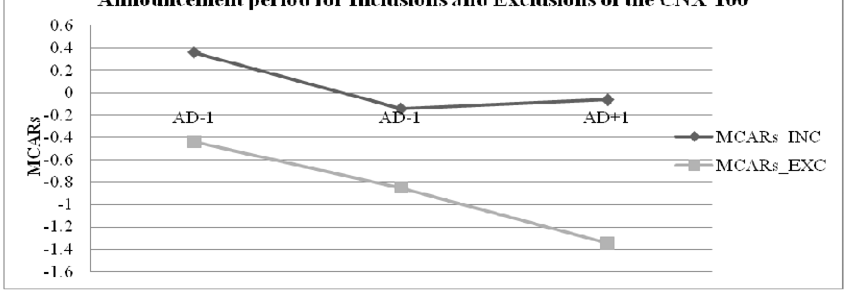
During the pre-announcement period, i.e. 21 days prior to the AD, the daily MCARs for the stocks added to the CNX 100are negatively significant at the 1% level. This shows no anticipation effect during this period, whereas the anticipation effect has been evidenced in case of deletions, because the daily MCARs for the stocks deleted to the CNX 100 in the aforesaid period are negative and significant. The pre-announcement period results can be evidenced from Figure 1.

Figure 1. Mean Cumulative Abnormal Returns (MCARs)for the Pre-announcement period for Inclusions and Exclusions of the CNX 100



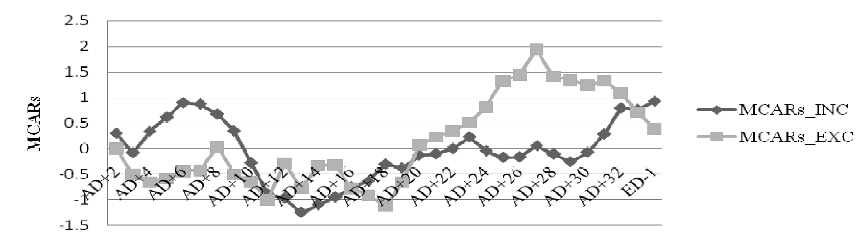
The daily MCARs around the AD are insignificant for additions, whereas the deletions experienced MCARs of -1.35 and significant at the 5% level. This can be experienced from Figure 2. The daily MCARs have a negative impact on the day prior to the announcement, on the AD, and also on the following day of announcement for both additions and deletions. The AD window results vary from the past research works of Lynch and Mendenhall (1997), Chakrabarti et al (2005), Kumar (2007) and Petajisto (2011) wherein the abnormal returns around the AD were significantly positive (negative) for both additions and deletions, whereas these results are comparable with the results of Rahman and Prabina (2014) where they documented similar kind of results for both additions and deletions of Nifty index.

Figure 2. Mean Cumulative Abnormal Returns (MCARs)for the Announcement period for Inclusions and Exclusions of the CNX 100



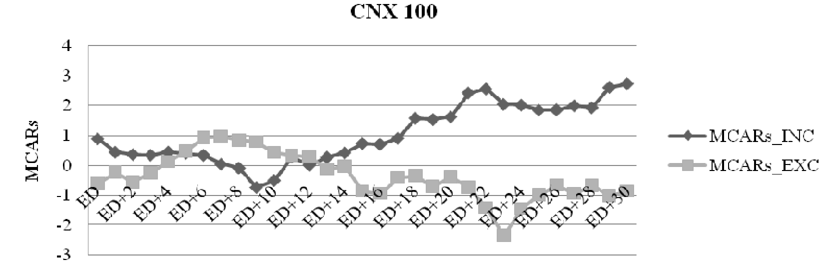
The pre-change period that runs through AD+2 has reported insignificant positive daily MCARs for both additions and deletions. The daily MCARs for deletions should have negative effect after the happening of the announcement, but the results are contrary to that. This shows that the index fund managers as well as other investors have not withdrawn their stocks from these companies resulting in positive MCARs for deletions. Nonetheless, the finding of this paper significantly varies from the other research papers. Kumar (2007) documented insignificant positive (negative) MAARs, and Selvam et al (2012) reported negative MCARs for both additions and deletions. But, in case of deletions, these results are akin to the results reported by Rahman and Prabina (2014) where the deletions evidenced positive and insignificant daily MCARs for Nifty index. The daily MCARs during the post-announcement period are shown in Figure 3.

Figure 3. Mean Cumulative Abnormal Returns (MCARs)for the Post-announcement period for Inclusions and Exclusions of the CNX 100



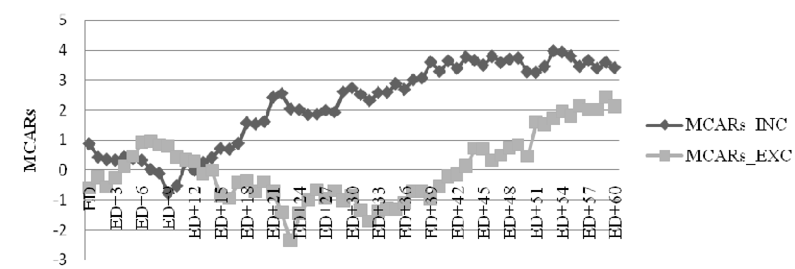
The result of the post-change period, which runs through ED to ED+30 shows positive significant MCARs for additions at the 1% level, and negative significant MCARs for deletions at the 5% level. This positive and negative effect got reversed after 7 days and 3 days of ED. These results are in contrast to the previous studies of Harris and Gurel (1986), Jain (1987), Lynch and Mendenhall (1997), Kumar (2007), Petajisto (2011) and Rahman and Prabina (2014) where the prices reverted in a different time frame for additions and deletions. The short-term price reversal can be evidenced from Figure 4.

Figure 4. Mean Cumulative Abnormal Returns (MCARs)for the short-term post change period for Inclusions and Exclusions of the CNX 100



Further, the long-term post change date window which runs from ED to ED+60 reported positive daily MCARs for both additions and deletions, but insignificant for deletions. This shows that there is persistency in price increase for additions, and for deletions also since the MCARs for deletions are insignificant. This can be evidenced from Figure 5.

Figure 5. Mean Cumulative Abnormal Returns (MCARs)for the Long-term post change period for Inclusions and Exclusions of the CNX 100



The Wilcoxon signed rank test shows significant MCARs at the 5% level for all the periods except for the post-announcement period, which runs from AD+2 to ED-1 for both additions and deletions. The long-term post-change window reported significantly positive MCARs for inclusions to CNX 100. The short-term post-change window for exclusions from CNX 100 has reported negatively significant MCARs and the long-term post-change window has reported insignificant positive MCARs. This shows that there is a permanent increase (decrease) in the prices of inclusions (exclusions) of CNX 100 index, hence allows the current study to support the DSDC hypothesis.

Volume Effects of Additions and Deletions

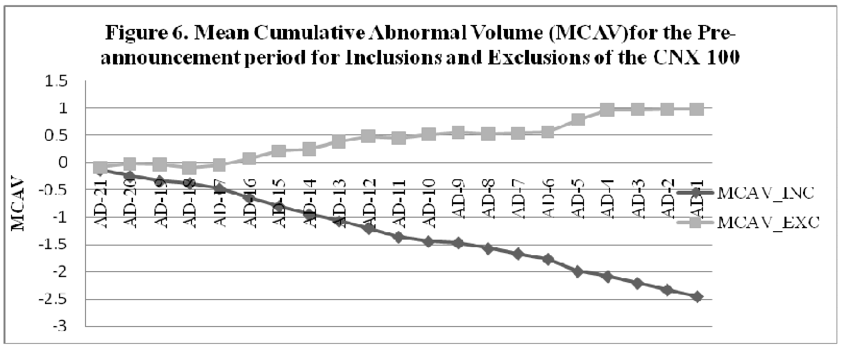
The movement of trading volume around AD and ED for additions and deletions has been reported in Table 2 below. The results report that the daily MCAV during all the periods except pre-announcement for additions, and announcement period for deletions are positive and significant.

Table 2: Mean Cumulative Average Volume (MCAV) for Inclusions and Exclusions of the CNX 100 Index

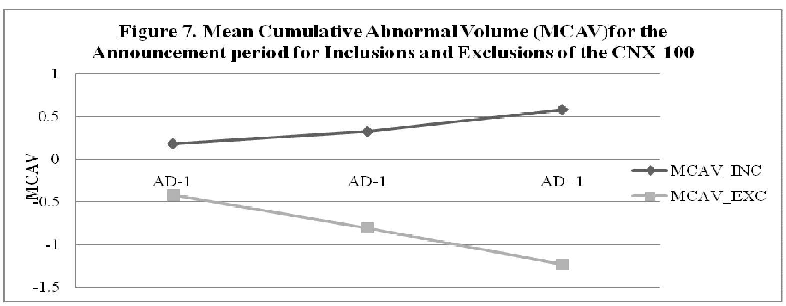
Interval	Inclusions		Exclusions	
	MCAV	t-statistic	MCAV	t-statistic
AD-21 to AD-2	-2.45	-7.99*	0.97	5.17*
AD-1 to AD+1	0.58	3.11**	-1.23	-3.50**
AD+2 to ED-1	0.55	7.79*	0.24	4.62*
ED to ED+30	2.76	4.97**	0.80	5.30*
ED to ED+60	6.59	8.49*	2.71	5.81*

*** Significant at 0.05 level*
** Significant at 0.01 level*

The daily MCAVs during the pre-announcement period are significantly negative and positive at 1% level for both additions and deletions. This shows that there is no anticipation effect for both the additions and deletions. This can be evidenced from Figure 6 below. This shows that the market is not able to pre-empt about the additions, and as well as for the deletions.



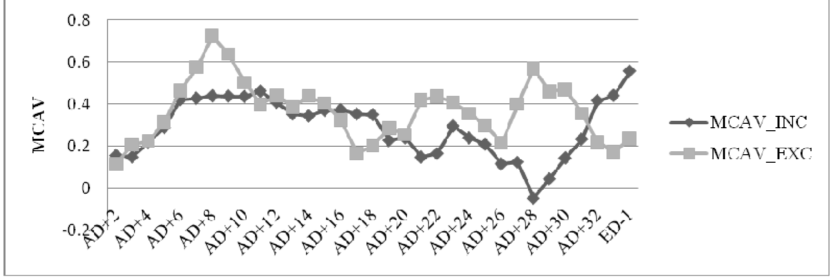
There was an increase and decrease of MCAVs around the announcement period for additions and deletions and significant at the 5% level. This can be evidenced from Figure 7.



Further, the MCAVs during the post-announcement period (AD+2 to ED-1) are positively significant at the 1% level for both additions and deletions. The trading activity reduced for additions, and increased for deletions after the announcement date. This shows that the index fund managers try to get some enhanced returns before the actual change date by taking some tracking error risks. This can be evidenced from Figure 8.

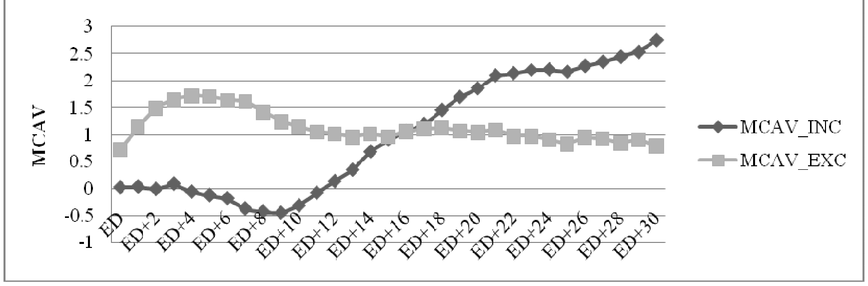
The daily MCAVs during the short-term post change period are positive and significant at 5% and 1% level for additions and deletions. The volume levels significantly increased for both throwing light on market liquidity. This can be experienced from Figure 9 below. Similarly, the MCAVs during the long-term post change period, which runs for 60 days from ED increased significantly to a large extent at the 1% level for both additions and deletions.

Figure 8. Mean Cumulative Abnormal Volume (MCAV)for the Post-announcement period for Inclusions and Exclusions of the CNX 100



To recapitulate, the aforesaid findings show that, the volume levels increased and decreased during the date of announcement for additions and deletions. Then they decreased to a negligible extent for additions, and increased for deletions, and peaked around the short-term actual change date and long-term actual change date. Moreover, it can be observed that the trading activity associated with the stock index revisions is happening on the actual change date.

Figure 9. Mean Cumulative Abnormal Volume (MCAV)for the short-term post change period for Inclusions and Exclusions of the CNX 100



To investigate, whether there is a persistent volume effect, the MCAVs for 60 days after the ED are analyzed. The study reports that the volume levels are positive and significant throughout the long-term post-change window period. The prices reversed after 1 day of the ED for additions, whereas for deletions the prices were positive and decreased negligibly to a small extent. This can be evidenced from Figure 10. Consequently, the trading volume patterns, alike the price effects, find support with regard to the DSDC hypothesis. The volume results are in contrast to the results of Kumar (2007) where no abnormal volumes were observed throughout the event period for both additions and deletions, and also in contrast to Rahman and Prabina (2014) where abnormal volumes are positive and above normal for all the event periods.

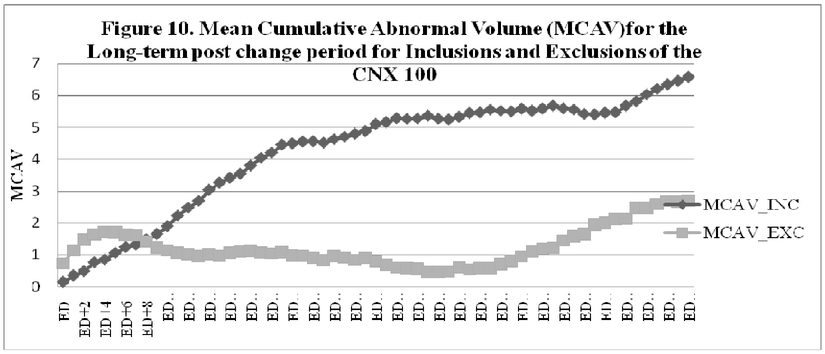


Figure 10. Mean Cumulative Abnormal Volume (MCAV)for the Long-term post change period for Inclusions and Exclusions of the CNX 100

5.1. Supplementary Test for PPH

The study intends to test further the DSDC and PPH to examine the presence of permanent effect and temporary effect in the price and volume of stocks added (deleted) to and from the CNX 100 index.

Following the methodology of Biktimorov (2004) and Shanker and Miller (2006), the study intends to predict the PPH by regressing the post-change day CAR ($CDCAR_{1-T,j}$) on the ED abnormal returns ($CDAR_{0,j}$) for each firm 'j' as given in Eq.13.

$$CDCAR_{1-T,j} = \alpha + \theta CDAR_{0,j} + \varepsilon_{t-T,j} \qquad (13)$$

A negative slope for additions and a positive slope for deletions in this regression indicate a temporary price effect, by full reversal of event day returns in the post change period (ED) as estimated by the PPH. A slope of zero for both the additions and deletions indicate a permanent price effect and hence supports the DSDC hypothesis.

Kaul et al (2000) in their model computed the weekly CARs, starting with the post-event week and advancing repeatedly for 15 weeks following the event. These weekly CARs are then regressed on the announcement week returns. They rejected the hypothesis of the regression in one test that the slope is -1, and accepted the hypothesis that the slope is zero in another test. Similarly, Biktimorov (2004) reported similar results for 60 days following the event. Both the studies found support for DSDC hypothesis. However, Shankar and Miller (2006) reported a slope of -1 for their regression for 60 days following the event. Their study supported the PPH.

Following the time period estimation of Rahman and Prabina (2014) for this model, the current study estimates a time period subsequent to the ED, which extends in 5 day increments to 30 days after the ED. A significant negative slope for additions and a significant positive slope for deletions is consistent with the PPH. A slope of zero for both the additions and deletions indicate a permanent price effect and hence supports the DSDC hypothesis.

Results of Price Pressure Hypothesis

The results of Eq. 13 are presented in Table 3. They report that the prices for additions reversed after 7 days of the ED which falls in the second interval of ED+6 to ED+10. Similarly, the slope estimates for third and fourth interval are positive, and the last interval is negative. But all the slope coefficients are insignificant.

Table 3: Results of the Price Pressure Hypothesis

Windows	C	$CDAR_{0,j}$	t-statistic	R^2
Additions to the CNX 100 index				
ED to ED+5	0.002	0.213	1.16	0.02
ED+6 to ED+10	-0.04	-0.48	-1.04	0.02
ED+11 to ED+15	-0.0003	0.22	-0.27	0.002
ED+16 to ED+20	-0.0004	0.35	0.78	0.012
ED+21 to ED+25	0.002	0.13	0.35	0.015
ED+26 to ED+30	0.02	-0.31	-1.21	0.005
Deletions to the CNX 100 index				
ED to ED+5	-0.003	-0.46	-1.14	0.12
ED+6 to ED+10	0.011	-0.17	0.95	0.003
ED+11 to ED+15	-0.00013	0.11	0.38	0.006
ED+16 to ED+20	-0.004	0.28	1.02	0.010
ED+21 to ED+25	-0.002	0.33	0.55	0.001
ED+26 to ED+30	-0.006	0.88	1.23	0.021

$$CDCAR_{1-T,j} = \alpha + \theta CDAR_{0,j} + \varepsilon_{t-T,j} \quad \text{......................................} (15)$$

$CDCAR_{1-T,j}$ = Post Effective Date Cumulative Abnormal Return for each firm

$CDAR_{0,j}$ = Effective Date Abnormal Return for each firm

****Significant at 0.10 levels*

The slope estimates were negative for the first and second intervals, and the remaining intervals experienced positive slope estimates. All the slope estimates are insignificant. The prices for deletions got reversed after 3 days of the ED which falls in the first interval.

Therefore, the current study does not find support to accept the hypothesis that, the slope is negative for additions and positive for deletions for the price reversal during the post change period that extends to 30 days beyond the ED.

Therefore, the results presented in Section 4 and Section 5 of this paper confirm that the prices and volumes persist for a long-term, since the long-term post-change window for inclusions is positive and significant, while it is positive and insignificant for exclusions, and the supplementary tests for PPH also failed to produce significant results, and hence paves the way to support the DSDC hypothesis. The investors should invest more in the companies getting added to the benchmarked index, as the prices are increasing, and this can persist for longer period of time. Similarly, in case of deletions, the investors should not drop the deleted company's stock from their portfolio, as the decreased price might reach its normal position within a short period of time.

6. Summary and Conclusion

The current study analyzes stock index revisions of companies added (deleted) to and from the CNX 100 index by testing DSDC hypothesis and the PPH. The effect on price and volume due to the index revisions has been found less on AD and more on the ED for additions, and vice-versa for deletions. This exhibit that the index fund managers are concentrating more on the actual change date for additions. Similarly, the trading volume levels were less on the AD and peaked on the ED for both additions and deletions. They were moving in an increasing trend even though there was a short reversal in between. This shows that the stocks added and deleted have lost none of their liquidity in the market.

Further, the results document persistency in case of price and volume for both additions and deletions, hence paving the way to support the DSDC hypothesis. This shows that the index fund managers and retail investors are of long-term horizon. The price results reported by the current study departure from the previous studies of Harris and Gurel (1986), Lynch and Mendenhall (1997), Peterson (2004), Petejitso (2011), Selvam et al (2012), and Rahman and Prabina (2014); however, the volume results are similar to that of Lynch and Mendenhall (1997), Shanker and Miller (2007) and in contrast to Kumar (2007). The study also estimated additional tests to predict the long-term and short-term price and volume effect, and does not found meaningful evidence in support of short-term price pressures leading to the PPH.

The current study contributes to the body of knowledge by examining the index revision effects in emerging markets like India and supporting the DSDC hypothesis. Further, the increasing pattern in the volume levels for both additions and deletions shows the presence of liquidity of the stocks which further effect the firm's cost of capital, and exploring those liquidity effects and cost of capital will be the improvement to the current study.

The current study contributes to the body of knowledge by examining the index revision effects in emerging markets like India. Further, the increasing pattern in the volume levels for both additions and deletions shows the presence of liquidity of the stocks, and exploring those liquidity effects will be the improvement to the current study.

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