Rajesh, Acharya H.; Gaikwad, Vishal

Article

Pre-open call auction and price discovery: Evidence from India

Cogent Economics & Finance

Provided in Cooperation with:
Taylor & Francis Group

Suggested Citation: Rajesh, Acharya H.; Gaikwad, Vishal (2014) : Pre-open call auction and price discovery: Evidence from India, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 2, Iss. 1, pp. 1-11, https://doi.org/10.1080/23322039.2014.944668

Acharya & Gaikwad, *Cogent Economics & Finance* (2014), 2: 944668
http://dx.doi.org/10.1080/23322039.2014.944668

cogent economics & finance

RESEARCH ARTICLE

Pre-open call auction and price discovery: Evidence from India

Rajesh Acharya H[1*] and Vishal Gaikwad[2]

Received: 07 March 2014
Accepted: 05 July 2014
Published: 12 August 2014

*Corresponding author: Rajesh Acharya H, Department of Humanities, Social Sciences and Management, National Institute of Technology Karnataka, Surathkal, Mangalore, India
E-mail: rajeshacharyah@gmail.com

Reviewing editor:
David McMillan, University of Stirling, UK

Additional article information is available at the end of the article

Abstract: Premier stock exchanges in India, viz. National Stock Exchange of India and Bombay Stock Exchange, introduced call auction in the pre-open session from 18 October 2010. This paper analyzes the impact of introduction of pre-open call auction on price discovery at the open. Empirical analysis is based on the familiar market model in an event study framework. The result shows a decline in the market model R^2 for both opening and closing returns of stocks forming the part of call auction and also control sample. However, the magnitude of decline is less in the opening prices for the call auction stocks compared with control sample. Furthermore, analysis carried out using the second pass β and R^2 regressions shows that the introduction of pre-open call auction does not have any significant impact on market quality. The findings of the study have implications for the future policy-making on the call auction framework.

Keywords: market microstructure, call auction, pre-open session, price discovery, market model

1. Introduction

Market opening and closing are the trickiest times for stock exchanges all over the world. Price discovery at the open is important because it is preceded by a long period of non-trading. Opening

ABOUT THE AUTHOR

Rajesh Acharya H has MA and PhD in Economics. His thesis titled "Market Microstructure and Market Quality—A Case of National Stock Exchange of India" was awarded with PhD degree in February 2010 by Department of Economics, University of Hyderabad. Currently he is working as assistant professor in the Department of Humanities, Social Sciences and Management at National Institute of Technology Karnataka, Surathkal. His areas of interest are market microstructure of financial markets and applied financial econometrics.

Vishal Gaikwad has a MA in Financial Economics from Gokhale Institute of Politics and Economics, Pune. Subsequently he joined as assistant lecturer (from June 2013 to till date) in Department of Economics at Fergusson College, Pune. His areas of interest are Behavioural Finance and applied financial econometrics. Currently, he is also pursuing PhD from Gokhale Institute of Politics and Economics, Pune.

PUBLIC INTEREST STATEMENT

The study on pre-open call auction is not just an academic interest but of utmost significance for policy-makers and investors at large. Emerging markets in general and India in particular are facing the problem of managing the volatility at the opening hours. Primary reason for such hyperactivity at the open is due to the fact that developed markets like USA operate during the non-trading hours in India and rest of the Asian markets open ahead of India. Therefore, India adopted various measures, viz. extending the market opening by almost one hour at the open, and pre-open call auction is the latest. Our study examined the impact of such an important change in the market mechanism, viz. pre-open call auction. Our finding shows that pre-open call auction has not resulted in significant improvement in price discovery at the open.

price has to discount the impact of all overnight news, which has bearing on price. Market closing is also equally important because the closing prices are generally used to mark the positions to market and for settling derivative contracts. Manipulation of closing prices can have a profound influence on these aspects. Most commonly used market mechanism in these circumstances is call auction trading session at the market open or close.

Call auction trading differs from the continuous trading session in a systematic way. In continuous markets, a trader can trade anytime when the market is open. From this point of view, trading is continuous as traders can continuously attempt to arrange their transactions. The transaction occurs whenever a bid is matched with an ask/offer. Continuous markets are very common; major stock, bond, foreign exchange, and derivative markets are continuous markets. In call auction trading sessions, the transaction occurs only when the market is called for a security and all traders trade at the same time. Orders are accumulated for simultaneous execution at a single price and at a predetermined time. Call market is credited with better liquidity and price discovery as all traders are interested in a security trade at a specific time and place. As a result, traders can find the counterpart for the transaction relatively easier. Although exclusive call markets are rare, most continuous markets arrange their opening and closing using a call auction framework.

Call auction mechanism has been in use around the world for a long time, before as well as after the introduction of automated trading systems. However, the reinvention of call auction system, especially in the post-automated era, did not use it as a stand-alone system. It is combined with continuous systems, especially to open and close the market, resulting in a hybrid market (Pagano & Schwartz, 2003).

The call auction experiment for market opening and closing is not new to Indian stock exchanges. National Stock Exchange of India (NSE) had introduced opening and closing call auction earlier and suspended it in 1999. Camilleri and Green (2009) examined the impact of the suspension of call auction. They found that volatility, efficiency, and liquidity of the securities improved after the suspension. The cumulative abnormal returns (CARs) were found to be significant after the suspension, but there was no clear pattern as either positive or negative CAR. However, Thomas (2010) advocated the call auction for less liquid securities based on the reasoning that it takes relatively longer time for opening volatility to stabilize in the Indian securities market.

The objective of this paper is to assess the impact of introduction of pre-open call auction session on the discovery of the opening price. Evaluating the efficiency of call auction is very important in the context of an emerging market as these markets are characterized by less liquidity, higher volatility, and concentration of trading in small number of securities in comparison with developed counterparts.

Generally, obtaining an accurate assessment of the impact of market structure on different variables is extremely a difficult task as statistical tests have to attribute the findings to the identified event instead of some other factors. However, the specific way in which pre-open call auction is introduced in Indian context provides an ideal setting to assess its impact on price discovery. The study employs a familiar market model framework to an event study problem to assess the impact of call auction on price discovery at the open.

The empirical results confirm that market model R^2 has declined for stocks that are part of the call auction in the pre-open session and also stocks that are not part of it. However, the decline is more pronounced in the latter category. Furthermore, analysis of price discovery based on second pass regressions of β and R^2 shows that introduction of call auction has not resulted in significant improvement in price discovery at the open. The findings have significant bearing on the

policy-makers' decision on the expansion of the call auction framework at the open to a larger universe of securities and to the market closing as well.

The balance of this paper is organized in the following manner. Section 2 reviews the relevant literature, Section 3 describes the framework of India's pre-open call auction, and Section 4 discusses the empirical methodology. Section 5 describes the data and estimation. Section 6 presents the discussion of empirical results and Section 7 presents the conclusions of the study.

2. Literature review

In this section, we review some of the studies that have examined the utility of call auction mechanism to market opening and closing and call auction versus other market mechanisms. Amihud and Mendelson (1987) documented that volatility in New York Stock Exchange (NYSE) market opening based on call auction method was higher than closing based on the continuous market method. It has highlighted the difficulty of price discovery at the open since it is preceded by a long period of market closure. Amihud, Mendelson, and Lauterbach (1997) further documented that when selected securities moved from call auction mechanism to continuous trading, it resulted in permanent price appreciation. They also documented improved liquidity and price discovery in the continuous trading in such stocks.

Handa and Schwartz (1996) examined three different market structures, viz. agency/auction continuous, dealer continuous, and agency/auction call markets to arrive at a good structure in terms of liquidity. They argued that a market should provide a set of choices from which participants can choose an appropriate structure considering their requirements. Madhavan and Panchapageasn (2000) studied the price discovery process of the opening call auction in the NYSE. Their theoretical model explained that the participation of the designated dealers facilitates the price discovery process than the fully automated call auction system. They argued that relying on pure call auction for thinly traded securities may not yield economically meaningful prices.

Lauterbach (2001) examined a batch of 97 stocks that moved from continuous market system to call auction method. The study has found that stock liquidity, accuracy of price discovery, and values dropped significantly after moving to call auction system. Kehr, Krahnen, and Theissen (2001) analyzed call auction system in Frankfurt Stock Exchange. The study has found that transaction cost was found to be smaller in call auction system compared with the quoted spreads in the continuous market for small transactions. However, transaction costs for large transaction were found to be higher in call auction markets than the spread of the continuous market. They also documented that specialists' participation in the market has reduced return volatility.

Schwartz (2001) documented the utility of the call auction mechanism for an order-driven platform. The study argued that order-driven trading platforms may work well for liquid stocks under stress-free situations. But the advent of fast dissemination of news puts pressure on the price discovery and overnight news on the opening prices. Thus, market makers and call auction systems are highly desirable in the present market environment.

Kalay, Wei, and Wohl (2002) examined the stocks that moved from call auction to continuous trading session at the Tel Aviv Stock Exchange of Israel. They documented a decline in the trading volume for small stocks in a call auction when large stocks moved to continuous trading. Significant increase in volume and positive abnormal return was recorded after these small stocks moved to continuous trading. However, the movement from call auction to continuous trading had benefitted the large stocks more than the smaller counterparts. Pagano and Schwartz (2003) analyzed the impact of closing call auction on the market quality of Euronext Paris. Empirical results confirmed a reduction in the execution costs for individual traders in the post-call auction period. Market model R^2 has increased significantly after the introduction of closing call auction indicating improvement in the price discovery in the market as a whole.

Ellul, Shin, and Tonks (2005) investigated the call market performance at the open and the close of the London Stock Exchange. It was a unique experiment in the sense that traders can choose to trade in the call market or a dealer system. It was found that call market was good for price discovery. However, trading cost of call auction increased with asymmetric information. It was also documented that call auction may not be an optimal method to open the market for medium and small stocks. This study concluded that it is premature to brand call market as a better alternative to continuous markets. The dealership was found to be superior for medium- and small-sized stocks.

Chang, Rhee, Stone, and Tang (2008) examined the introduction of call auction method to open and close the market in Singapore Stock Exchange. Both call and continuous markets were used to determine the opening prices. However, traders do not have a choice to decide which system to use. Stocks opening and closing on time will use call auction method, whereas stocks opening late or closing early use continuous market system. As a result, same stocks may open or close with call or continuous systems in different days. It was found that call auction system improved the price discovery and it also reduced the day-end price manipulation. They documented that liquid stocks benefitted more from the call auction than illiquid stocks.

Barclay and Hendershott (2008) analyzed the trading and non-trading mechanisms for the price discovery process. They found that the efficiency of the opening price increased with volume and the price discovery process shifted from opening trade to pre-open session. They argued that pre-open session can improve the efficiency of the price discovery process providing that there is sufficient trading volume.

3. India's pre-open call auction framework

Securities and Exchange Board of India (SEBI) in its circulars[1] laid down the framework for the call auction in the pre-open session. Two premier stock exchanges, viz. NSE of India and Bombay Stock Exchange (BSE), introduced call auction on 18 October 2010. It is done on a pilot basis for 50 scrips forming the part of S&P CNX Nifty and SENSEX, flagship indices of NSE and BSE, respectively.[2]

Pre-open session is for a period of 15 min, i.e. from 9:00 am to 9:15 am. First 8 min is allocated for order collection, modification, and cancelation of orders. Order collection will be closed anytime between 7 and 8 min through a random system driven closure. Subsequent 4 min is meant for order matching and remaining 3 min for effecting a smooth transition from call auction to continuous market.

Equilibrium opening price will be discovered in the following manner:

The equilibrium price is the price at which maximum quantity can be executed. If there is more than one price at which same quantity can be matched, the equilibrium price is the price at which there is least imbalance quantity. Furthermore, if there is more than one price at which both matchable and imbalance quantities are same, the equilibrium price is the price which is close to previous day's closing price. If previous day's price is the midpoint of two prices with same matchable and imbalance quantities, previous closing price itself will be equilibrium price.

Limit and market orders are allowed in the pre-open session. However, iceberg orders, disclose quantity orders, and orders valid only for pre-open session are not allowed. Limit orders will be given preference over market orders at the time of execution. The sequence of order matching is as follows: limit orders against limit orders, residual limit orders against market orders, and finally market orders against market orders. All pending orders will be shifted to the order book of normal market based on time priority and unmatched market orders will be shifted as limit orders at the equilibrium price as limit price following time priority.

The equilibrium price will not be discovered in the pre-open session if there are only market orders. In such a scenario, market orders will be matched at the previous day's closing price and residual

market orders will be transferred to normal market order book as limit orders at the previous day's closing price as a limit price following time priority. If an equilibrium price is not discovered in the pre-open session and there are no market orders to be matched, all unmatched market orders at precious day's closing price and all limit orders will be transferred to normal market on the basis of price and time priority.

4. Methodology

The objective of this study is to test whether the introduction of pre-open call auction has improved the price discovery process. Toward this end, we employ a market model regression approach proposed by Cohen, Hawawini, Maier, Schwartz, and Whitcomb (1983a, 1983b) in an event study setting. As argued by Pagano and Schwartz (2003), bid–ask spreads are not appropriate measures of market quality in a call auction setting because call auction algorithm for price matching eliminates the spread. The patterns of autocorrelation in security prices make it not so appropriate to use the variance ratio test and other market microstructure-related models. As a result, the market model regression approach is proposed for the present study. In fact, market model is built to explain the correlation pattern in the security prices in relation to a broad market index. The market model regression approach can be used even if the true return generating is a multifactor specification providing that the additional factors are not correlated with independent variable of the market model, i.e. market index.

The entire sample period is split into two periods, i.e. pre and post event around the event, i.e. introduction of the call auction. Market model is estimated for both pre- and post-event periods for 12 return differencing intervals, i.e. 1–10, 15, and 20 days return differencing intervals. Thus, first pass β is estimated for 100 stocks for 12 return differencing intervals in both pre- and post-event periods. Total 1,200 beats are estimated separately for pre- and post-event window and are used for this study.

Using 12 market model regression estimates of β and R^2, the following second pass regression is estimated:

$$\beta_{j,1LE} = a_{j,2} + b_{j,2} \ln(1+L^{-1}) + c_{j,2}(\text{Dummy}_{jE} \times \ln(+L^{-1})) + e_{jLE} \quad (1)$$

where $\beta_{j,1LE}$ is the first pass β estimate for security j based on L day stock returns for the time period E; $E=A$ or B, and denotes either the period before (B) or after (A) the event; $\ln(1+L^{-1})$ is a measure to capture the asymptotic level of stock's β as L approaches infinity, where L is the length of period, in days, for which return is calculated; (Dummy_{jE}) is a binary variable equal to one if the first pass β is estimated using the post-event data (i.e. $E=A$) and zero if the first pass β is estimated using the pre-event data ($E=B$); (Dummy_{jE})$\times\ln(+L^{-1})$ is an interaction variable that equals $1\times\ln(1+L^{-1})$ for the post-event period and zero for the pre-event period; and e_{jLE} is stochastic disturbance term.

Cohen et al. (1983a) showed that if stocks are lagging the overall market, the β estimates at shorter return differencing intervals will be downward biased. In such a case, $b_{j,2}$ in Equation 1 will be negative. It is because of the fact that we are regressing the first pass β on the inverse of L, as L increases, β estimates increase and $\ln(1+L^{-1})$ decreases. However, in case of 100 sample stocks, call auction stocks are large capitalization stocks and control sample are smaller capitalization stocks.

The question, whether the introduction of pre-open call auction has improved the efficiency of the price discovery process or not, is being tested by the sign and the size of the coefficient of dummy variable $c_{j,2}$. It is expected to be positive and in absolute size, it should be less than $b_{j,2}$.

Non-synchronicity in the price adjustments can depress the R^2 of the market model for shorter differencing intervals. As a result, the market model R^2 can increase as return differencing interval increases. If the efficiency of the price discovery process increases in the post-call auction period, market model R^2 should be higher than the pre-open call auction period.

cogent economics & finance

Similar to the logic of the second pass β regression (1), the R^2 analysis can be specified as:

$$RSQ_{jLE} = r_j + s_j \ln(1+L^{-1}) + t_j(\text{Dummy}\, RSQ_{jE}) + u_j(\text{Dummy}\ C_{jE}) + \upsilon_{LE} \quad (2)$$

where RSQ_{jLE} is the adjusted R^2 statistic from the market model regression for security j based on L day stock returns for the time period E, where $E=A$ or B, and denotes either the period before (B) or after (A) the event; (Dummy RSQ_{jE}) is a dummy variable for the slope that is equal to $1\times\ln(1+L^{-1})$ if the first pass adjusted R^2 statistic is estimated using the post-event data (i.e. $E=A$) and zero if the first pass adjusted R^2 statistic is estimated using the pre-event data ($E=B$); (Dummy C_{jE}) is a dummy variable for the intercept that is equal to one if the first pass adjusted R^2 statistic is estimated using the post-event data (i.e. $E=A$) and zero if the first pass adjusted R^2 statistic is estimated using the pre-event data ($E=B$); υ_{LE} is a stochastic disturbance term.

As per the logic of Cohen et al. (1983b), both t_j and u_j are expected to be positive as the introduction of call auction is expected to push the market model R^2 higher in the post-call auction period.

5. Data and estimation

Data for this study are taken from the CMIE Prowess database. This study is based on 100 stocks, i.e. 50 stocks which are part of pre-open call auction (i.e. Constituents of S&P CNX Nifty index[3]) and 50 stocks (constituents of the Nifty Junior index) as controlling stocks. We decided to use NSE data due to the fact that it is the largest stock exchange in India in terms of volume compared with BSE. The study period ranges from January to September 2010 as pre-event period and November 2010 to July 2011 as post-event period. It should be noted that from 18 December 2009 onwards, market timing has been extended to 9 am[4] at the open. Therefore, the study period begins from January 2010 to avoid the impact of this event. Total 16 months, i.e. eight months each before and after the introduction of call auction is considered for the analysis. CNX 500 index is taken as market index.[5]

6. Results and discussion

Table 1 provides the descriptive statistics, i.e. average returns and standard deviations for the constituents of S&P CNX Nifty and CNX Nifty Junior index for both pre- and post-event period. Standard deviation has decreased in the post-event period for both opening and closing returns of S&P CNX Nifty and CNX Nifty Junior indices. It can also be noted that opening return volatility is higher than the closing returns for both the indices, confirming the findings of extant studies (Amihud & Mendelson, 1987).

Tables 2–5 report the market model statistics, i.e. average β and R^2 statistics for opening and closing returns of constituents of S&P CNX Nifty and CNX Nifty Junior indices. Average β of S&P CNX Nifty opening returns has increased marginally at different differencing intervals with an exception of first differencing interval, which has increased by comparatively a higher magnitude. However, there is a clear-cut increase in the average β in the post-event period at all differencing intervals. It is puzzling

Table 1. Descriptive statistics

	S&P CNX Nifty				Nifty Junior			
	Pre-event		Post-event		Pre-event		Post-event	
	Return	Std. Dev.	Return	Std. Dev.	Return	Std. Dev.	Return	Std. Dev.
Opening	−.00031	.044157	−.00054	.027093	−6.2E-05	.042016	−.00054	.02903
Closing	−.0003	.039308	−.00052	.025801	−6.2E-05	.036034	−.00051	.025072

Source: NSE of India.

Notes: Opening and closing prices were downloaded from the website of NSE of India (www.nseindia.com). Continuously compounded logarithmic returns are calculated by taking the first difference of natural logarithm of opening and closing prices for pre-and post-event.

Table 2. Market model results—S&P CNX Nifty opening returns

Differencing interval	Average β				Average R^2			
	Pre-event	Post-event	Change in β	Percent change (%)	Pre-event	Post-event	Change in R^2	Percent change (%)
1	.907	1.111	.204	22.47	.294	.285	−.009	−3.12
2	.941	1.071	.130	13.78	.321	.299	−.022	−6.89
3	.950	1.078	.128	13.49	.340	.320	−.020	−5.91
4	.949	1.069	.120	12.60	.357	.328	−.029	−8.17
5	.954	1.062	.108	11.38	.369	.336	−.033	−8.92
6	.953	1.057	.104	10.86	.376	.341	−.035	−9.38
7	.958	1.027	.068	7.14	.379	.344	−.035	−9.34
8	.960	1.052	.093	9.64	.387	.345	−.042	−10.90
9	.962	1.050	.088	9.16	.394	.346	−.048	−12.11
10	.964	1.050	.087	8.98	.401	.349	−.051	−12.84
15	.967	1.039	.073	7.51	.439	.349	−.091	−20.64
20	.964	1.036	.072	7.46	.464	.358	−.106	−22.93

Notes: Market model regressions were estimated from the opening returns of S&P CNX Nifty constituent stocks pertaining to pre- and post-event period. Average β and R^2 from the model at different differencing intervals are reported.

Table 3. Market model results—S&P CNX Nifty closing returns

Differencing interval	Average β				Average R^2			
	Pre-event	Post-event	Change in β	Percent change (%)	Pre-event	Post-event	Change in R^2	Percent change (%)
1	.991	1.047	.056	5.60	.359	.284	−.075	−20.97
2	.988	1.049	.061	6.16	.371	.303	−.069	−18.56
3	.986	1.062	.075	7.63	.382	.325	−.057	−14.86
4	.983	1.054	.071	7.25	.391	.334	−.057	−14.49
5	.981	1.045	.064	6.55	.396	.341	−.055	−13.81
6	.978	1.043	.065	6.64	.398	.344	−.054	−13.55
7	.977	1.042	.065	6.64	.400	.347	−.053	−13.28
8	.976	1.040	.064	6.53	.404	.348	−.057	−14.03
9	.977	1.039	.062	6.30	.412	.349	−.062	−15.10
10	.976	1.038	.062	6.33	.418	.351	−.066	−15.90
15	.975	1.033	.059	6.01	.450	.350	−.100	−22.27
20	.954	1.026	.072	7.51	.464	.355	−.109	−23.49

Notes: Market model regressions were estimated from the closing returns of S&P CNX Nifty constituent stocks pertaining to pre- and post-event period. Average β and R^2 from the model at different differencing intervals are reported.

to see that there is marginal reduction in the R^2 statistics in the post-event period. This is in clear contrast to our expectation of increased R^2 in the post-event period as call auction is expected to improve the price discovery. A comparison of the changes in the β and R^2 statistics shows that at shorter differencing intervals, the magnitude of increase in β is higher and deterioration in R^2 is smaller. However, the opposite is true at longer differencing intervals. Increase in average β and decline in R^2 is found in the S&P CNX Nifty closing returns as well. But the increase in the average β is smaller in magnitude and more or less uniformly distributed across all differencing intervals. At the

Table 4. Market model results—CNX Nifty Junior opening returns

Differencing interval	Average β				Average R^2			
	Pre-event	Post-event	Change in β	Percent change (%)	Pre-event	Post-event	Change in R^2	Percent change (%)
1	.846	1.027	.181	21.39	.264	.191	−.073	−27.61
2	.885	1.010	.125	14.15	.292	.221	−.071	−24.35
3	.899	1.017	.119	13.20	.313	.249	−.064	−20.51
4	.915	1.024	.109	11.97	.334	.262	−.072	−21.59
5	.930	1.028	.098	10.50	.352	.273	−.079	−22.34
6	.945	1.032	.088	9.27	.365	.281	−.083	−22.87
7	.965	1.032	.067	6.96	.374	.286	−.088	−23.51
8	.975	1.040	.065	6.70	.386	.293	−.093	−24.18
9	.983	1.050	.068	6.89	.398	.300	−.097	−24.49
10	.988	1.061	.073	7.42	.408	.308	−.101	−24.67
15	1.012	1.101	.089	8.81	.456	.329	−.127	−27.81
20	1.025	1.126	.100	9.79	.489	.349	−.139	−28.47

Notes: Market model regressions were estimated from the opening returns of Nifty Junior constituent stocks pertaining to pre- and post-event period. Average β and R^2 from the model at different differencing intervals are reported.

Table 5. Market model results—CNX Nifty Junior closing returns

Differencing interval	Average β				Average R^2			
	Pre-event	Post-event	Change in β	Percent change (%)	Pre-event	Post-event	Change in R^2	Percent change (%)
1	.869	.966	.097	11.15	.296	.224	−.072	−24.17
2	.906	.985	.079	8.70	.327	.253	−.075	−22.81
3	.929	.995	.065	7.03	.349	.275	−.073	−21.03
4	.948	1.011	.063	6.66	.368	.287	−.081	−21.94
5	.958	1.016	.058	6.03	.378	.294	−.084	−22.26
6	.969	1.021	.052	5.39	.386	.298	−.088	−22.80
7	.981	1.027	.046	4.67	.394	.302	−.092	−23.44
8	.989	1.034	.045	4.52	.403	.306	−.097	−24.06
9	.993	1.044	.051	5.14	.414	.312	−.102	−24.67
10	.998	1.054	.056	5.61	.424	.317	−.107	−25.19
15	1.018	1.095	.076	7.49	.468	.336	−.133	−28.33
20	1.026	1.122	.096	9.32	.498	.353	−.146	−29.22

Notes: Market model regressions were estimated from the closing returns of Nifty Junior constituent stocks pertaining to pre- and post-event period. Average β and R^2 from the model at different differencing intervals are reported.

same time, the reduction in the R^2 in the post-event period is much sharper than the opening returns. Average β does not seem to be increasing at higher differencing intervals in both opening and closing returns. This could be due to the fact that call auction stocks are large market capitalization stocks and they do not lag the market (Cohen et al., 1983a). An increase in the R^2 statistics at higher differencing intervals confirms that non-synchronicity in the price adjustment is responsible for depressing it at shorter differencing intervals. (Cohen et al., 1983b).

The market model result of the constituents of CNX Nifty Junior index of opening and closing returns shows that β and R^2 are increasing as differencing interval increases. This could be due to the fact that

Nifty Junior is a smaller capitalization index compared with S&P CNX Nifty. Increase in the average β and decline in the average R^2 statistics in the post-event period is found in both opening and closing returns. However, reduction in R^2 statistics is sharper compared with S&P CNX Nifty opening returns.

The market model result confirms that there is no significant improvement in price discovery for call auction stocks at the open in the post-event period. However, a closer examination of the result indicates that the magnitude of the decline in the price discovery for S&P CNX Nifty stocks is sharper in the closing period, which is not influenced by call auction. It is equally true in the case of control stocks as well. Price discovery has deteriorated more than call auction stocks for both opening and closing.

Table 6 reports the result of the second pass β regression, i.e. Equation 1. The intercept of the equation, i.e. asymptotic level of β when L reaches infinity, is significant and has increased marginally from .998 to 1 in the post-call auction period. The slope coefficients, viz. $b_{j,2}$ and $c_{j,2}$ in the case of both S&P CNX Nifty and CNX Nifty Junior indices, are coming with expected signs, but all are statistically insignificant at 5% level of significance. It is clear from this result that the introduction of pre-open call auction has not significantly improved the price discovery process.

Table 7 reports the second pass R^2 regression, i.e. Equation 2. The intercept of the equation, i.e. asymptotic level of R^2 when L reaches infinity, is significant and has increased marginally in the post-call auction period. Similar to the results of the β regression, the slope coefficients are having expected signs, but all are statistically insignificant at the 5% level of significance. Once again, it reaffirms the fact that introduction of pre-open call auction has not improved the price discovery process.

The overall results are based on both first pass market model and second pass β and R^2 regressions; introduction of the call auction has not resulted in significant improvement in market quality.

Table 6. Ordinary least squares (OLS) estimates of second pass β regression (Equation 1)

Coefficients	S&P CNX Nifty		Nifty Junior	
	Opening	Closing	Opening	Closing
Intercept	.998*	1.000*	1.036*	1.043*
$\ln(1+L^{-1})$	−.182	−.067	−.363	−.318
$(\text{Dummy}_{jE} \times \ln(+L^{-1}))$	.399	.199	.345	.204
Adjusted R^{2a}	.390	.389	.442	.420

Note: $\beta_{j,1LE}$ is the first-pass β estimate for security j based on L-day stock returns for the time period E, where $E=A$ or B, and denotes either the period before (B) or after (A) the event.

[a]Adjusted R^2 of the Equation 1.

*Coefficient is significant at 5% level of significance.

Table 7. OLS estimates of second pass R^2 regression (Equation 2)

Coefficients	S&P CNX Nifty		Nifty Junior	
	Opening	Closing	Opening	Closing
Intercept	.418*	.427*	.433*	.448*
$\ln(1+L^{-1})$	−.220	−.130	−.303	−.265
$(\text{Dummy}_{jE} \times \ln(+L^{-1}))$	.104	.012	.079	.088
Dummy C_{jE}	−.060	−.066	−.107	−.114
Adjusted R^{2a}	.815	.823	.801	.792

Note: RSQ_{jLE} is the adjusted R^2 statistic from the market model regression security j based on L-day stock returns for the time period E, where $E=A$ or B, and denotes either the period before (B) or after (A) the event.

[a]Adjusted R^2 of the Equation 2.

*Coefficient is significant at 5% level of significance.

Generally, call auctions were introduced for small and less liquid stocks in other countries. In quite a contrast, India has introduced call auction for the large and liquid stocks. This could explain the reason for not finding significant improvement since these stocks are most closely followed and frequently traded.

7. Conclusion

In an endeavor to reduce the opening volatility in the securities prices and to reflect the overnight news suitably in the opening prices, SEBI directed the two premier stock exchanges, viz. NSE and BSE to introduce the call auction in the pre-open session. Both the exchanges introduced the call auction in their pre-open session with effect from 18 October 2010 on a pilot basis for constituent stocks of BSE SENSEX and S&P CNX Nifty indices.

Assessment of the impact of call auction in the pre-open session is carried out using the well-known market model. It is based on the logic that if call auction results in better price discovery, the market model R^2 should increase in the post-call auction period. We used a total of 12 return measurement intervals, i.e. from 1 to 10, 15, and 20 days, on a sample of 100 stocks, i.e. 50 stocks forming part of call auction and 50 control stocks. Our empirical results confirm that there is no significant improvement in the market quality, i.e. price discovery.

Results obtained using NSE data indicate that market model R^2 has not increased in the post-call auction period. In fact, they declined in the post-call auction period for constituent stocks of S&P CNX Nifty and Nifty Junior index. However, the decline is marginal in case of S&P CNX Nifty constituent stocks compared to Nifty Junior. All slope coefficients from the second pass β and R^2 regressions are having expected signs but all are insignificant. This confirms that introduction of call auction does not show any significant improvement in price discovery.

The findings of the paper call for the attention of policy-makers in the following areas: first, the expansion of the call auction for smaller and less liquid stocks; second, expansion of the call auction session for the closing session; third and finally, a close look at the current framework of the call auction, viz. timing, manner of deriving equilibrium prices, etc. However, while generalizing the findings of the study, it should be kept in mind that it is based on an experiment for a group of 50 stocks on a pilot basis. Therefore, it may call for further investigation in this regard, especially examining the intraday behavior of stock prices and expanding the same study for a larger universe of stocks in the event of extension of call auction for more number of stocks.

Funding
The authors received no direct funding for this research.

Author details
Rajesh Acharya H[1]
E-mail: rajeshacharyah@gmail.com
Vishal Gaikwad[2]
E-mail: vishalg1500@gmail.com
[1] Department of Humanities, Social Sciences and Management, National Institute of Technology Karnataka, Surathkal, Mangalore, India.
[2] Department of Economics, Symbiosis International University, Pune, Maharashtra, India.

Citation information
Cite this article as: Pre-open call auction and price discovery: Evidence from India, H.R. Acharya & V. Gaikwad *Cogent Economics & Finance* (2014), 2: 944668.

Notes
1. SEBI circular on introduction of call auction in Pre-open session dated 15 July 2010 (CIR/MRD/DP/21/2010) and clarifications issued on 27 August 2010 (CIR/MRD/DP/27/2010) and 17 September 2010 (CIR/MRD/DP/32/2010).
2. It may be noted that the companies listed in NSE are listed in BSE also. However, BSE has more number of companies than NSE. But these additional companies in BSE are hardly traded in the market. S&P CNX NIFTY includes all 50 stocks forming the part of call auction, whereas SENSEX includes only 30 companies.
3. S&P CNX Nifty index constituents' encompass all constituent stocks of SENSEX also.
4. NSE of India Circular No. 059, Capital Market Segment.
5. The CNX 500 Index represents about 96% of the free float market capitalization of the stocks listed on NSE and also about 97% of the total traded value during the study period.

References
Amihud, Y., & Mendelson, H. (1987). Trading mechanisms and stock returns: An empirical investigation. *The Journal of Finance, 42*, 533–553. http://dx.doi.org/10.1111/j.1540-6261.1987.tb04567.x
Amihud, Y., Mendelson, H., & Lauterbach, B. (1997). Market microstructure and securities values: Evidence from the Tel Aviv Stock Exchange. *Journal of Financial Economics, 45*, 365–390. http://dx.doi.org/10.1016/S0304-405X(97)00021-4

Barclay, M. J., & Hendershott, T. (2008). A comparison of trading and non-trading mechanisms for price discovery. *Journal of Empirical Finance, 15*, 839–849. http://dx.doi.org/10.1016/j.jempfin.2008.03.001

Camilleri, S. J., & Green, C. J. (2009). The impact of the suspension of opening and closing call auctions: Evidence from the National Stock Exchange of India. *International Journal of Banking, Accounting and Finance, 1*, 257–284. http://dx.doi.org/10.1504/IJBAAF.2009.022716

Chang, R. P., Rhee, S. G., Stone, G. R., & Tang, N. (2008). How does the call market method affect price efficiency? Evidence from the Singapore Stock Market. *Journal of Banking & Finance, 32*, 2205–2219.

Cohen, K. J., Hawawini, G. A., Maier, S. F., Schwartz, R. A., & Whitcomb, D. K. (1983a). Friction in the trading process and the estimation of systematic risk. *Journal of Financial Economics, 12*, 263–278. http://dx.doi.org/10.1016/0304-405X(83)90038-7

Cohen, K. J., Hawawini, G. A., Maier, S. F., Schwartz, R. A., & Whitcomb, D. K. (1983b). Estimating and adjusting for the intervalling-effect bias in beta. *Management Science, 29*, 135–148. http://dx.doi.org/10.1287/mnsc.29.1.135

Ellul, A., Shin, H. S., & Tonks, I. (2005). Opening and closing the market: Evidence from the London Stock Exchange. *Journal of Financial and Quantitative Analysis, 40*, 779–801. http://dx.doi.org/10.1017/S0022109000001976

Handa, P., & Schwartz, R. A. (1996). How best to supply liquidity to a securities market. *The Journal of Portfolio Management, 22*, 44–51. http://dx.doi.org/10.3905/jpm.1996.44

Kalay, A., Wei, L., & Wohl, A. (2002). Continuous trading or call auctions: Revealed preferences of investors at the Tel Aviv Stock Exchange. *The Journal of Finance, 57*, 523–542. http://dx.doi.org/10.1111/jofi.2002.57.issue-1

Kehr, C. H., Krahnen, J. P., & Theissen, E. (2001). The anatomy of a call market. *Journal of Financial Intermediation, 10*, 249–270. http://dx.doi.org/10.1006/jfin.2001.0314

Lauterbach, B. (2001). A note on trading mechanism and securities' value: The analysis of rejects from continuous trade. *Journal of Banking & Finance, 25*, 419–430.

Madhavan, A., & Panchapageasn, V. (2000). Price discovery in auction markets: A look inside the black box. *Review of Financial Studies, 13*, 627–658. http://dx.doi.org/10.1093/rfs/13.3.627

Pagano, M. S., & Schwartz, R. A. (2003). A closing call's impact on market quality at Euronext Paris. *Journal of Financial Economics, 68*, 439–484. http://dx.doi.org/10.1016/S0304-405X(03)00073-4

Schwartz, R. A. (Ed.). (2001). *Call auction trading: New answers to old questions*. Boston, MA: Kluwer.

Thomas, S. (2010). *Call auctions: A solution to some difficulties in Indian finance*. Working Paper No. WP-2010-006, Indira Gandhi Institute of Development Research. Retrieved from http://www.igidr.ac.in/pdf/publication/WP-2010-006.pdf

***Cogent Economics & Finance* (ISSN: 2332-2039) is published by Cogent OA, part of Taylor & Francis Group.**