

Analysing the dynamic influence of US macroeconomic news releases on Turkish stock markets

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Abstract

We investigate the effects of macroeconomic announcements made in the United States on trading activity of stocks listed in Borsa Istanbul. The influence of these releases on the selected variables are an important source of information for market participants. Results show a clear negative impact on weighted bid, ask and mid-prices in the five-minute period post-release. Available liquidity measured by pending orders in limit order book decreases with the news arrival. These results present implications for market dynamics and signal that liquidity consumption (through market orders) largely dominates liquidity provision (through limit orders) in the five-minute period following the release.

JEL Codes: G14, G15, G12

Keywords: US Macroeconomic Announcements; Stocks; Liquidity; High-Frequency Data; Trading; Borsa Istanbul.

1. Introduction

Information and more particularly macroeconomic news have long been acknowledged to have a significant effect on prices and various dynamics in financial markets (Wasserfallen [1989]; Jones et al. [1998]; Christie-David et al. [2000]; Nikkinen and Sahlström [2004]; Gürkaynak et al. [2005]; Ramchander et al. [2005]; Özatay et al. [2009]; Kilian and Vega [2011]). The idea is also related to market efficiency which is one of the most extensively researched areas in finance. Announcements based on central bank policy actions, public debt plans and government securities issues, unemployment or capacity utilisation rates present examples of such releases. It is important to consider the US economy, which alone, constitutes almost one quarter of the world economy and has a power to globally influence financial markets. Such US announcements are carefully followed by most traders and investors worldwide. As a leading emerging market, the Borsa Istanbul is subjected to a substantial amount of international investment, which renders the role of US macroeconomics news even more critical for investors. Hence, the main purpose of this study is to analyse whether the

US macroeconomic releases provide useful information for investors in Turkish stock markets. We analyse the short-term impact of these releases on market activity using fifty-two different variables, covering liquidity, returns, volatility, bid-ask spread and inter-order and inter-trade durations. To date, such an exhaustive high-frequency analysis on the impact of news has not been performed on Borsa Istanbul, nor on another exchange.

There is a vast literature investigating the impacts of macroeconomics news on financial asset prices. Savor and Wilson [2013] show that on the days of US macroeconomic announcements about inflation, unemployment or interest rates, average excess returns and Sharpe ratios on the US stock market are much higher. Although the impact of the macroeconomic news on FX markets have been widely documented (Fornari et al. [2002]; Simpson et al. [2005]; Omrane and Hafner [2015]; Caporale et al. [2017]), the number of studies investigating the effects of the macroeconomic news on stock markets is limited. There has been some research that has built upon events such as political influence (Goodell and Vähämaa [2013]; Sita [2017]), sovereign downgrades (Corbet [2013]), order imbalances (Gao et al. [2018]; Shen et al. [2017]), trading volume (Choi [2019]) and market volatility (Fang et al. [2019]). In one of the rare studies on stock markets, Nikkinen et al. [2006] examine the integration of global stock markets in terms of the US macroeconomic news announcements to find that although the Latin America and transition economies are not affected by US news, G7, European and Asian countries are closely integrated in terms of the US macroeconomic news. In a Portuguese study, Albuquerque and Vega [2008] study the role of US and local news on stock market co-movement by focusing on the US to find that Portuguese macroeconomic news reduces stock market co-movement while US macroeconomic news do not, but identify evidence that US news significantly affects Portuguese stock market returns. There are also a limited number of studies which look for the impact of US macroeconomics news at high-frequency level. For instance, Harju and Hussain [2011] investigate conditional means and volatility behaviour in European markets by using a dataset consisting of more than five years of 5-minute intraday stock index returns for major European stock indices (CAC40, DAX30, FTSE100 and SMI) and US macroeconomic surprises identifying significant and unison relationships. Hussain [2011] conducts a similar study for the return and volatility response of major European and US equity indices to monetary policy surprises and finds similar results.

Erenburg and Lasser [2009] study the dynamics of the island ECN electronic limit order book (LOB) around the arrival of macroeconomic news for the Nasdaq-100 equity index tracking stock. They show that traders tend to submit more aggressive orders as early as three minutes before an announcement and the most aggressive orders within the first minute after the announcement. Their results reveal that the quality of the electronic market, measured by spread and depth, deteriorates during the releases. Hanousek et al. [2009] investigate the reaction of stock market returns in Czech Republic, Hungary, and Poland to EU and US macroeconomic news by using intraday data for the period from mid-2003 to 2006. They document spillover effects of past EU and US composite index returns on all three stock markets. The effects are strongest in Hungary, followed by Poland and the Czech Republic. In a following paper, Hanousek and Kočenda [2011] jointly model the volatility of returns taking account of intraday movements and day-of-the-week effects. A close study recently conducted by Sensoy [2016] investigates in a HF setup the commonality in liquidity in Borsa Istanbul stocks upon the arrival of monetary policy and macroeconomic announcements from various countries. Consistent with our results, the paper finds that only US monetary policy and macroeconomic announcements raise commonality in liquidity. However, its scope is much narrower than what we do in this study since it mostly concentrates on commonality in liquidity. Our objective is to cover the whole market activity. Moreover, most of our liquidity measures are

different.

The rest of the study is organised as follows. Section 2 describes the data, Section 3 presents the research methodology, Section 4 provides empirical results and finally Section 5 gives a summary with concluding remarks.

2. Data

Our dataset consists of official public announcements about selected US macroeconomic indicators (listed in Table 1) made at a certain frequency (weekly, monthly or quarterly) as well as rare tick-by-tick stock-level trades and tick-by-tick snapshots of the five best price level LOB aggregates for 112 companies listed in the Borsa Istanbul (BIST) for the entire trading year of 2010. We could not obtain more recent data but such data already provides very valuable information about market dynamics. To avoid intraday bias, we select only the news that were released at 15:30 (8:30 am EST in the US)¹. Finally, out of 235 releases in the US, 202 could be followed simultaneously by Turkish market participants when BIST was open and at 111 distinct points in time (91 releases overlap). So, there were 136 non-US-release days while the market was open in Turkey.

Insert Tables 1 and 2 about here

The included 112 stocks are classified in six groups according to their inclusion in BIST30, BIST50, BIST100 and BIST All indices as shown in Table 2. This grouping aspires to identify differences in the impact of news announcements. The Borsa Istanbul is a typical LOB market in the sense that there is no official market maker except for very few thinly traded stocks. There are two sessions a day (from 9:30 to 12:30 and from 14:00 to 17:30), where a call auction takes place at the day opening and closing sessions².

3. Methodology

We assess the impact of announcements on four categories of market dynamics. These are i) prices and returns; ii) trading activity observed in quantities; iii) trading activity observed in durations; and iv) volatility. To this end, we define twenty four liquidity variables based mostly on orders and twenty eight trade variables based mostly on trades, listed in Tables 3 and 4.

Insert Tables 3 and 4 about here

There are quite a number of different ways to investigate the effects of announcements on stock markets. Indeed, these methods range from basic statistical methods such as F-test (Christie-David et al. [2000]) to advanced microeconomic models (Albuquerque and Vega [2008]) and also from basic regressions of time series (Birz and Lott Jr [2011]; Erenburg and Lasser [2009]) to

¹Additionally, we looked at the news releases that took place at 9:15, 9:45 and 10:00 (67 releases). Results partially change. For brevity, these are not included in the paper but are available from the authors on request.

²More recently, continuous auctions are set from 10:00 to 13:00 and from 14:00 to 18:00 while call auctions take place before session openings and after day closing.

advanced econometric models such as GARCH (Corbet et al. [2017]; Corbet et al. [2019]) or VECM (Ramchander et al. [2005]; Simpson et al. [2005]). On the other hand, all of these models focus only on the dynamics of market volatility and returns after news releases. However, unlike previous studies, as we mentioned earlier we want to take a big and general picture of the market by using fifty-two variables. Hence, it is not feasible to apply the above mentioned methods in our case to each of the variables defined in this paper. Instead, we employ simple yet efficient t-test approach, which allows us to compare the results for all the variables and draw general conclusions about the market as a whole.

As exhibited in Figure 1, we first compute the value of each variable (V_1 , V_2 , V_3 and V_4) for two successive five-minute periods before and after the data release that takes place at exactly 15:30 in local time in Turkey. Then, we take the percentage change in subsequent time periods ($\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$). Finally, we compare the release days and non-release days for these values and run a Student-T test to analyse the difference-in-mean assuming unequal variances. Any considerable effects of the data release would be revealed by significant t-statistics.

Insert Figure 1 about here

We can argue two points of strength of this method. First, it is robust to any impact related to intraday seasonality. Secondly, it is unit-free. Hence, changes in any variable and for any stock can be interpreted in a standardised way. Note that some variables are just one observation within the time interval (e.g., minimum or median values), some are totals (e.g. number of trades and trading volume), some are averages (e.g. mean waiting times) and some are time-weighted averages (e.g. weighted bid and ask prices). To limit the effect of outliers, we run the tests on the data winsorized at 5% and 95%. This procedure replaces extreme values with the ones at 5% (respectively 95%) quantile.

4. Empirical Results

The effects of US releases on prices, returns, trading activity and volatility of BIST stocks are visible in Table 5 through Table 8, respectively. In the first part of Table 5 noted by $\% \Delta V_2$, most t-statistics are insignificant at 5%. By contrast, in the second time-period ($\% \Delta V_3$), almost all the statistics are significantly negative showing that the variations in weighted-bid, weighted-ask and weighted-mid-prices all are less in release days than in non-release days. In the last time-period ($\% \Delta V_4$), none of the statistics about weighted prices are significant. In terms of volume-weighted average price (VWAP) and return, the results are less clear. Returns during the second time-period are significantly negative at 1% (5%) in groups All and G5 (G6) signalling a smaller variation in returns in release days compared to non-release days.

Insert Table 5 through Table 8 about here

Trading activity measured by quantities consists of two points of investigation in Table 6, divided by total quantities pending at bid and ask for two best and five best price levels in the limit order book (LOB) on the left, and on the right, the number and volume of trades. In the second time-period of the panel ($\% \Delta V_3$), t-statistics are all negative and mostly significant at 1% showing that

the variations in LOB aggregates are smaller in release days than in non-release days. However, in the third time-period, many t-statistics become significantly positive (ex. 3.61 for TAQ2 in ‘All’). However, t-statistics based on trading volumes present an inverse pattern. They are mostly negative and significant at 1% in the first and third time-periods while fully positive and significant at 1% in the second time-period. Therefore, the variations in numbers of trades and volumes are significantly higher on release days.

In Table 7, we present test statistics based on the trading activity variables based on inter-order and inter-trade durations. In the first section, mean, median, maximum and minimum values of waiting times between orders as well as waiting time for buy and sell orders at two best price levels are given. The table shows that most t-statistics in the second time-period are negative and significant at 1% while in the third time-period they are significantly positive. This shows that the variations in waiting time between orders as well as waiting time for buy and sell orders at the top of the LOB are smaller in release days compared to non-release days. The bottom of Table 7 presents the same statistics for trades (all, buyer-initiated and sell-initiated trades), yielding very similar results to that of orders.

Finally, Table 8 presents the statistics based on the impact on volatility as measured by a number of variables³. In the upper and lower parts of Table 8 (representing $\% \Delta V_2$ and $\% \Delta V_4$), most t-statistics are negative whereas the analysis of $\% \Delta V_3$, presents evidence that the volatility variables, with the exception of AART are significantly positive and significant at 1% as far as stocks from All and G1 groups are concerned. Test statistics based on PV, AART and WS2/WS5 slightly diverge from the others. As opposed to other volatility variables, AART is mostly positive in $\% \Delta V_2$ and $\% \Delta V_4$, and negative in $\% \Delta V_3$, PV is significantly positive only in $\% \Delta V_4$ and WS2 and WS5 are significantly positive even in $\% \Delta V_2$. In general, these results show that variations in volatility variables just after 15:30 pm (local time) are higher in release days than in non-release days. The fact that test statistics based on WS2 and WS5 are significantly positive in $\% \Delta V_2$ and $\% \Delta V_3$ implies that uncertainty is higher before the releases, indicating that investors provide less aggressive orders while the weighted spreads widen. Further, both NCBS/NCSB and MaxNSBIT/MaxNSSIT pairs yield significantly positive values suggesting that both number of switches from buy to sell or from sell to buy and the number of successive orders on one side of the trade (either buy or sell) increase just after the news releases. This presents evidence of the dual nature of volatility (reversal vs continuation) which cannot be revealed by simple measures such as variance.

5. Conclusion

This paper investigates the immediate impact of US macroeconomic news releases on stock market dynamics in Turkey. We identify a clear negative impact on weighted bid, ask and mid prices in the five-minute period just after the release. Available liquidity measured by the orders pending in LOB decreases with the arrival of the news while trading that was rather delayed before the release accelerates as volumes and numbers of trades become higher and inter-trade and inter-order durations become lower. Trading slows down again after the first five-minute interval upon the release. Expectedly, volatility measured by various methods is particularly high just after the

³The weighted spreads at two and five best price levels (WS2 and WS5); price-based indicators such as price variance (PV), price fluctuation (PF), sum of absolute returns (SAR) and average absolute returns per trade (AART); numbers of changes from buy to sell and from sell to buy (NCBS and NCSB); and maximum number of successive buyer- and seller-initiated trades (MaxNSBIT and MaxNSSIT)

release. These results have some implications about market dynamics. First, returns mostly are negative after the releases. This raises questions about market efficiency. Secondly, investors are perturbed before the release, so they reduce their trading activity. The observation that inter-order durations are significantly lower upon the release shows that the delayed order submission is freed up with the release. These findings are also consistent with the high volatility observed just after the release. It is interesting to see that inter-order durations are significantly lower after the release while LOB aggregates too are significantly negative. This signals that liquidity consumption (through market orders) largely dominates liquidity provision (through limit orders) in the five-minute period following the release.

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Table 1: Types and Numbers of US Macroeconomic News Releases in 2010

Type No	News Type	Hour of Release (EST)	No. Releases (All)	No. Releases ¹	No. Releases ²
1	Building Permits	08:30	12	11	11
2	Change in Nonfarm Payrolls	08:30	12	11	11
3	CPI MoM	08:30	12	9	9
4	Current Account Balance	08:30	4	3	1
5	Durable Goods Orders	08:30	12	10	10
6	Employment Cost Index	08:30	4	3	3
7	GDP Annualized QoQ	08:30	12	10	7
8	Housing Starts MoM	08:30	12	10	0
9	Initial Jobless Claims	08:30	52	46	36
10	Nonfarm Productivity	08:30	8	7	2
11	PCE Core MoM	08:30	12	10	8
12	Personal Consumption	08:30	12	10	0
13	Personal Income	08:30	12	10	0
14	Personal Spending	08:30	12	10	0
15	PPI MoM	08:30	12	10	1
16	Retail Sales Advance MoM	08:30	12	11	6
17	Trade Balance	08:30	11	10	6
18	Unemployment Rate	08:30	12	11	0
	Total		235	202	111

Note: ¹Differing DST Dates and Holidays Excluded. ²Coincidences Excluded. The table gives 18 different types of news announcements. Out of 235 announcements, 33 were done in public holidays in Turkey or in the periods where the difference of local times in Turkey and the US deviates from its usual level of 7 hours (this is mostly due to varying daylight saving time (DST) policies). Moreover, 91 announcements are eliminated due to coincidence. Among coincident announcements, only one is chosen according to alphabetical priority.

Table 2: Stocks and Their Inclusion in the Index

Group	Inclusion in the Index	Number of Stocks
All		112
G1	In BIST 30	27
G2	In BIST 50 and occasionally in BIST 30	8
G3	In BIST 50 and never in BIST 30	11
G4	In BIST 100 and occasionally in BIST 50	11
G5	In BIST 100 and never in BIST 50	33
G6	In BIST All and occasionally in BIST 100	22

Table 3: Liquidity Variables Used in the Analysis

Type	Abbreviation	Liquidity Variable	Category
Price-Based	WBP2	Weighted bid price at two best price levels ^{a,b}	Prices and Returns
	WAP2	Weighted ask price at two best price levels ^{a,b}	Prices and Returns
	WMP2	Weighted mid price at two best price levels ^{a,b}	Prices and Returns
	WBP5	Weighted bid price at five best price levels ^{a,b}	Prices and Returns
	WAP5	Weighted ask price at five best price levels ^{a,b}	Prices and Returns
	WMP5	Weighted mid price at five best price levels ^{a,b}	Prices and Returns
	WS2	Weighted spread at the two best price levels (WAP2-WBP2) ^{a,b}	Volatility
	WS5	Weighted spread at the five best price levels (WAP5-WBP5) ^{a,b}	Volatility
Quantity-Based	TBQ2	Total bid quantity at two best price levels ^b	Trading Activity (Quantity)
	TAQ2	Total ask quantity at two best price levels ^b	Trading Activity (Quantity)
	TBQ5	Total bid quantity at five best price levels ^b	Trading Activity (Quantity)
	TAQ5	Total ask quantity at five best price levels ^b	Trading Activity (Quantity)
Time-Based	MWTO	Mean waiting time between orders	Trading Activity (Duration)
	MedWTO	Median waiting time between orders	Trading Activity (Duration)
	MinWTO	Mean waiting time between orders	Trading Activity (Duration)
	MaxWTO	Max waiting time between orders	Trading Activity (Duration)
	MWTBO2	Mean waiting time for a buy order at two best price levels	Trading Activity (Duration)
	MedWTBO2	Median waiting time for a buy order at two best price levels	Trading Activity (Duration)
	MinWTBO2	Min waiting time for a buy order at two best price levels	Trading Activity (Duration)
	MaxWTBO2	Max waiting time for a buy order at five best price levels	Trading Activity (Duration)
	MWTSO2	Mean waiting time for a sell order at two best price levels	Trading Activity (Duration)
	MedWTSO2	Median waiting time for a sell order at two best price levels	Trading Activity (Duration)
	MinWTSO2	Min waiting time for a sell order at two best price levels	Trading Activity (Duration)
	MaxWTSO2	Max waiting time for a sell order at two best price levels	Trading Activity (Duration)

Note: ^aWeighted by the quantity at each price level. ^bWeighted by time in seconds.

Table 4: Trade Variables Used in the Analysis

Type	Abbreviation	Trade Variable	Category
Price-Based	VWAP	Volume weighted average price	Prices and Returns
	R	Return	Prices and Returns
	PV	Price variance	Volatility
	PF	Price fluctuation $((P_{min} - P_{max})/(P_{min} - P_{max}/2))$	Volatility
	SAR	Sum of absolute returns	Volatility
	AART	Average absolute returns per trade	Volatility
Quantity-Based	NT	Number of trades	Trading Activity (Quantity)
	V	Trading volume	Trading Activity (Quantity)
	NBIT	Number of buyer-initiated trades	Trading Activity (Quantity)
	NSIT	Number of seller-initiated trades	Trading Activity (Quantity)
	VBIT	Volume of buyer-initiated trades	Trading Activity (Quantity)
	VSIT	Volume of seller-initiated trades	Trading Activity (Quantity)
	NCBS	Number of changes from buy to sell	Volatility
	NCSB	Number of changes from sell to buy	Volatility
	MaxNSBIT	Max number of successive buyer-initiated trades	Volatility
	MaxNSSIT	Max number of successive seller-initiated trades	Volatility
	Time-Based	MWTT	Mean waiting time between trades
MedWTT		Median waiting time between trades	Trading Activity (Duration)
MinWTT		Min waiting time between trades	Trading Activity (Duration)
MaxWTT		Max waiting time between trades	Trading Activity (Duration)
MWTBIT		Mean waiting time for a buyer-initiated trade	Trading Activity (Duration)
MedWTBIT		Median waiting time for a buyer-initiated trade	Trading Activity (Duration)
MinWTBIT		Min waiting time for a buyer-initiated trade	Trading Activity (Duration)
MaxWTBIT		Max waiting time for a buyer-initiated trade	Trading Activity (Duration)
MWTSIT		Mean waiting time for a seller-initiated trade	Trading Activity (Duration)
MedWTSIT		Median waiting time for a seller-initiated trade	Trading Activity (Duration)
MinWTSIT		Min waiting time for a seller-initiated trade	Trading Activity (Duration)
MaxWTSIT		Max waiting time for a seller-initiated trade	Trading Activity (Duration)

Table 5: Test Results of the Difference between News Days and No-News Days in Terms of % Variation in Successive Periods: Prices and Returns

$\% \Delta V_2$	WBP2	WAP2	WMP2	WBP5	WAP5	WMP5	VWAP	R
All	0.35	1.21	0.89	0.13	1.87*	1.34	0.61	1.26
G1	1.05	1.82*	1.44	0.95	1.48	1.34	0.96	0.64
G2	2.34**	1.52	1.96*	1.53	2.71***	2.35**	0.93	-0.61
G3	-0.66	0.02	-0.28	-1.14	0.27	-0.6	-0.56	-0.63
G4	0.57	1.45	1.14	0.47	1.27	0.83	0.27	0.83
G5	-0.05	-0.24	-0.15	0.26	0.36	0.36	-0.22	1.77*
G6	0.6	1.59	1.28	0.6	1.92*	1.87*	1.07	0.36

$\% \Delta V_3$	WBP2	WAP2	WMP2	WBP5	WAP5	WMP5	VWAP	R
All	-8.08***	-6.37***	-7.2***	-9.15***	-5.23***	-7.45***	-0.93	-2.99***
G1	-4.29***	-3.17***	-3.73***	-5.52***	-2.24**	-4.1***	-0.85	-1.63
G2	-3.77***	-3.6***	-3.73***	-4.39***	-3.05***	-4.01***	0.43	-0.17
G3	-2.29**	-2.82***	-2.6***	-3.14***	-2.63***	-3.03***	-1.31	-0.23
G4	-3.54***	-2.61***	-3.06***	-3.15***	-1.89*	-2.55**	1.39	-1.03
G5	-4.38***	-2.95***	-3.55***	-4.94***	-2.86***	-3.76***	-1.82*	-2.65***
G6	-4.45***	-3.74***	-4.15***	-4.12***	-3.32***	-4.01***	-1.23	-2.25**

$\% \Delta V_4$	WBP2	WAP2	WMP2	WBP5	WAP5	WMP5	VWAP	R
All	1.45	1.55	1.5	1.2	0.78	1	0.17	1.12
G1	0.21	0.32	0.27	-0.49	-0.14	-0.3	0.88	0.56
G2	0.16	0.2	0.2	-0.32	-0.07	-0.26	-2.44**	1.69*
G3	-1.18	-1.24	-1.23	-1.12	-1.38	-1.37	0.39	0.22
G4	-0.58	0.52	0	-1.02	0.5	-0.29	-2.08**	-1.61
G5	0.09	-0.25	-0.12	0.01	-0.56	-0.38	-0.39	0.17
G6	0.04	0.02	0.04	0.48	-0.38	0.09	0.39	0.96

Note: All the numbers are t-statistics. The null hypothesis is the equality of percentage variation in the relevant variable across release days and non-release days. The first column (from 'All' to 'G6') shows the stock groups as mentioned in Table 2. The lists of abbreviated variables are given in Tables 3 and 4. $\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$ show the percentage change in the variable from period 1 (15:20-15:25) to period 2 (15:25-15:30), from period 2 to period 3 (15:30-15:35) and from period 3 to period 4 (15:35-15:40), respectively. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Table 6: Test Results of the Difference between News Days and No-News Days in Terms of % Variation in Successive Periods: Trading Activity (Quantities)

$\% \Delta V_2$	TBQ2	TAQ2	TBQ5	TAQ5	NT	V	NBIT	VBIT	NSIT	VSIT
All	-3.45***	0.41	-2.81***	0.4	-7.83***	-2.94***	-4.15***	-0.71	-4.22***	-3.15***
G1	-2.1**	0.31	-1.68*	0.53	-5.72***	-2.47**	-3.13***	-0.69	-2.95***	-1.74*
G2	-1.98**	1.19	-0.23	0.93	-4.68***	-2.3**	-3.98***	-0.69	-2.24**	-2.16**
G3	-1.34	-1.19	-2.23**	-0.72	-2.19**	-1.69*	0.3	-1.33	-1	-0.71
G4	-0.52	0.52	0.41	-0.57	-0.73	1.04	1.18	0.58	-1.36	-0.15
G5	-1.01	0.81	-1	0.06	-3.56***	-3.03***	-1.74*	-1.55	-2.47**	-2.79***
G6	-2**	0.2	-1.36	0.85	-0.98	-0.03	-0.41	0.09	-0.27	-1.5

$\% \Delta V_3$	TBQ2	TAQ2	TBQ5	TAQ5	NT	V	NBIT	VBIT	NSIT	VSIT
All	-4.51***	-6.99***	-8.01***	-10.08***	24.88***	15.71***	17.17***	10.54***	16.62***	12.23***
G1	-3.95***	-5.51***	-5.5***	-8.12***	18.39***	10.88***	14.37***	8.54***	12.9***	7.5***
G2	-1.09	-4.02***	-3.02***	-5.19***	8.95***	6.03***	6.02***	2.95***	5.62***	4.86***
G3	-1.71*	-0.59	-3.11***	-2.69***	6.73***	4.81***	2.87***	2.29**	6.49***	3.34***
G4	-0.31	-3.68***	-2.16**	-3.1***	6.57***	4.78***	4.97***	2.42**	2.71***	4.23***
G5	-2.58**	-2.57**	-4.72***	-4.15***	10.45***	5.24***	5.66***	2.32**	7.38***	5.68***
G6	-0.23	-2.86***	-2.76***	-3.7***	7.42***	3.73***	3.25***	2.61***	5.26***	4.74***

$\% \Delta V_4$	TBQ2	TAQ2	TBQ5	TAQ5	NT	V	NBIT	VBIT	NSIT	VSIT
All	-0.35	3.61***	2.63***	1.32	-6.17***	-6.23***	-2.16**	-3.23***	-7.73***	-4.38***
G1	1.64	2.05**	3.27***	0.95	-3.48***	-5.32***	-1.87*	-3.16***	-4.52***	-2.49**
G2	-3.03***	2.47**	-1.4	0.62	-2.52**	-2.7***	-1.04	-1.7*	-3.34***	-2.25**
G3	1.87*	-0.08	0.37	-1.08	-2.6***	-1.32	0.32	0.29	-1.69*	-0.27
G4	-0.93	-0.15	-0.36	-1.42	-3.16***	-2.15**	-0.94	-1.46	-1.4	-0.75
G5	-1.26	2.63***	1.17	1.16	-2.54**	-2.28**	-0.84	0.19	-2.53**	-3.31***
G6	-0.42	0.65	0.1	0.04	-1.37	-1.98**	-0.52	-2.64***	-3.92***	-2.06**

Note: All the numbers are t-statistics. The null hypothesis is the equality of percentage variation in the relevant variable across release days and non-release days. The first column (from 'All' to 'G6') shows the stock groups as mentioned in Table 2. The lists of abbreviated variables are given in Tables 3 and 4. $\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$ show the percentage change in the variable from period 1 (15:20-15:25) to period 2 (15:25-15:30), from period 2 to period 3 (15:30-15:35) and from period 3 to period 4 (15:35-15:40), respectively. *, ** and *** indicate significance at 10%, 5% and 1%.

Table 7: Test Results of the Difference between News Days and No-News Days in Terms of % Variation in Successive Periods: Trading Activity (Durations)

$\% \Delta V_2$	MWTO	MedWTO	MaxWTO	MinWTO	MWTBO	MedWTBO	MaxWTBO	MinWTBO	MWTSO	MedWTSO	MaxWTSO	MinWTSO
All	2.91***	2.33**	3.05***	0.95	-0.41	-0.77	-1.14	-0.47	2.05**	1.89*	1.8*	1.59
G1	2.73***	2.26**	1.85*	1.25	-0.17	0.05	-0.81	0.2	0.68	0.73	0.07	0.85
G2	0.73	0.9	0.47	-0.33	-0.4	-0.26	-1.69*	0.37	3.11***	2.15**	2.96***	2.62***
G3	1.2	-0.23	1.8*	-0.89	-1.21	-0.94	-1.08	-1.36	1.11	0.37	0.9	0.52
G4	0.81	0.36	1.03	0.66	-1.29	-0.89	-1.74*	-0.85	0.62	1.02	0.93	-0.73
G5	1.65*	1.94*	2.75***	1.16	0.53	-0.33	0.31	0.2	1.05	1.2	0.43	1.48
G6	-0.54	-0.7	-0.59	-0.6	1.04	-0.07	1.6	-0.07	-0.65	-0.7	-0.38	0
$\% \Delta V_3$	MWTO	MedWTO	MaxWTO	MinWTO	MWTBO	MedWTBO	MaxWTBO	MinWTBO	MWTSO	MedWTSO	MaxWTSO	MinWTSO
All	-20.65***	-18.59***	-11.28***	-9.26***	-8.28***	-8.89***	-2.45**	-4.93***	-7.77***	-8.52***	-0.66	-6.52***
G1	-18.81***	-16.07***	-11.15***	-6.44***	-8.33***	-8.56***	-2.34**	-4.22***	-7.66***	-7.35***	-1.2	-5.49***
G2	-7.72***	-6.93***	-2.49**	-3.5***	-1.61	-1.61	-0.41	-1.92*	-4.97***	-5.47***	-1.41	-2.36**
G3	-6.63***	-5.55***	-3.98***	-3.12***	-2.84***	-2.79***	-0.28	-2.33**	-2.65***	-2.79***	-1.05	-2.01**
G4	-4.94***	-4.02***	-2.94***	-2.01**	-0.77	-0.92	0.7	-0.14	-0.69	-0.91	0.1	-1.42
G5	-7.82***	-7.81***	-4.33***	-3.75***	-1.84*	-2.54**	-0.51	-0.52	-1.28	-2.39**	1.07	-2.73***
G6	-4.2***	-3.95***	-1.97**	-3.6***	-2.8***	-3.04***	-2.35**	-1.91*	-1.57	-1.88*	0.52	-0.8
$\% \Delta V_4$	MWTO	MedWTO	MaxWTO	MinWTO	MWTBO	MedWTBO	MaxWTBO	MinWTBO	MWTSO	MedWTSO	MaxWTSO	MinWTSO
All	6.88***	7.5***	2**	-0.43	3.77***	4.55***	0.65	1.15	5.7***	6.89***	3.03***	1.41
G1	6.58***	6.01***	2.51**	-0.75	3.18***	3.48***	0.04	0.63	4.52***	5.49***	2.28**	1.14
G2	2.45**	2.55**	-0.35	-0.35	0.74	0.83	-0.14	1.61	2.98***	3.4***	1.26	1.15
G3	3.01***	2.56**	1.18	0.94	0.84	1.85*	-1.03	-0.53	2.35**	1.81*	1.89*	1.96*
G4	2.16**	2.99***	-0.99	1.27	1.26	1.44	0.72	0.94	0.78	0.7	1.23	-1.27
G5	1.85*	2.5**	1.32	-2.04**	-0.05	1.08	-1.17	-0.02	2.42**	3.47***	1.42	0.8
G6	1.32	1.9*	0.34	0.41	1.89*	1.17	2.01**	0.57	0.59	0.64	0.23	-1.27

Note: All the numbers are t-statistics. The null hypothesis is the equality of percentage variation in the relevant variable across release days and non-release days. The first column (from 'All' to 'G6') shows the stock groups as mentioned in Table 2. The lists of abbreviated variables are given in Tables 3 and 4. $\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$ show the percentage change in the variable from period 1 (15:20-15:25) to period 2 (15:25-15:30), from period 2 to period 3 (15:30-15:35) and from period 3 to period 4 (15:35-15:40), respectively. *, ** and *** indicate significance at 10%, 5% and 1%.

Table 8: Test Results of the Difference between News Days and No-News Days in Terms of % Variation in Successive Periods: Trading Activity (Durations) (continued)

$\% \Delta V_2$	MWTT	MedWTT	MaxWTT	MinWTT	MWTBIT	MedWTBIT	MaxWTBIT	MinWTBIT	MWTSIT	MedWTSIT	MaxWTSIT	MinWTSIT
All	2.73***	0.56	2.43**	2.95***	0.3	-0.8	0.54	0.75	1.17	0.66	0.68	0.43
G1	3.25***	1.43	3.48***	2.24**	1.34	0.85	1.27	1.12	1.51	1.45	1.5	0.41
G2	1.87*	0.79	1.8*	1.07	-0.26	-0.53	-0.14	0.12	1.56	0.21	1.33	0.35
G3	0.89	0.21	0.76	0.82	-0.61	-1.2	-0.52	-1.25	0.73	0.25	-0.18	0.97
G4	-0.6	-1.04	-1.21	0.1	-0.2	-0.36	-0.05	1.33	2.11**	0.89	1.88*	-0.76
G5	1.83*	1.39	0.06	1.77*	0.69	0.26	0.65	0.99	-0.66	0.03	-1.14	-0.01
G6	-0.99	-2.1**	0.93	1.48	-0.58	-0.98	-0.43	-0.39	-1.69*	-2.12**	-1.07	-0.06
$\% \Delta V_3$	MWTT	MedWTT	MaxWTT	MinWTT	MWTBIT	MedWTBIT	MaxWTBIT	MinWTBIT	MWTSIT	MedWTSIT	MaxWTSIT	MinWTSIT
All	-11.97***	-12.8***	-2.81***	-9.66***	-7.67***	-6.65***	-1.75*	-6.07***	-5.95***	-6.89***	-0.17	-3.7***
G1	-12.06***	-11.69***	-4.81***	-4.98***	-8.36***	-6.84***	-3.61***	-6.06***	-6.96***	-6.96***	-1.68*	-4.08***
G2	-5.08***	-5.79***	-0.6	-5.17***	-2.04**	-2.57**	0.69	-1.87*	-2.81***	-3.11***	-0.41	-1.32
G3	-2.93***	-3.57***	-0.33	-1.93*	0.2	-0.14	2.15**	0.82	-2.48**	-2.17**	-0.59	-0.95
G4	-1.55	-1.91*	-0.08	-3.25***	-2.34**	-2.64***	-1.28	-1.72*	0.18	-0.26	1.68*	-1.04
G5	-4.92***	-6.18***	-0.3	-5.13***	-3.41***	-2.58**	-1.4	-3.38***	-1.52	-2.59***	0.6	-1.48
G6	-2.36**	-2.19**	-0.28	-2.6***	-0.43	-0.49	0.62	0.26	-0.91	-1.12	-0.09	-0.07
$\% \Delta V_4$	MWTT	MedWTT	MaxWTT	MinWTT	MWTBIT	MedWTBIT	MaxWTBIT	MinWTBIT	MWTSIT	MedWTSIT	MaxWTSIT	MinWTSIT
All	6.76***	9.38***	-0.18	1.99**	4.06***	4.71***	0.1	1.27	6.49***	10.7***	0.82	3.52***
G1	6.58***	7.63***	1.43	0.69	3.71***	3.55***	1.06	1.93*	5.4***	9.44***	0.36	2.27**
G2	0.86	1.72*	-1.51	0.59	-0.18	0.21	-2.01**	0.23	1.23	2.16**	-0.15	1.38
G3	2.23**	3.69***	0.99	-1.24	1.04	2.54**	0.56	-0.61	2.92***	3.09***	2.34**	0.22
G4	1.55	2.03**	-0.46	1.04	1.28	1.18	-0.01	-0.04	4.06***	4.08***	2.58**	1.2
G5	2**	3.52***	0.75	2.28**	1.15	0.78	0.65	0.55	0.47	2.25**	-0.65	1.65*
G6	1.99**	2.44**	-1	0.84	0.98	1.78*	-1.36	0.03	1.46	1.57	0.34	0.07

Note: All the numbers are t-statistics. The null hypothesis is the equality of percentage variation in the relevant variable across release days and non-release days. The first column (from 'All' to 'G6') shows the stock groups as mentioned in Table 2. The lists of abbreviated variables are given in Tables 3 and 4. $\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$ show the percentage change in the variable from period 1 (15:20-15:25) to period 2 (15:25-15:30), from period 2 to period 3 (15:30-15:35) and from period 3 to period 4 (15:35-15:40), respectively. *, ** and *** indicate significance at 10%, 5% and 1%.

Table 9: Test Results of the Difference between News Days and No-News Days in Terms of % Variation in Successive Periods: Volatility

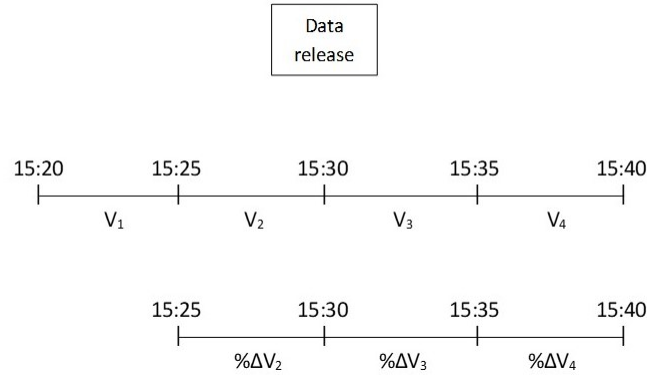
$\% \Delta V_2$	WS2	WS5	PV	PF	SAR	AART	NCBS	NCSB	MaxNSBIT	MaxNSSIT
All	2.04**	2.18**	1.28	-2.94***	-2.54**	1.24	-3.2***	-2.49**	-3.55***	-3.84***
G1	2.6***	0.97	1.46	-2.41**	-1.45	1.94*	-2.19**	-1.65*	-2.8***	-3***
G2	-0.33	2.77***	0.39	-2.13**	-1.38	1	-1.62	-1.41	-3.52***	-1.84*
G3	0.82	1.61	0.72	1.21	0.32	0.77	-0.58	-0.78	0.21	-0.86
G4	-0.19	-0.4	1.57	0.49	0.24	-0.18	-0.74	0.42	0.69	-0.88
G5	0.13	-0.12	0.9	-0.8	-1	0.24	-1.29	-0.78	-1.06	-2.35**
G6	2.38**	1.87*	-1.42	-0.92	-0.89	-0.16	0.2	-0.74	-0.27	0.02

$\% \Delta V_3$	WS2	WS5	PV	PF	SAR	AART	NCBS	NCSB	MaxNSBIT	MaxNSSIT
All	4.11***	6.94***	1.22	7.75***	8.13***	-5.77***	10.13***	10.56***	15.09***	14.77***
G1	3.54***	5.31***	0.11	7.66***	8.22***	-4.63***	10.14***	10.44***	12.19***	11.25***
G2	1.13	2.44**	-0.28	2.35**	2.84***	-1.29	3.11***	3.25***	4.79***	4.51***
G3	-0.72	0.66	2.2**	2.13**	1.67*	-0.73	1.79*	3.15***	2.17**	6.05***
G4	2.15**	1.94*	-1.06	0.66	1.29	-1.78*	1.43	1.33	4.93***	1.67*
G5	2.01**	4***	1.25	3.32***	2.13**	-2.29**	3.27***	2.4**	4.88***	6.79***
G6	1.07	1.89*	0.75	2.02**	1.47	-2.08**	1.96*	2.67***	3***	5.58***

$\% \Delta V_4$	WS2	WS5	PV	PF	SAR	AART	NCBS	NCSB	MaxNSBIT	MaxNSSIT
All	-1.04	0.24	3.88***	-1.75*	-4.23***	2.69***	-1.79*	-3.51***	-0.07	-7.06***
G1	-1.22	1	2.91***	0.72	-1.83*	3.52***	-1.78*	-2.18**	0.27	-4.09***
G2	-0.68	0.91	1.89*	-1.42	-1.56	1.19	-1.22	-1.27	-0.66	-2.72***
G3	-1.28	-0.46	0.32	-0.15	0.72	2.05**	1.34	1.58	0.36	-2.26**
G4	2.31**	1.76*	2.07**	-0.57	0.09	2**	1.14	-0.05	-1.06	-1.35
G5	-0.62	0.07	1.53	-1.6	-2.93***	-0.27	-0.12	-1.6	-0.07	-1.93*
G6	-1.13	-0.97	2.35**	0.02	-1.52	0.03	-1.14	-1.83*	0.73	-3.93***

Note: All the numbers are t-statistics. The null hypothesis is the equality of percentage variation in the relevant variable across release days and non-release days. The first column (from 'All' to 'G6') shows the stock groups as mentioned in Table 2. The lists of abbreviated variables are given in Tables 3 and 4. $\% \Delta V_2$, $\% \Delta V_3$ and $\% \Delta V_4$ show the percentage change in the variable from period 1 (15:20-15:25) to period 2 (15:25-15:30), from period 2 to period 3 (15:30-15:35) and from period 3 to period 4 (15:35-15:40), respectively. *, ** and *** indicate significance at 10%, 5% and 1%.

Figure 1: Time Line of the Variables



Note: V_i shows the value of the relevant variable in the five-minute period. $\% \Delta V_i$ is the percentage change in this variable from period $i-1$ to i .