PRICE IMPACT OF BLOCK TRADES AND PRICE BEHAVIOR SURROUNDING BLOCK TRADES IN INDIAN CAPITAL MARKET

Sobhesh Kumar Agarwalla[1] **and Ajay Pandey**[2]

ABSTRACT

This study examines the price effects of large (block) trades in the Indian capital market. Block trades are identified using multiple criteria like trade value, number of shares, and trade volume given the overall liquidity level of the stock. Identified block trades are classified as All-or-None (AON) and Non-AON trades based on the number of orders against which a block order is executed. Like other markets, block purchases are more informative in Indian market than block sales, which may be motivated by liquidity needs. AON block trades do not have as much information content as Non-AON trades possibly because AON trades are simultaneous purchase and sale of large blocks motivated by factors other than the private information. Arrival of multiple block trades increases market confidence on the information, and the permanent price impact is higher on days with multiple block trades as compared to the days with a single block trade. Unlike in other markets, the temporary price impact in India is greater than the permanent impact in case of block purchase indicating price reversal. To analyze the speed of market response to the information associated with block trades, transaction-time event approach as used by Holthausen et al. (1990) is used. Some information about the impending block purchase is already factored in by the market. The prices start increasing (front running) 8 minutes before block purchases but not in case of block sales. In case of block sales, prices revert quickly leaving little permanent price impact.

Keywords: Block Trades, Market Microstructure, All-or-None Trades
JEL Classifications: G12, G15

1. Doctoral Student (Finance and Accounting Area), Indian Institute of Management, Ahmedabad
Contact Address: MSH- 103; Indian Institute of Management, Vastrapur, Ahmedabad 380015, INDIA.
Tel.: +91.79.66325903; E-mail address: sobhesh@iimahd.ernet.in
2. Professor (Finance and Accounting Area), Indian Institute of Management, Ahmedabad.

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1. Introduction

Large trades (referred to as block trades in the literature) are associated with price movements, attributed mainly to inventory costs and asymmetric information (Mikkelson & Partch, 1985). Block trades affect the subsequent price formation process in the stock markets in two ways - (a) they are informative and (b) they impact prices due to their size (market impact cost), termed as permanent and temporary effects respectively. The permanent component is the amount by which traders revise their value estimates based on the trade; whereas the temporary component reflects the transitory discount needed to accommodate the block.

Permanent price effect has been explained by substitution effect (Scholes, 1972) and information effect (Chan & Lakonishok, 1993). Due to lack of close substitutes, an excess demand (supply) of a security leads to excess demand (supply) curve that is not perfectly elastic and hence leads to a new equilibrium price. Information effect attributes the permanent price effects to the release of new information, which the informed trader cashes in before it becomes public. Arrival of block trades in the market signals the presence of private information and causes the investors or traders to revise their price expectations depending on the nature of block trades.

Temporary price impact has been explained by liquidity effect and price pressure theories. Liquidity cost theories argue that a temporary price impact around a block trade reflects compensation for the liquidity provided by the counterparties, described as seller of liquidity (Holthausen, Leftwich & Mayers, 1987). Price pressure hypothesis suggests that the purchase of a large block is associated with a short-run increase in demand for the security resulting in premium and vice versa (Shleifer, 1986).

Although it has been empirically observed that information about block trades have mixed signalling effect in terms of permanent and temporary price impact, but still information on block trades is used extensively by professional traders to take informed investment decisions. A study of the price behavior surrounding block trade in India will help us in making inferences about the institutional settings in the market, especially the transparency in the trading system, role of intermediaries in execution of trades, and the speed of market response to information release on the arrival of private information.

Research in the field of market microstructure in the Indian context is relatively scant in general and on the price effect of block trades in particular. This study seeks to fill this research gap. In addition to filling this gap on essentially an empirically issue, there are some features of Indian context which warrant assessing impact of block trades in Indian market. In India, long-term capital gains are taxed at a differential (lower) rate than short-term capital gains and the law allows set-off of short-term capital loss from other short-term capital gains. Unlike the tax laws in other countries, where the law does not consider a 'transfer' if a security is bought back within a definite time interval, Indian tax laws do not make such a difference. This provides an incentive to just rollover the existing investments to convert any

long-term capital gain to short-term capital gain and vice-versa as a tax planning measure[1]. The investors can roll-over their existing holding by selling and buying back at the same price (especially in order to book losses)[2]. Similarly, large size transactions may also be in the nature of institutional transfer of shares or as a part of personal / family financial arrangements. Therefore, the block trades in India may not always be backed by private information but also may be for non-informative[3] purposes, like for tax planning and for family arrangement. In this study, we have segregated informative and non-informative block trades executed in the normal market, based on the number of transaction through which a block trade was executed.

While analyzing the price effect of block trades, past studies have not differentiated between days with a single block trade and days with multiple numbers of block trades. Arrival of multiple block trades in a trading day is more likely to increase the confidence on the information arrival, and therefore one would expect that the permanent price impact would be higher on those days, which have multiple such trades than the days with just a single block trade. Since, breaking a single order into multiple orders of smaller size will delay the information flow to the market it may also lower the impact costs of the transaction. In this study, we have measured the price impact of block purchases and block sales separately for days when there is only one block trade and days when there are more than one block trade on a particular stock.[4]

The remainder of this paper is organized as follows. Section 2 gives an overview of the Indian capital market and the trading mechanism at NSE. Section 3 summarizes the past studies on the effects of block trades. Section 4 explains various criteria used for identifying block trades. Section 5 describes the data set used and gives the descriptive analysis of the block trades identified using various criteria. Section 6 describes the methodology used to measure the price impact of block trades and to analyze the price behavior surrounding block trades. Section 7 describes the results and section 8 concludes.

2. Indian Capital Market and Trading Mechanism at NSE

Indian financial markets have been growing at an astounding pace during the last decade. As per Standard and Poor's Fact book, India has been ranked 17th in terms of market capitalization (553Bn $ as on end December, 2005), 18th in terms of total value traded in stock exchanges and 20th in terms of turnover ratio as on December 2005 (NSE – ISMR,

[1] In India, income on transfer of shares held for more than 1 year is treated as long-term capital gain (loss) and such gains are taxed at a lower rate. Short-term capital gain is taxed as normal income and losses are allowed to be set off against other incomes.

[2] This can be done on the same day by entering the transactions through different brokers to ensure that the stocks numbers in the portfolio are changed.

[3] All-or-None (AON) trades are expected to be much less informative as these are simultaneous purchase and sale of a block by two parties. AON trades are explained later.

[4] This was done after discussion with a few brokers in the Indian market. They explained that the number of block trades taking place in a particular script is considered to assess the reliability of the underlying information. According to them, sometimes day traders enter into block trades just to mislead small traders/investors.

2006). In total, 23 Stock Exchanges are operative in India. NSE is the leading stock exchange with highest volume in both the capital market and the derivatives segment. The other major exchange operative in India is the Bombay Stock Exchange (BSE). We have chosen NSE for this study as it attracts higher volume than BSE and over the years, it has replaced BSE as the leading exchange in India. The liquidity of the markets measured using the market efficiency coefficient developed by Hasbrouck and Schwartz (1987) was higher for NSE than BSE (Krishnamurti, 2000).

NSE introduced internet trading in 1999 and thereafter NSE has witnessed a phenomenal growth rate as compared to other competitors. NSE capital market turnover grew from Rs. 18,050 Millions in the year 1994-95 to Rs. 19,452,870 Millions in 2006-07 and Rs. 35,510,380 Millions in 2007-08. Derivative trading (futures trading on S&P CNX Nifty Index) commenced on June 2000. Subsequently in 2002, NSE introduced derivative contracts on individual securities and other indices. In the global market, NSE ranks first in the world in terms of number of contracts traded in the single stock futures and second in Asia in terms of number of contracts traded in equity derivatives instrument. The Indian market has also witnessed a dramatic increase in the number of institutional investors (Foreign Institutional Investors, Mutual Funds, Venture capital funds, Foreign Venture capital investors, etc.) and an increasing importance of portfolio managers in recent years. The increasing role of institutional investors and introduction of on-line fully automated screen based trading may have arguably resulted in improved efficiency and effectiveness of the Indian capital market.

NSE is the first stock exchange in the country set up as a national exchange having nation-wide access with fully automated screen based trading system (NSE-ISMR, 2006). This helped NSE become the largest exchange in India with approximately 66% of the trading volumes. Both NSE and BSE are pure order-driven market with no pre-opening auction. It relies completely on limit orders for liquidity and the execution of an order depends on the existing orders / order flows. Similar to the ASX (Anderson, Cooper & Prevost, 2006), NSE also employs an electronic continuous auction limit order book mechanism known as NEAT (National Exchange for Automated Trading).

The order matching in NSE is done through the National Exchange for Automated Trading (NEAT) system, which is a fully automated screen-based trading system. The system allows for a large number of participants irrespective of their geographical location to trade with one another simultaneously thereby increasing the depth and liquidity of the market. The NEAT system matches the orders electronically thereby minimizing the time spent, costs, risk of error, and frauds resulting in improved operational efficiency. The NEAT system queues and executes orders based on "price-time" priorities, whereby all orders are arranged according to price and, within price, by time. NEAT system does not take into account the identity of the trader or the size of the order. Buy and sell orders are entered into NEAT system via trading terminals and once entered (unless hidden orders), are immediately displayed (total quantity ordered in the best five buy and sales order are also displayed) to all traders in the network. Trades occur automatically when an order can be matched (either fully or partially) to an order in the opposite direction. The uniform response time per trade is less than 1.5 seconds (NSE Fact Book, 2008).

The NEAT system provides an Open Electronic Consolidated Limit Order Book (OECLOB), which ensures full anonymity by not disclosing the identity of the parties placing the order, rather displaying only the details about price and quantity of the limit orders. A single consolidated order book for each stock displays on a real time basis, buy and sell orders originating from all over the country. Total transactions (quantity and value) during the day,

pending buy quantity and sales order quantity in total, are displayed on real-time basis. By allowing the market participants to see the market on real time basis, the NEAT system allows for the faster incorporation of price sensitive information into prevailing prices.

Like other markets, there are two economically distinct trading mechanisms for large-block transactions in India. Firstly, some large pre-negotiated trades (or in cases where brokers facilitate the trade by locating counter-parties to the trade) are transacted in a separate 'block deal window' (like upstairs market in NYSE), which opens for only 35 minutes at the market opening. Secondly, a large quantity order can be sent directly to the normal trade window through limit or market orders (like downstairs market in NYSE), which constitutes the continuous intraday markets and batch closing period.

We do not analyze the impact of the former category of block trades in the study. Our focus is only on the large sized trades executed in the normal trade window. There are various reasons for excluding the trades executed through the block deal window. Firstly, these are pre-negotiated trades and the objective of the trade may be different from information content, like taxation benefits, family arrangements, within group transfers, etc. In India the benefits of a reduced tax rate in capital gains is available only for shares transacted through a recognized stock exchange and hence parties execute such large pre-negotiated trades through the stock exchange. Madhavan (1995) argues that large traders are afraid of being front-run or having their strategies leaked, and prefer to use upstairs markets to accomplish large-block trades in one single step. Secondly, it is difficult to determine the nature (buy/sale) of the block orders since there are two parties taking opposite stand in the upstairs transaction, resulting in simultaneous purchase and sale of stocks. Unavailability of exact time stamps for these trades makes the comparison with most recent market prices impossible. Lastly, the price of block transaction in upstairs market is subject to floor and cap price[5] of ± 1 % of the ruling market price/ previous day closing price, limiting the benefits of private information.

Although large orders through the normal trade window is subject to front-running by the brokers and comes with a risk that the buyer may not get the entire bid quantity, but still some investors may prefer to trade large quantity in the normal market, rather than the block deal window in order to maintain their identity secret. This behavior may also be because trading at the normal window is free from the pricing (± 1%) and duration (first 35 minutes of trading) restriction that is applicable to the block deal window.

In India, reporting of bulk and block trades became mandatory since 14 January 2004 and 2nd September 2005 respectively. As per the SEBI guidelines, whenever the cumulative quantity traded under a single client code exceeds the limits for bulk trades, disclosure is to be made within one hour from the close of the trading hours (i.e. 5.00 pm). Because of this, the information about the bulk trades generally is disseminated after the market hours. Further, it is difficult to trace the timings of the reported bulk orders from the bulk trades reports because the number of trades may be more than one for a particular bulk order. Since the exchange provides information about bulk and block deals to the members and the public after market hours, it is highly likely that effects of reporting can only be found in returns and volatility on subsequently days. Thus, the intraday effects (if any) of the block trades are because of the automated systems of brokers/traders which enable them to identify block

[5] SEBI Circular No MRD/DoP/SE/Cir- 19/05 dated September 2, 2005

trades (orders) on real time or because of very large observed trades, and not because of the reporting of block trades by the exchanges.

3. Literature Review

To examine the price behavior surrounding block transactions, two approaches have been generally used. The first approach estimates the impact of block trades by comparing the block price with the equilibrium price before and after the block trade to estimate the abnormal returns caused due to the arrival of the block trade. Chan & Lakonishok (1993) and Aitken & Frino (1996) have followed this approach. The second is a transaction-time event study approach similar to Holthausen et al. (1990). Here the price impacts of block trades and the price behavior (return and volatility) surrounding the block trades is analyzed, by measuring the returns and volatility behavior of each minute surrounding block trades.

In literature, price effect of block transactions is estimated using three measures (Madhavan, 2000). The **total effect** is usually defined as the difference between the equilibrium price before the block trade and the block trade price, is calculated from open to the block trade price. The **temporary effect is** defined as the difference between block trade price and equilibrium price post the block trade and the difference between the total price impact and the temporary price impact (i.e. difference between equilibrium price before block trade and equilibrium price after block trade) is called **permanent price effect**. Figure 1 explains the total, temporary and permanent effects. The choice of pre-trade equilibrium price makes a large difference in the estimated price impact. The equilibrium price before and after the block trades should be such that there is no effect of the information about the incoming large trades. Both Keim and Madhavan (1996) and, Madhavan and Cheng (1997), show that information can leak into the market prior to the block transaction. Past studies have used different prices as equilibrium prices before and after the block trades. Madhavan and Cheng (1997) used the price of the 20th transaction after the block trade as equilibrium price after the block trade. They used two measures of equilibrium price before the block trade – last day closing price and the price of the 20th transaction before the block trade. Anderson, Cooper and Prevost (2006) used the price of the 10th transaction before and after the block transaction as the equilibrium prices before and after the block trades respectively. Following, Chan and Lakonishok (1993) and Frino, Bjursell, George & Lepone (2008), we have used the opening price as the equilibrium price before a large trade and the closing price as the equilibrium price after a large trade.

Permanent impact has been found elsewhere to be higher for block purchases than for block sales, implying a price continuation (further increase) following a block purchase, and a price reversal (increase in price) following a block sale, thereby creating an asymmetry in reaction (Holthausen, Leftwich & Mayers, 1987 and 1990; Chan & Lakonishok, 1993 and 1995; Frino, Jarnecic, Johnstone & Lepone, 2005). Further, the magnitude of the permanent price impact of block purchases has been found to be greater than the price impact of block sales (Gemmill, 1996; Aitken & Frino, 1996; Keim & Madhavan, 1995, 1996 and 1997). Krauss and Stoll (1972), Loeb (1983), Holthausen et al., (1987) and Keim and Madhavan (1996) showed that the price impacts of block trades are larger for small capitalization stocks are in small cap stocks and are systematically related to trade size and market capitalization. Keim and Madhavan (1996) observed that price impacts of block trades are a concave function of order size and a decreasing function of market capitalization (or liquidity). Block trades have

been found to have negligible impact on return volatility. Gemmill (1996) found no significant change in volatility immediately after the block trade and Holthausen et al. (1990) found an increase in volatility only upto 3 trades post block trade.

There are various possible explanations for the asymmetric price impact of block trades. The asymmetry in the magnitude has been used to describe block purchases to be more informative than sales; block sellers paying a liquidity premium, which block buyers do not; possible short-term imbalances in supply and demand (Chan & Lakonishok, 1993; Saar, 2001). This asymmetry is been described as both "intriguing" (Holthausen et al., 1987; Chan & Lakonishok, 1993) and a "key puzzle" (Chan & Lakonishok, 1993).

Past studies have not differentiated between informative and non-informative block trades. However, based on our explanation in Section 0, we have classified all the large sized trades in the normal trade window into two categories viz. All-or-None[6] (AON) trades and Non-AON trades[7]. This classification is based on the number of parties involved in a transaction. AON trades are trades between two parties, each taking opposite positions. In an order driven market, large pre-decided stock transfers between two known parties can be executed through limit orders in the market in two ways: (a) when both the parties place opposite limit orders at the same time and at the same price, and the price lies in between the best bid and best ask price. Here, the whole quantity is traded in between the two parties; (b) when both the parties place opposite limit orders either at the prevailing best bid or best ask price. In this case, the pending orders at the limit price enjoy a priority over the new order and therefore some pending orders may get executed alongwith. We classified such trades as AON trades, where the order is executed through few transactions.

In contrast, in the case of information backed block trades, where importance is given on acquiring/disposing the stocks in the minimum possible time, investors will prefer placing a market order, wherein the order will be executed against the pending orders with price-time priority. The investor may also place a limit order but the price should be such that there is high probability of such order being executed. Immediate non-execution of large size limit orders runs a risk of front running. Such orders are generally executed through a number of transactions. We classified such trades as Non-AON trades. One would expect, therefore, that Non-AON trades have higher information effect than AON trades, since they are generally backed with arrival of information.

[6] Placing of All-or-None (AON) orders, although earlier allowed, was banned by SEBI in 1999. We have classified trades as AON trades based on the criteria explained in Section 4.1. Our objective is to classify large trades executed through opposite limit orders by two parties as AON trades.

[7] We noticed that the brokers are also aware of such trades (AON) and refer to such trades as 'Hands-in' trades. They also believe that such block trades are not executed to benefit from any insider/private information.

A glance at the reported bulk trades[8] indicate that in many cases, the bulk buyers/ sellers square off their positions among themselves in the same day, with a small price difference between the purchases and the sales. Therefore, the intent behind such trades may not be to gain from private information. Bulk trades reported in NSE indicate that most of the transactions are institutional transfers or private arrangements. In some cases, these are family transfers or transfer between group companies. Since the identity of the buyer or the seller is revealed for bulk trades, it may also affect the perception of the market and hence affect the prices.

4. Identification and Classification of Block trades

NSE does not provide order data even for research purpose. NSE provides only trade data that includes the time stamp of the trade, the volume traded and the price at which the trade was executed. It does not contain details about the parties involved in the transaction. Hence, it is not possible to identify block orders directly from the available data. We have identified block trades based on total quantity traded for each stock during a fixed 5 seconds interval (1 – 5th second, 6 – 10th second … 55 – 60th second) within a given minute. If the total volume/value of trades in a block of five seconds exceeds certain threshold limit prescribed later, we assume occurrence of a block trade. Due to the unavailability of order data and the buyer/seller details in the trade data, the main limitation of this approach is the intentional suppression of block trades by the traders, which can happen if the trader splits the total quantity into multiple trades over time.

The identified block trades are further classified into block purchase and block sale based on tick rule i.e. depending on whether the trades are at an uptick or downtick. By defining large orders at uptick as purchase order and at downtick as sale order, we acknowledge the possibility of bias in analyzing the price impact associated with such trades. This bias is in reality, however unlikely. In an order driven market, large trades can be executed through either a market order or limit order. If a market order is placed to purchase a large quantity, it will result in trades being executed at successively higher prices and vice versa. Similarly, if a limit purchase order is placed for execution, it has to be higher than the best offer and it will be executed at successively high prices subject to the limit set upfront. The opposite is the case when a large sale order is placed. A limit order of large quantity at a price in which the probability of the same being executed is less has non-execution risks and there is a risk of front running since market will be aware of such order, hence leaving less probability of such an order being placed by an investor or trader. Therefore, the risk of misidentifying the trades in a small interval of 5 seconds is minimal.

[8] For India, Security Exchange Board of India, (SEBI: the regulatory authority for capital market operations in India) has classified large trade size into two categories viz. block trade and bulk trade. Block trades are defined as a single trade with a minimum quantity of 500,000 shares or of a value of 50 Millions executed through a single transaction on block deal window. The block deal window operates for only the first 35 minutes of a trading day and the price of trade is subject to an upside and downside cap of ± 1 % of the ruling market price/previous day closing price. Bulk trades refer to situations where the total quantity traded in a day (in normal trade window) by a particular client is greater than 0.5% of number of equity shares of company listed on the exchange (SEBI Circular No. MRD/DoP/SE/Cir-19/05, dated September 2, 2005).

Definition of block trade has been a contentious issue (Kraus & Stoll, 1972, Gemmill, 1996, Frino et al., 2005) in empirical research. There is no standard definition of block trades in the literature. For example, Frino, et al. (2005) considered the largest 1% of on-market transactions for each stock in each calendar year as block trades. Gemmill (1996) considered the 20 largest purchases and 20 largest sales in each month as block trades. Kraus and Stoll, (1972) used NYSE definition for reporting purpose (10000 shares and over) but with minimum cut-off value to identify the block trades.

For the purpose of this study, we follow multiple approaches to identify block deals based on total traded quantity and value of the trades. These are:

Criterion 1: Where within a period of 5 seconds, the total quantity is greater than equal to 500000 **or** the total value of the trade is greater than Rs. 30 Millions[9]: The number of block trades identified using this criterion is 18,257.

Criterion 2: Where, within a period of 5 seconds, the total value of trades exceeds the average daily trade value in the year: This criterion helps us to capture block trades in case of low value and low volume illiquid shares, since we did not prescribe any minimum value for the trades to qualify as a block trade. The number of block trades identified using this criterion is 23,445 of which, 1622 block trades were already covered under criterion 1.

4.1 'All-or-None' trades (AON) and Non- AON trades

In the absence of order data, we have classified trades as AON/ Non-AON based on the following four criteria:

i. If the block trade is identified based on trades in a period of 5 seconds and all the shares traded in the 5-sec period have taken place in one single trade. (AON-A): This is a trade between one buyer and seller only and hence is classified as AON (All-or-None) trades

ii. If the block trade is identified based on trades in a period of 5 seconds and more than 95% of the volume during the 5-seconds period has been through a single trade (AON-B): This is a subset of case A and takes care of cases when the block trade order may have been executed in more than one trade. This case takes into account the probability of execution of hidden orders, which are invisible on the trading screen when the pre-negotiated AON trade was executed.

iii. If the maximum value of one trade in the minute exceeds Rs. 30 Millions (AON-C): The total number of such block trades is 7187 out of which 4,857 block trades is already covered in AON-A and AON-B. Only 177 of the block trades under this category are those identified using criterion 2 (as well as criterion 1).

[9] A more liberal definition was tried but it was found that it generally leads to over-representation of high value stocks in the sample. This criterion alongwith other criteria ensured an even representation of all stocks in the block sample. We have also analyzed the price impact of block trades based on a cut-off trade value of 50 Millions, the cut-off value for reporting purpose for trades in the block-deal window. The price impact was found to be higher for those block trades. The results for such block trades can be obtained from the author on request.

iv. If number of block trades in the minute when a block trade has occurred is less than 10 transactions (AON – D): The total number of such cases are 18361 out of which, 12,652 cases have already been identified as AON-A, AON-B and AON-C.

If none of the criterion above is met then we consider the block trades as Non-AON trades. As can be noticed above, the number of Non-AON trades is only 42 % in our data. **Table 1** gives the distribution of block trades for all the years and **Figure 2** shows the distribution of AON and Non-AON trades across the years. The percentage of Non-AON trades over AON trades does not show any distinct change over years.

4.2 Block Purchases and Sales

While it is important to differentiate between purchase and sale, the unavailability of order data necessitates the use of certain identification algorithm. NSE does not provide the data indicating whether a particular trade is buyer- or seller- initiated. We have classified the block trades into trades at uptick (purchase) or downtick (sale) based on tick rule, based on the following conditions.

Block Purchase (Uptick trades): Two types of trades are considered- (1) trades at upticks, and (2) trades at unchanged ticks immediately following an uptick trade and occurring within the next 3 seconds. As the market orders are executed within a uniform response time of around 1.5 to 2 seconds by the NSE automatic order-matching software (NSE Fact Book, 2008), we classify such trades as block purchase as these are executed against standing limit ask order(s).

Block Sale (Downtick trades): Two types of trades are considered here- (1) trades at downticks, and (2) trades at unchanged ticks immediately following a downtick and occurring within the next 3 seconds. Such trades are executed against standing limit bid order(s), and hence are treated as block sales.

Trades not covered in the above two categories are classified as **ambiguous** trade. We aggregated the total volume in uptick, downtick or unchanged tick during each minute of trade for each stock and then classified the block trade as purchase and sale based on the number of shares traded in each category during the minute when the block trade has occurred. AON trades were classified as block purchase if the transaction had taken place at an uptick and vice versa. This, to a certain extent induces bias in the reported results, since AON trades are simultaneous purchase and sale of large blocks. However, there is no such bias in case of Non-AON trades, since they are executed against a series of pending orders.

4.3 Multiple block trades in a day

Analysis of impact of block trades has been done in this study separately for those days where more than one block trade has occurred for each stock. The multiple block trades are classified into four groups: (a) Days with only block purchases; (b) Days with only block sales (c) Days where all block trades are ambiguous trades; and (d) Days where there are both uptick and downtick block trades in the day. Category (d) is classified into three sub-groups- (i) where the total block purchases volume is more than the total block sales volume (i.e. Net Purchase) (b) Where the total block sales volume is more than total block purchase volume

(i.e. Net Sale) (c) Where the total volume under block purchases and block sales is equal (Net 0)[10].

On days where there is no block sale for a particular stock in a day, but there are multiple block purchases, ambiguous block trades during the day are considered as block purchases for the purpose of above classification. Similarly, for days with no block purchase but only block sales, ambiguous block trades are considered as block sales for the purpose of above classification. To determine the price effect of multiple AON block trades, only those days when all block trades are AON block trades are considered. Figure 3 gives a quick overview of the exercise undertaken for identification and classification of block trades.

4.4 High Information (HE) days, thin trading (LT) days and stock with large number of block trades

Days where there are more than eight block trades of any particular stock on a single trading day are considered as high information day for that stock. We have separately measured the effect of block trades occurring on high-event days, since the price changes during such days may be due to arrival of any company specific or macro-economic news[11]. In most of the cases, we found that such high trading days correspond to the announcement of quarterly results of the company, or any significant achievement on the part of the company. The intraday effects of such block trades will depend on the nature of the information. There are 7369 block trades on high information days in our data set.

Block trades during thin trading days for any particular stock were also separately studied. We have defined thin trading days as those where the number of trades during a particular day for any particular stock is less than 10. The low number of trades indicates that there is no active trading for the stock on that day and hence it is difficult to comment on the price effect of any block trade on such a day. There are 3472 block trades on thin trading days.

In order to ensure a fair representation of various stocks in the analysis, stocks that are over represented in the sample (after removing the high-trading days) are studied separately. Stocks, where the number of block trades exceeded 300 during the whole period are considered as liquid stocks with large number of block trades. There were 12,151 block trades represented by seven different stocks out of which 6520 block trades were executed on high information days. **Table 2** gives the details about the stocks with high number of block trades.

4.5 Block trades occurring at market opening and closing

Following Frino et al. (2005), we have analyzed trades executed near the open or close of trading day separately. On the NSE, the normal market closes at 1530 hours and then reopens for closing session from 1550 to 1600 hrs. The purpose of closing hours is to provide the investors or traders with an opportunity to close their trading positions before ending the day. Only market orders are allowed during this session and pending orders, if any, can be cancelled but cannot be modified. All trades during the closing session take place at a single

[10] The number of block trades in this category is very less (28) and hence we have not reported the price impact for this category.

[11] For example, the high volume of trades in case of 'Reliance' stock during on 17, 18 and 19 January 2006 is because of splitting of Reliance industries limited into various listed companies.

price. The price (within the daily price band) is determined by matching all overlapping buy and sale orders using a computer algorithm in a way that the maximum number of shares can be traded for a security. We have excluded such block trades from the analysis for two reasons. Firstly, the price is not determined by the traders and secondly, we cannot compute the temporary impact and permanent impact separately in these cases. Out of all the identified block trades, 342 block trades took place during the closing session.

Similarly, block trades executed at the open of the market (first minute) are also excluded from the analysis. By our definition, if there is only one trade for stock in a day then it falls under 'open' trade. The number of block trades that were executed at the opening minute was 2419, out of which 1311 cases were related to thin trading days (dormant stock) where the trading during the day started with the arrival of a block trade.[12] However, we will not draw any conclusions due to the low number of observations in such cases.

5. Data Studied and Descriptive Statistics of Block Trades

Almost all the companies, which were listed during the entire period beginning from 1999 to 2007, were included in the study, thereby eliminating any potential selection bias. Trade data for 500 stocks in the capital market segment of the NSE covering a period of 104 months is used in the study. The period covered is from January 1999 to August 2007, which includes 2164 days, excluding weekends and holidays. High frequency data is available from NSE since 1999. We checked the accuracy and completeness of the data by ensuring that the stockwise total trades volume (and value) matches the daily data reported in the NSE website. We obtained the data until August 2007, on the commencement of the study. We did not consider those stocks, which were listed after 1999. This in a way excludes the price behavior surrounding block trades in case of newly listed securities where casual observation suggests that one can find high trading volume during the initial days after listing.

Table 3 gives a brief summary statistics of the companies selected in our data set. The average daily turnover for all the selected stocks has increased five times (from Rs. 17bn for the 1999 to Rs. 65bn for the year 2007) in the 9-years period. The average number of transactions per trading day for all 500 stocks increased around 8.5 times (from 0.22mn in 1999 to 1.925mn trades in 2007) and the average volume per day for these stocks increased five times from 60mn in 1999 to 290mn in 2007.

Table 4 presents the descriptive statistics of the block trade size and value for different types of block trades identified from the data and classified as block purchases and block sales. The block trade value and quantity are the volume and value of sales during the five seconds period where the block trade is identified from the data. The average for block trade size is 79,417 shares, with Non-AON trades having a larger trade size (90,076 shares) as compared to AON trades (75,677 shares). It can be noticed that the Non-AON trades are of lower value and price than AON trades (Rs. 15.2 million as against 22.15 million). This implies that, in case of Non-AON block trades, which are executed through market orders, the traders try to transact large market orders in smaller chunks in order to hide the information flow to the market. Another reason may be the low liquidity level of NSE, which forces the block traders to transact large market orders in smaller chunks. The average price per share in case of Non-

[12] Estimated price impacts can be supplied on request.

AON block trade (169) is nearly half as that for AON block trades (293), implying that off-loading through market orders is more for low-priced shares than for high-price shares. Traders may prefer trading high priced shares through block deal window or through pre-negotiated AON trades.

The average value of block trade is much less in case of block trades identified using criterion 2 (14 million) than those identified using criterion 1 (71 million). The block trades are of lesser value (almost one-fifth) and the average price per share is less in case of criterion 2 than in case of criterion 1.

The weighted average (weight value assigned = number of block trades) market capitalization of the stocks at the year end for which block trades were identified using criterion 1 was Rs. 358,660 million. The corresponding figure for block trades identified using criterion 2 was Rs. 5750 million. This indicates that criterion 2 block trades are usually of stocks with lower market capitalization as compared to block trades identified using criterion 1.

Figure 4 shows the distribution of block trades across a trading day. The block trades are evenly distributed through out the day except for the first one hour when the number of block trades is less. The number of block trades in the last 30 minutes is relatively higher than during other time of the day.

6. Methodology

In this study, we have measured the price impact of block trades and analyzed the price behavior surrounding the block trades.

6.1 Price Impact of Block Trades

CNX Nifty Index returns has been used as a benchmark return to control for the broad market movements for each of the three price effects viz. total, temporary and permanent price effects. The excess return for each effect is found by subtracting the benchmark return during the same time of the day from the above computed returns. The excess returns are then aligned around the block trade, and averaged across each interval. In other words, the net total effect is computed by deducting NIFTY effect from the gross block effect. The price effects are computed as under:

$$\textbf{Net Total Effect} = \text{Ln}\,(P_{bt} / P_{open}) - \text{Ln}\,(N_{bt} / N_{open})$$

$$\textbf{Net Temporary Effect} = \text{Ln}\,(P_{close} / P_{bt}) - \text{Ln}\,(N_{close} / N_{bt})$$

$$\textbf{Net Permanent Effect} = \text{Ln}\,(P_{close} / P_{open}) - \text{Ln}\,(N_{close} / N_{open})$$

Where P_{bt} denote the price of the transaction, for which the price impact is estimated; P_{open} and P_{close} denotes the price of the day opening and closing price of the stock respectively. N_{bt}, N_{open} and N_{close} denote the CNX Nifty Index value during the time when the block trade was executed, the day opening value and the day closing value respectively.

6.2 Price Behavior Surrounding Block Trades

Past studies have analyzed the price behavior with a single trade defined as the event (Anderson, et al, 2006; Gemmill, 1996). However, we have taken 1-minute return interval

surrounding the block trades as the definition of event. We considered 1-minute return as our unit of analysis for four reasons. Firstly, unlike in case of quote-driven market, where the specialists gets instantaneous information about the block trades, in an order-driven market, even where the brokers' terminals are connected to the NSE system on a real-time basis, we expect that the market participants will take some time to identify and react to the block trade information. Secondly, we feel that analyzing the trade-by-trade changes is not likely to help us draw any meaningful conclusion regarding the price direction, due to market microstructure noise in the data at the highest feasible frequency. Thirdly, unlike in a quote-driven market[13], in an order-driven market it may happen that the trades get executed (in case of market orders) at a price which is undesirable to the buyer/seller[14], especially for market orders immediately following a large market order. Fourthly, with the unavailability of order data, it is not possible to know the exact size and exact price of the next order, which may have been executed against more than one pending limit orders.

A minute wise analysis of the excess return and volatility is done for a period of 30 minutes surrounding the block trades. The return for each minute is computed as the difference in log closing price during the minute and the closing price in the previous minute. If the stock is not traded in the previous minute then the last trading price, subject to a minimum time gap of one minute, is considered. This is irrespective of the actual time gap between the trades, which may be more than 1 minute apart. One may argue that the price formation process may be occurring throughout the period of 5 minutes but since we are concerned with instantaneous returns in price, we have assumed that the trade is based on information about the arrival of the block trade. Similar to measurement of returns, the instantaneous volatility around the block trade is measured by squaring the return for each minute. Instantaneous volatility measures the speed of market response to the arrival of information.

The excess return and excess volatility is computed by subtracting the return and volatility of CNX Nifty index during the corresponding time interval. This controls for any macro-economic and other significant news arriving during that period. Cumulative return for the day is measured by summing up the return of each minute since the opening of the market. Overnight return is not considered while computing the cumulative returns. The analysis is separately done for AON trades and Non-AON trades. Filters are applied to the data set to detect any abnormal price changes. Cases where the magnitude of one-minute return is more than 10% are considered outliers and hence not considered.

For days, on which there are multiple block trades, around 30% of the block trades are located within a time interval of less than 30 minutes from another block trade. However, we have not removed the block trades that are located within 30 minutes of another block trade from our analysis. We have rather measured the price behavior surrounding block trades for each block trade separately and then averaged across block trades of similar nature. This may make interpretation of returns/volatility difficult on days with multiple block trades.

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[13] In a quote driven market, the quotes may be revised immediately after a large order is placed by the market specialist, and the orders can be modified accordingly.

[14] For example, if a purchase order arrives just after a block purchase, it will get executed at the next best available selling price which can be the highest trade price within the block or a price greater than the block trade price, since all pending sell orders at a lower price are already executed against the block trade. This may not be the last visible price on the screen of the buyer when he placed the order, since the time taken for streaming the live quotes in the investors' terminals is generally more than the time taken for electronically matching of the order, which is 1.5 – 2 seconds for NSE.

We have not considered block trades executed at the opening and the closing of trading on NSE in our analysis. Block trades occurring on high information days, thin trading days and for stocks with large number of block trades are also excluded in this analysis[15].

7. Results

7.1 Price Impact of Block Trades

7.1.1 All Block Trades

The price impacts of block trades is presented separately for all block trades, AON block trades and Non-AON block trades in Table 5[16]. Figure 5 gives a graphical representation of the price impacts of all block trades. The price impact reported here has been estimated after removing high information days, thin trading days, and highly represented stocks from the sample. The magnitude of total effect is higher for single block sale (-1.80%) than single block purchase (1.60%). Unlike other markets, where there is price continuation in case of block purchases and price reversal in case of block sales, we noticed a price reversal in both the cases i.e. block purchases as well as block sales. However, the price reversal is larger in case of sales than purchase. This leaves the permanent effect to be of the same order in case of single block sale and single block purchase (-1.3%).

The average permanent impact of block trade is higher on days when multiple block trades are executed as compared to days with a single block trade. This is true for block sales as well as block purchases. The permanent impact is higher for multiple purchases (2.9%) than multiple sales (-2.3%). The higher magnitude of temporary effects of block sales as compared to block purchases implies that the block sales have stronger liquidity effect than the block purchases. One possible reason for such finding may be due to high impact cost in the order-driven Indian capital market.

On days when there are both block purchases as well as block sales, the total effect is positive (1.2 %) in case when the total volume for block purchase is higher than the volume of block sales and negative when the total volume of block sales is higher than total volume for block purchases (-0.5%). The net effect (1%) is significant only on those days when the volume under block purchases is higher than the volume under block sales.

7.1.2 AONs and Non-AON trades

Figure 6 and **Figure 7** show the plots of price impacts for AON trades and Non-AON trades respectively. Our findings are consistent with the hypothesis that AON trades have lower information content (low permanent price impact) as compared to Non-AON trades. In case of the days with a single block sale, the difference between permanent effect of AON (-1.1%)

[15] The price impacts in these cases are separately measured. It can be made available on request.

[16] We have not provided detail break-up of the price impacts for ambiguous block trades, and for block trades on days when there are both block purchases and block sales since it is difficult to draw any conclusion from the estimated results in such situations. This can, however, be provided on request.

and Non-AON (-1.7%) trade is 0.6 % but for the days with a single block purchase, the difference is 2.1% (AON: 0.7% and Non-AON: 2.8%), indicating that market does consider the nature of trade while assessing the information content of block purchases. For multiple purchases, there is a difference of 2.6% (AON: 1.8% and Non-AON: 4.4%) in the permanent impact between the days where there are only AON block purchases and the days where there are only Non-AON block purchases. The difference between AON and Non-AON category in case of multiple sales is only 0.20%. Thus, whether the block trade is an AON trade or a Non-AON trade effects price impact more in case of block purchases than in case of block sales.

The magnitude of the liquidity impact is higher for block sales than block purchases, in both AON and Non-AON category. The liquidity (temporary) effect of Non-AON trades is higher than in case of AON trades except for days with multiple purchases in which case the liquidity impact is higher in case of AON trades.

7.1.3 Comparison of price impact of block trades identified using different criterion

Table 6 shows the price impact of block trades separately for block trades identified using criterion 1 and criterion 2. **Figure 8** and **Figure 9** show the plots for price impacts separately for AON and Non-AON block trades identified under different criteria.

The price impact is higher for Non-AON trades than AON trades in all cases under both the criteria. The total price effects and the permanent price effects are larger in case of block trades identified using criterion 2 than the block trades identified using criterion 1 for both AON as well as Non-AON categories. Criterion 2 used by us to define a 'block trade' ends up identifying block trades based on traded quantity in a short period for a stock relative to its usual trading volume. However, there is not much difference in the temporary price effects in case of block trades under criterion 1 and criterion 2. The difference in the total and permanent impact for block trades identified using criterion 1 and criterion 2 is larger in case of Non-AON block trades than in case of AON block trades. The difference is the highest (4.1 %) for days when there are multiple block purchases, in which case the permanent price impacts are 6% and 1.9% for block trades identified using criterion 2 and criterion 1 respectively. Considering the fact that the average size of block trade is less in case of block trades identified using criterion 2 than block trades identified using criterion 1, we can infer that market participants can discern information more from the relative size of the block trade rather than the absolute size of the block trade.

7.2 Price Behavior Surrounding Block Trades-Results

In this section, we discuss our findings on price behavior surrounding a block trade. Table 7 gives the 10 minutes price behavior surrounding block trade for days when only a single block purchase is executed. The positive returns before the block trades are significant for 4 minutes before the block trade (8 minutes for Non-AON trades) indicates that there is some front running or information leakage in the case of Non-AON block trades. The price reverses (becomes negative, although statistically insignificant in most cases) after the block trades. The reversal is faster in case of Non-AON block purchase than in case of AON block trades. The impact cost, measured as the return of the minute when the block trade took place is higher for Non-AON trades (1.73 %) than for AON trades (1.13 %). The returns are not significantly different from zero for most of the minutes surrounding AON trades.

Unlike in case of single block purchase, in case of single block sales (Refer Table 8) the 1-minute returns before the block trade is not statistically different from zero, indicating that there is no front-running in case of block sale. However, the 1-minute returns are positive and statistically significant (for around 9 minutes) indicating that the price reversal commences immediately after the block trade. The impact cost is higher for Non-AON blocks (- 1.83 %) than in case of AON blocks (- 1.16 %).

For multiple block purchases (Refer Table 9), the price behavior surrounding block trades is similar to days with single block purchase, except that the magnitude of front running is higher than in case of single block trade. The magnitude of 1-minute return prior to the block trade is larger in case of Non-AON trades than AON trades days with multiple block purchases. The one-minute return is significant positive for a period of 15 minutes before the block trade in case of Non-AON trades. However, the price reversal is slow (of a lower magnitude) than in case of a single block purchase days, and does not commence immediately after the block purchase as in case of single block purchase / sale. This may be because of the fact that in our data set there are successive block purchases within the 30 minutes period.

Table 10 shows the return behavior around the block sale for days where there are more than one block sale. Although there is a reversal following a block sale for both AON and Non-AON trades, but the returns are not significantly different from zero post the block trades, especially in case of Non-AON block trades. In case of AON block trades, the price reversal is significant for 2 minutes before and 2 minutes (2^{nd} and 3^{rd} minute) after the block trade.

We also do a comparative analysis of the price and volatility (square returns) behavior surrounding block trades for different types of block trades examined in the study. Comparison is done for days with single block purchase and single block sales, days with single and multiple block purchases and days with single and multiple block sales. Comparison has also been done for AON trades and Non-AON trades simultaneously in a single plot. The cumulative returns are computed by summing the returns from the first trading minute (overnight returns are not included) of the day.

7.2.1 Single Block Purchases and Single Block Sales

Figure 10 shows a comparison of excess returns for 30 minutes around AON and Non-AON block trades for days where there is only one block purchase or sale. It can be seen that there is price reversal for both block sales and block purchases in the next minute following the block trade. There is some evidence of front running/ information leakage for the block purchase but not for block sales. The price impact of block trade is higher in case of Non-AON trades as compared to AON trades for block purchase as well as for block sales.

Figure 11 shows the cumulative returns since the first trading minute for days with a single block purchase and a single block sale, separately for AON trades, Non-AON trades and for all trades. We notice a price reversal in both the cases. However, at the end of thirty minutes the reversal in case of block sales is larger than that in the case of block purchases. This implies low information content of block sales as compared to block purchases.

We find significant difference between AON and Non-AON purchases. The difference is significant both prior to and following block trades. The intraday returns upto the time of block purchases is negative for AON block purchases, but for Non-AON purchases the cumulative returns are positive (around 0.5%) even before -30 minute. This implies that, in

general, Non-AON block purchase order is placed when the stock price is moving up during the day.

In case of block sales, however, there is no significant difference in the cumulative return for AON and Non-AON trades indicating that the temporary effect is mainly because of liquidity cost. The reversal happens quickly and the net effect becomes zero only after 5 minutes in case of AON sales and after 25 minutes in case of Non-AON sales. The significant difference in price behavior for AON and Non-AON trades supports the hypothesis that market perceives that execution of AON trades is for reasons other than the arrival of private information.

Figure 12 shows the average excess volatility for a period of 30 minutes surrounding AON and Non-AON block trades on days with a single block trade (both purchase and sale). The one-minute volatility pattern prior to the block trade is similar in case of single block purchase and single block sales. Subsequent to the block trade, the price volatility is comparatively higher in the case of block sale than in the case of block purchase. This is true in case of AON trades as well as Non-AON trades. The volatility increases and the prices are settled at the equilibrium level sooner in case of block sale than block purchase, indicating that much of the decrease in price was because of liquidity cost.

7.2.2 Single Block Purchase and Multiple Block Purchases

Figure 13 draws a comparison between the excess returns around block purchases for days with single and with multiple block purchase, for both AON and Non-AON block trades. The impact cost is higher on days with single block trade than for days when there are multiple block purchases, implying that executing multiple orders help in lowering the liquidity costs for the traders.

Figure 14 plots the cumulative excess returns for days with single block purchase and days with multiple block purchases separately AON and Non-AON block trades. Multiple block purchases indicate that there is strong positive information about the company and the market responds by increasing the demand of the security. The effect of arrival of AON trades on prices is low as compared to Non-AON trades. Strong information effect in case of Non-AON trades and especially in case of days with multiple block purchases, results in larger increase in the price level subsequent to the block trades as compared to AON trades. The price reversal happens faster in case of AON trades even on days when there are multiple block purchases.

The cumulative return before 30 minutes of the Non-AON block purchase on days with single block trade is positive and large, indicating an increased probability of block purchase being executed on days when some positive information is expected. The increase in prices immediately before the Non-AON block purchase (even in case of single block purchase) may indicate front running/ information leakage in the market. Although such results were also found for days with multiple block purchases but that may be because of execution of successive block purchases within a short duration.

Figure 15 plots the average excess volatility for a period of 30 minutes surrounding block trades. There are few spikes in the average volatility on days with multiple AON purchases, which simply indicate that AON purchases are concentrated at a particular time during the day. We found that around 40% of the AON block trades occur within a period of 30 minutes of another AON block trades. This may also imply that the price at which the AON trades are

executed may not be in congruence with the prevailing market price. An example of such cases is execution of trades at a price that lies in between the best ask and best bid offer price when there is a large spread.

7.2.3 Single Block Sale and Multiple Block Sales

Figure 16 shows excess return around block trade and **Figure 17** shows the cumulative excess returns since the market opening in case of days with single block sale and days with multiple block sales. The impact cost of block trade is found to be higher for Non-AON block sales than AON block sales in both cases. In case of days with multiple block sales, we notice a negative return for few minutes prior to the block trade. This is true for both AON as well as Non-AON cases. For Non-AON trades, it may probably indicate that instead of executing the whole block at a time, the investors break the order and execute them successively in the market, in order to delay the information release and reduce the transaction cost since the impact cost is lower in case of days with multiple block trades.

Figure 18 compares the excess volatility in the stock price around block trades. The price reversal is faster in case of days with a single block sale as compared to days with multiple block sales. This may be attributed to larger negative information effect on days with multiple sales. The price reversal is faster for AON trades supporting the hypothesis that market perceives that such trades are not usually undertaken to reap benefits of any private information but for other purposes. The increased volatility in case of multiple Non-AON block sales may be due to execution of successive block trades in a short duration.

8. Conclusion

Although there are numerous studies empirically investigating market microstructure induced phenomenon in the financial markets, there is a dearth of such studies in India. In order to understand the price impact of block trades, we analyze the NSE data empirically. With the unavailability of order data, the identification and classification of block trades becomes a challenging task. Block trades are identified based on total quantity at uptick, downtick and same tick executed for each stock at every five-second interval. Certain assumptions are made for classifying the block trades into block purchase/ block sale and wherever the status is not clear, we classify the identified block trade as 'ambiguous' trades. It is only during this exercise, that distinction between All-or-None (AON) and Non-AON trades becomes apparent. As found in other markets, the permanent price impact (information effect) is more for block purchases than for block sales in the Indian market, implying that block purchases are more informative than block sales, which may be motivated by liquidity need. Unlike in other markets, we observe that the temporary price impact is greater than the permanent impact in case of block purchases. This may be because of the higher impact costs or more of noise trading in the market. Our findings support the hypothesis that AON trades have much lower information content than Non-AON trades. The price impact is higher for Non-AON trades as compared to AON trades. AON trades are simultaneous purchases and sales of large blocks possibly motivated by factors other than information. Market does acknowledge the relative information content in different types of block trades and reacts accordingly. This is an important insight especially in case of an order driven market like India. In the case of a quote driven market, the specialist or the dealer takes the opposite position for a trade and can observe block trades. Arrival of multiple block trades increases market confidence regarding

the information, and the permanent price impact is found to be higher for days with multiple trades than days with single trades. Further, in line with past findings, we also observe that the price impacts of block trades are larger for lower market capitalization stocks (criterion 1 stocks) than higher market capitalization stocks (criterion 2 stocks).

Following transaction-time event approach, we find that some information about the impending block purchase is already factored in by the market. This is not the case with block sales. The stock price starts increasing from 8 minutes before Non-AON block purchases (front running) but not in case of block sales. In case of block sales, prices revert quickly, leaving little permanent price impact. The price reversal is faster for AON trades than in case of Non-AON trades.

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Table 1: Number of AON and Non-AON Block Trades

Nature	No. of trades	Nature	No. of trades
AON-A	10,011 (25%)	AON-D	5,709 (14%)
AON-B	7,169 (18%)	Non-AON	14,861 (37%)
AON-C	2,330 (06%)		
Total			**40,080**

Table 2: Details of Stocks with High Number of Block Trades

Stock symbol	No. of block trades	Stock symbol	No. of block trades
HIMACHLFUT	3,281	GLOBALTELE/GTL	1,050
RELIANCE	2,670	ZEETELE/ ZEEL	1,139
SATYAMCOMP	1,980	IFCI	447
INFOSYSTCH	1,584		
TOTAL			**12151**

Table 3: Summary Statistics of Data Set Used

500 Stocks Selected (Aggregated Figures)	1999	2007
Average Turnover (in billion Rs.)	17	65
Average No of Trades per trading Day (in million)	0.22	1.93
Average No of Shares Transacted (in million)	60	290
Market Capitalization (in billion Rs.)	4051	24646

Table 4: Descriptive Statistics of Intraday Block Trades

(Excluding Block Trades on High Information Days, Thin Trading Days and for Companies with large number of Block Trades)
(Quantity and Value traded in 5 seconds period when block trade occurred)

Tick	All				AON*				Non-AON			
	No.	Quantity	Value	Price	No.	Quantity	Value	Price	No.	Quantity	Value	Price
All Block Trades												
Single Purchase	4,912	98,459	27,655,700	281	3,481	103,457	32,329,979	312	1,431	86,301	16,285,212	189
Single Sale	4,333	99,127	24,768,181	250	3,295	99,867	27,914,187	280	1,038	96,778	14,781,583	153
Multiple Purchases	3,504	60,276	15,398,521	255	2,439	50,077	14,796,040	295	1,065	83,632	16,778,287	201
Multiple Sales	2,560	78,774	16,238,366	206	2,038	60,775	16,944,771	279	522	149,049	13,480,409	90
Single Ambiguous	2,644	65,960	13,942,313	211	1,914	64,354	15,873,956	247	730	70,170	8,877,702	127
Multiple Ambiguous	1,375	44,158	6,337,451	144	1,029	37,668	6,130,070	163	346	63,459	6,954,200	110
Multiple Both (Net Purchase)	1,782	66,745	20,740,002	311	1,371	59,856	19,403,111	324	411	89,726	25,199,557	281
Multiple Both (Net Sale)	1,263	77,559	27,007,116	348	989	75,637	28,865,612	382	274	84,495	20,298,894	240
Multiple Both (Net 0)	26	32,038	7,611,584	238	25	32,319	7,209,047	223	1	25,000	17,675,000	707
Total	**22,399**	**79,417**	**20,337,337**	**256**	**16,581**	**75,677**	**22,143,385**	**293**	**5,818**	**90,076**	**15,190,192**	**169**
Criterion 1 (Where in a 5-seconds period the total quantity > 500000 or total value > Rs. 30 million)												
Single Purchase	1,516	260,118	78,718,542	303	1,013	292,334	98,365,431	336	503	195,238	39,151,348	201
Single Sale	1,234	281,431	76,208,714	271	907	297,137	89,475,847	301	327	237,867	39,409,663	166
Multiple Purchases	866	176,190	53,092,930	301	452	174,419	66,134,998	379	414	178,123	38,853,765	218
Multiple Sales	536	288,853	66,336,619	230	383	235,920	77,959,880	330	153	421,359	37,240,481	88
Total	**4,152**	**252,657**	**71,029,328**	**281**	**2,755**	**266,727**	**87,314,130**	**327**	**1,397**	**224,909**	**38,914,345**	**173**
Criterion 2 (Where in a 5-seconds period the total value > average daily trade value in the year)												
Single Purchase	3,889	76,801	20,179,874	263	2,902	86,820	24,651,695	284	987	47,344	7,031,722	149
Single Sale	3,497	74,496	17,390,301	233	2,743	79,909	20,567,404	257	754	54,803	5,832,219	106
Multiple Purchases	2,786	34,088	6,576,117	193	2,114	34,785	7,364,644	212	672	31,896	4,095,540	128
Multiple Sales	2,172	53,124	9,120,032	172	1,779	39,927	9,555,000	239	393	112,863	7,151,052	63
Total	**12,344**	**62,342**	**14,373,232**	**231**	**9,538**	**64,553**	**16,829,819**	**261**	**2,806**	**54,825**	**6,022,940**	**110**

* The figures represent AON trades in general and not restricted to days with multiple block trades wherein all cases are AON trades. However, we have considered only Only-AON cases in our analysis to find the effect of multiple AON trades.

Note: The weighted- average Market Capitalization of companies (weighted by the number of block trades) is Rs. 358,560 million and Rs. 5,750 millions for criterion 1 block trades and criterion 2 block trades respectively.

Table 5: Net Price Impact (Net of Nifty Returns) of Intraday Block Trades

(Blocks Excluding High Information Days, Thin trading Days and for Companies with large number of Block Trades)

Condition	Number / Nature of Ticks during the Day	No. of Block Trades	Total Effects			Temporary Effects			Permanent Effects		
			Return	t-stat		Return	t-stat		Return	t-stat	
All Trades	Single Purchase	4864	0.016	23.116	**	(0.003)	(7.179)	**	0.013	16.343	**
	Single Sale	4282	(0.018)	(21.892)	**	0.006	10.671	**	(0.013)	(13.963)	*
	Multiple Purchases	3463	0.030	28.905	**	(0.001)	(1.765)		0.029	25.558	**
	Multiple Sales	2528	(0.027)	(20.767)	**	0.004	4.285	**	(0.023)	(16.222)	**
	Single Ambiguous	2617	0.007	7.232	**	(0.001)	(2.021)	*	0.006	5.496	**
	Multiple Ambiguous	1354	0.004	2.676	**	(0.000)	(0.156)		0.003	2.202	*
	Multiple Both (Net Purchase)	1762	0.012	7.173	**	(0.002)	(1.457)		0.010	6.064	**
	Multiple Both (Net Sale)	1247	(0.005)	(2.941)	**	0.005	4.255	**	(0.000)	(0.026)	
	Multiple Both (Net 0)	26	0.012	1.706		0.002	0.688		0.014	1.860	
All-AON Trades	Single Purchase	3444	0.009	12.455	**	(0.003)	(5.378)	**	0.007	7.771	**
	Single Sale	3260	(0.016)	(16.811)	**	0.005	7.749	**	(0.011)	(10.779)	**
	Multiple Purchases	1944	0.019	15.110	**	(0.002)	(2.318)	*	0.018	12.351	**
	Multiple Sales	1686	(0.024)	(16.269)	**	0.003	2.804	**	(0.021)	(12.580)	**
Not- AON Trades	Single Purchase	1420	0.032	22.329	**	(0.004)	(4.787)	**	0.028	16.932	**
	Single Sale	1022	(0.026)	(14.732)	**	0.009	7.994	**	(0.017)	(9.349)	**
	Multiple Purchases	1055	0.045	23.689	**	(0.000)	(0.267)		0.044	21.803	**
	Multiple Sales	514	(0.028)	(8.794)	**	0.005	2.191	*	(0.023)	(6.959)	**

Certain cases are excluded due to unavailability of NIFTY data for particular time

* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Table 6: Net Price Impact (Net of Nifty Returns) of Intraday Block Trades

(Blocks Excluding High Information Days, Thin trading Days and for Companies with large number of Block Trades)

Sl. No.	Condition	Number / Nature of Ticks during the Day	No. of Block Trades	Total Effects			Temporary Effects			Permanent Effects		
				Return	t-stat		Return	t-stat		Return	t-stat	
CRITERIA 1	All Trades	Single Purchase	1,507	0.005	6.402	**	(0.001)	(3.230)	**	0.003	3.794	**
		Single Sale	1,224	(0.007)	(7.267)	**	0.004	6.185	**	(0.002)	(2.369)	*
		Multiple Purchases	858	0.012	10.992	**	(0.002)	(2.311)	*	0.011	8.241	**
		Multiple Sales	529	(0.011)	(6.985)	**	0.005	3.346	**	(0.005)	(2.898)	**
	All-AON Trades	Single Purchase	1,007	(0.001)	(0.757)		(0.001)	(0.998)		(0.001)	(1.193)	
		Single Sale	903	(0.006)	(5.998)	**	0.004	4.876	**	(0.002)	(2.054)	*
		Multiple Purchases	349	0.004	3.221	**	(0.001)	(1.549)		0.003	1.821	
		Multiple Sales	320	(0.005)	(4.486)	**	0.004	3.018	**	(0.002)	(1.065)	
	Not- AON Trades	Single Purchase	500	0.015	10.240	**	(0.003)	(4.165)	**	0.012	7.162	**
		Single Sale	321	(0.008)	(4.113)	**	0.006	3.818	**	(0.003)	(1.200)	
		Multiple Purchases	414	0.021	11.370	**	(0.002)	(1.856)		0.019	8.894	**
		Multiple Sales	149	(0.021)	(5.155)	**	0.008	1.628		(0.014)	(2.652)	**
CRITERIA 2	All Trades	Single Purchase	3,846	0.019	22.328	**	(0.003)	(6.309)	**	0.015	16.060	**
		Single Sale	3,454	(0.021)	(21.643)	**	0.006	10.345	**	(0.015)	(13.822)	**
		Multiple Purchases	2,750	0.035	27.599	**	(0.001)	(1.522)		0.034	24.521	**
		Multiple Sales	2,144	(0.031)	(20.374)	**	0.005	4.288	**	(0.026)	(15.848)	**
	All-AON Trades	Single Purchase	2,867	0.011	13.223	**	(0.003)	(5.053)	**	0.009	8.609	**
		Single Sale	2,711	(0.018)	(16.671)	**	0.005	7.716	**	(0.013)	(10.606)	**
		Multiple Purchases	1,707	0.022	15.060	**	(0.002)	(2.250)	*	0.020	12.339	**
		Multiple Sales	1,472	(0.027)	(16.272)	**	0.003	2.772	**	(0.023)	(12.600)	**
	Not- AON Trades	Single Buy	979	0.039	20.605	**	(0.005)	(3.779)	**	0.035	15.763	**
		Single Sale	743	(0.033)	(14.767)	**	0.010	7.513	**	(0.023)	(9.518)	**
		Multiple Buy	662	0.059	22.449	**	0.000	0.235		0.060	21.035	**
		Multiple Sale	387	(0.032)	(8.039)	**	0.008	2.537	*	(0.024)	(6.046)	**

Table 6: Net Price Impact (Net of Nifty Returns) of Intraday Block Trades

(Blocks Excluding High Information Days, Thin trading Days and for Companies with large number of Block Trades)

Certain cases are excluded due to unavailability of NIFTY data for particular time
* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Table 7: Days with Single Block Purchase
Price Behavior Surrounding Block Trades

Relative Minute	All			AON Trade			Non-AON Trade		
	Net excess return	t-Statistic		Net excess return	t-Statistic		Net excess return	t-Statistic	
-10	0.0002	1.222		0.0000	0.238		0.0004	1.474	
-9	0.0003	1.717		0.0001	0.633		0.0005	1.865	
-8	0.0003	1.787		0.0001	0.312		0.0006	2.140	*
-7	0.0002	1.393		(0.0001)	(0.331)		0.0007	2.590	**
-6	0.0002	1.609		(0.0001)	(0.297)		0.0007	2.557	*
-5	0.0003	1.858		0.0000	0.083		0.0008	3.000	**
-4	0.0006	3.504	**	0.0003	1.124		0.0012	4.103	**
-3	0.0004	2.265	*	(0.0005)	(2.638)	**	0.0016	5.102	**
-2	0.0008	4.205	**	0.0002	0.774		0.0017	5.772	**
-1	0.0015	6.530	**	0.0006	1.938		0.0029	8.211	**
0	0.0131	47.376	**	0.0113	37.379	**	0.0173	29.889	**
1	(0.0004)	(1.732)		(0.0000)	(0.128)		(0.0009)	(2.496)	*
2	(0.0003)	(1.620)		(0.0001)	(0.687)		(0.0006)	(1.561)	
3	(0.0001)	(0.698)		0.0001	0.325		(0.0004)	(1.305)	
4	(0.0007)	(3.855)	**	(0.0004)	(1.938)		(0.0012)	(3.541)	**
5	(0.0004)	(2.378)	*	(0.0004)	(2.065)	*	(0.0003)	(1.216)	
6	(0.0000)	(0.035)		0.0001	0.255		(0.0001)	(0.346)	
7	(0.0002)	(1.025)		(0.0000)	(0.050)		(0.0004)	(1.291)	
8	0.0000	0.209		(0.0001)	(0.371)		0.0002	0.789	
9	(0.0003)	(1.632)		(0.0002)	(0.808)		(0.0004)	(1.635)	
10	(0.0001)	(0.640)		0.0002	0.856		(0.0006)	(2.033)	*

* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Table 8: Days with Single Block Sale
Price Behavior Surrounding Block Trades

Relative Minute	All			AON Trade			Non-AON Trade		
	Net excess return	t-Statistic		Net excess return	t-Statistic		Net excess return	t-Statistic	
-10	(0.0001)	(0.719)		0.0001	0.304		(0.0006)	(1.766)	
-9	0.0001	0.699		0.0003	1.264		(0.0002)	(0.463)	
-8	0.0004	2.111	*	0.0004	1.548		0.0004	1.636	
-7	0.0001	0.420		0.0002	1.034		(0.0003)	(0.853)	
-6	(0.0001)	(0.804)		(0.0001)	(0.630)		(0.0001)	(0.508)	
-5	0.0002	1.673		0.0003	2.208	*	(0.0000)	(0.160)	
-4	0.0004	1.613		0.0003	1.074		0.0005	1.278	
-3	(0.0001)	(0.350)		0.0001	0.523		(0.0005)	(1.270)	
-2	0.0002	0.717		0.0002	1.012		(0.0001)	(0.184)	
-1	(0.0002)	(0.909)		0.0001	0.175		(0.0008)	(1.968)	*
0	(0.0131)	(41.202)	**	(0.0116)	(34.942)	**	(0.0183)	(22.719)	**
1	0.0021	7.534	**	0.0021	7.699	**	0.0020	3.026	**
2	0.0016	6.271	**	0.0012	4.179	**	0.0024	4.863	**
3	0.0009	3.600	**	0.0007	2.426	*	0.0012	2.785	**
4	0.0007	3.199	**	0.0006	2.496	*	0.0010	2.014	*
5	0.0005	2.390	*	0.0005	2.006	*	0.0006	1.313	
6	0.0004	2.229	*	0.0004	1.690		0.0006	1.453	
7	0.0003	1.423		0.0001	0.618		0.0007	1.425	
8	0.0005	2.897	**	0.0006	3.103	**	0.0003	0.736	
9	0.0006	2.915	**	0.0005	2.345	*	0.0006	1.734	
10	0.0001	0.580		0.0004	1.715		(0.0004)	(0.961)	

* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Table 9: Days with Multiple Block Purchases
Price Behavior Surrounding Block Trades

Relative Minute	All			All-AON Trade			Non-AON Trade		
	Net excess return	t-Statistic		Net excess return	t-Statistic		Net excess return	t-Statistic	
-10	0.0008	3.451	**	0.0003	0.932		0.0005	1.972	*
-9	0.0008	3.101	**	0.0006	1.205		0.0011	3.447	**
-8	0.0007	2.716	**	(0.0000)	(0.028)		0.0010	3.221	**
-7	0.0008	3.172	**	0.0010	1.831		0.0010	3.462	**
-6	0.0015	5.452	**	0.0005	1.141		0.0020	5.840	**
-5	0.0013	4.922	**	0.0005	1.161		0.0020	5.334	**
-4	0.0008	3.055	**	0.0008	1.801		0.0010	2.812	**
-3	0.0017	6.007	**	0.0019	3.692	**	0.0017	4.822	**
-2	0.0023	7.287	**	0.0021	3.937	**	0.0026	6.265	**
-1	0.0042	13.131	**	0.0037	7.426	**	0.0039	9.896	**
0	0.0087	28.216	**	0.0080	20.081	**	0.0111	18.282	**
1	0.0003	1.125		0.0004	1.005		0.0001	0.328	
2	(0.0000)	(0.104)		0.0003	0.887		(0.0003)	(0.821)	
3	(0.0002)	(0.958)		0.0000	0.042		(0.0004)	(1.447)	
4	(0.0005)	(1.996)	*	(0.0010)	(1.855)		(0.0002)	(0.638)	
5	(0.0004)	(1.580)		(0.0004)	(0.974)		(0.0007)	(2.092)	*
6	(0.0003)	(1.302)		(0.0006)	(1.369)		0.0001	0.306	
7	(0.0006)	(2.576)	*	(0.0010)	(2.475)	*	(0.0003)	(1.177)	
8	(0.0005)	(1.921)		(0.0009)	(2.104)	*	(0.0003)	(0.902)	
9	0.0002	0.664		0.0007	1.658		(0.0001)	(0.179)	
10	(0.0001)	(0.380)		0.0000	0.063		(0.0001)	(0.211)	

* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Table 10: Days With Multiple Block Sales
Price Behavior Surrounding Block Trades

Relative Minute	All			All-AON Trade			Non-AON Trade		
	Net excess return	t-Statistic		Net excess return	t-Statistic		Net excess return	t-Statistic	
-10	0.0000	0.033		0.0003	0.731		(0.0000)	(0.022)	
-9	(0.0005)	(1.242)		0.0001	0.177		(0.0011)	(1.486)	
-8	(0.0004)	(1.083)		(0.0002)	(0.319)		(0.0007)	(1.122)	
-7	0.0003	0.734		0.0000	0.006		0.0008	1.035	
-6	(0.0001)	(0.167)		(0.0000)	(0.059)		(0.0001)	(0.140)	
-5	(0.0007)	(1.701)		(0.0007)	(1.286)		(0.0009)	(1.093)	
-4	(0.0008)	(1.852)		(0.0008)	(1.266)		(0.0006)	(0.869)	
-3	(0.0009)	(2.320)	*	(0.0007)	(1.589)		(0.0007)	(0.919)	
-2	(0.0017)	(3.682)	**	(0.0012)	(2.166)	*	(0.0017)	(2.079)	*
-1	(0.0036)	(7.026)	**	(0.0034)	(5.749)	**	(0.0020)	(2.501)	*
0	(0.0099)	(24.455)	**	(0.0084)	(18.490)	**	(0.0151)	(14.391)	**
1	0.0011	2.713	**	0.0002	0.496		0.0021	1.992	*
2	0.0015	3.329	**	0.0012	2.348	*	0.0015	1.627	
3	0.0010	2.214	*	0.0012	2.108	*	0.0002	0.167	
4	0.0005	1.165		(0.0001)	(0.103)		0.0012	1.329	
5	0.0006	1.359		0.0005	0.957		0.0006	0.558	
6	0.0007	1.807		0.0006	1.231		0.0009	1.390	
7	(0.0004)	(0.903)		(0.0003)	(0.552)		(0.0010)	(1.248)	
8	0.0004	1.058		0.0000	0.099		0.0008	0.901	
9	0.0006	1.416		0.0004	0.775		0.0002	0.260	
10	0.0006	1.588		0.0004	1.076		0.0010	1.266	

* Indicates that the returns are significantly different from zero at 5 % level and ** indicates significance at 1% level

Figure 1: Total, Temporary and Permanent Effect of Block Trade

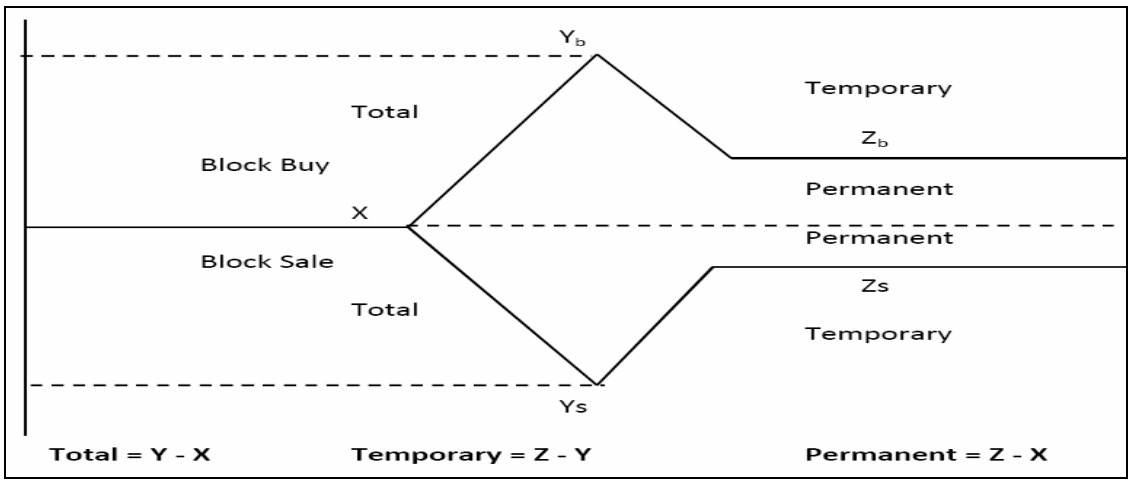


Figure 2: Distribution of AON and Non-AON Trades

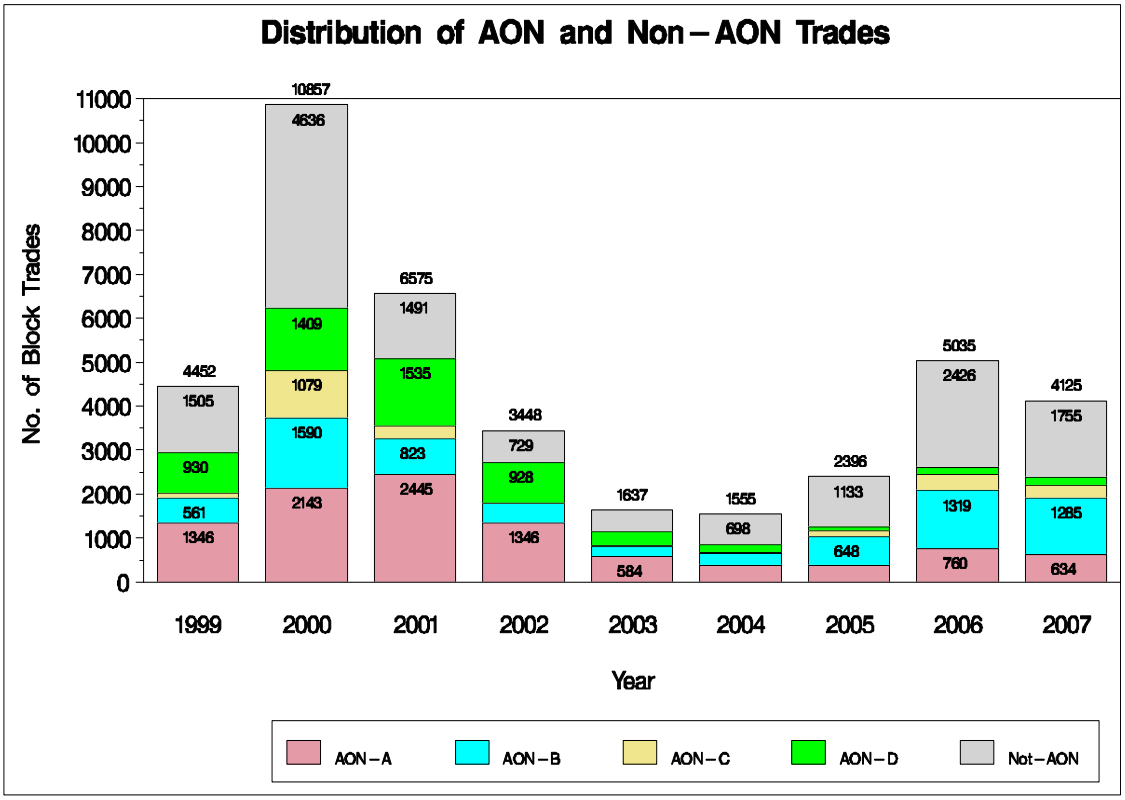


Figure 3: Identification and Classification of Block Trades

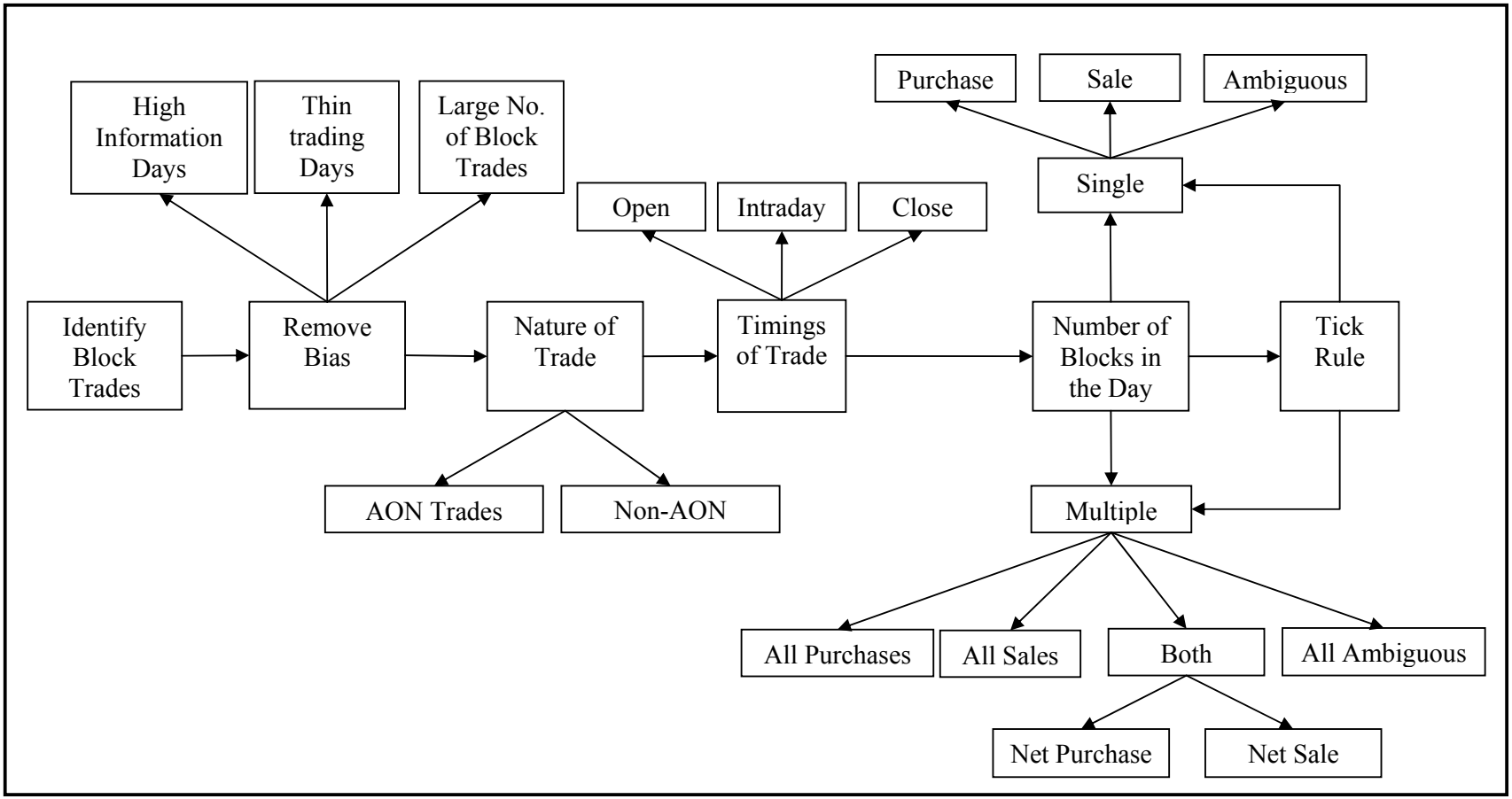
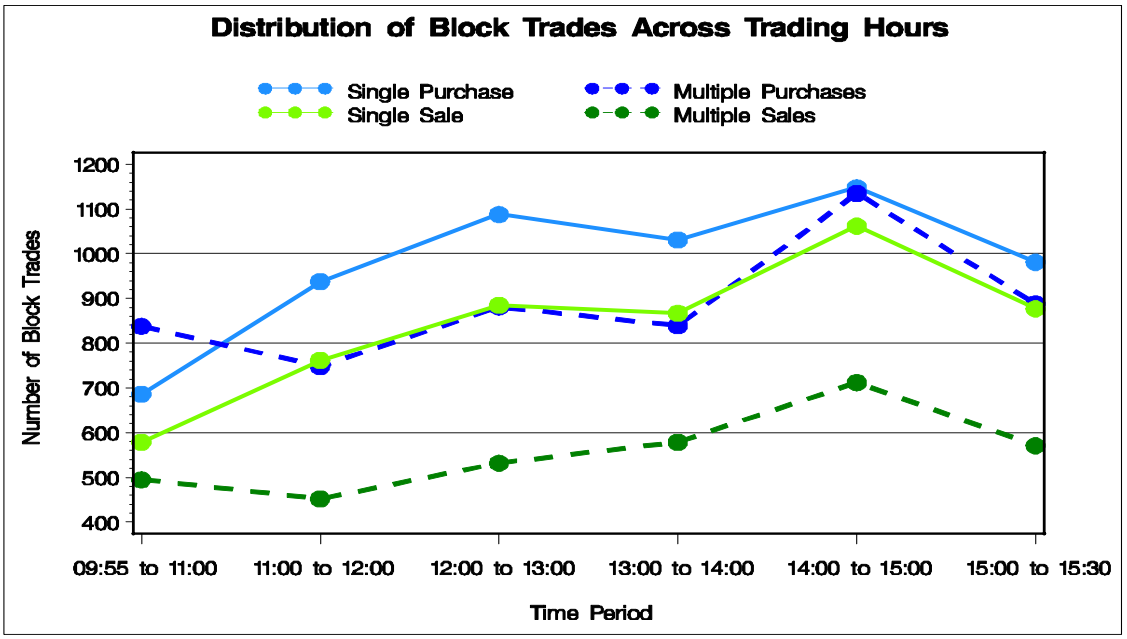
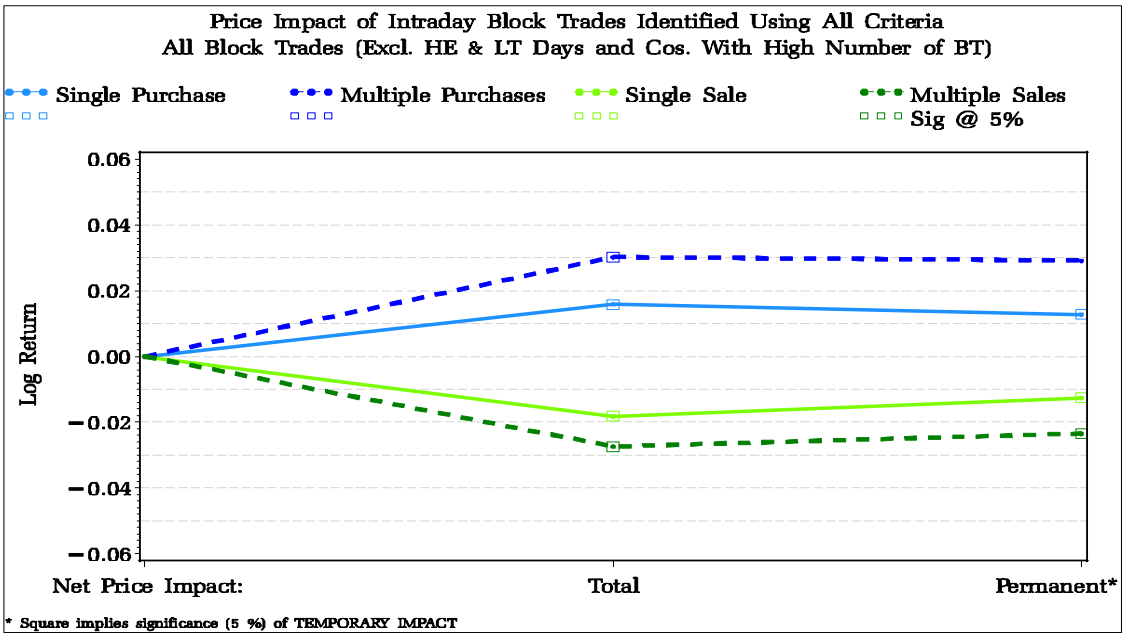


Figure 4: Distribution of Block Trades across the Day



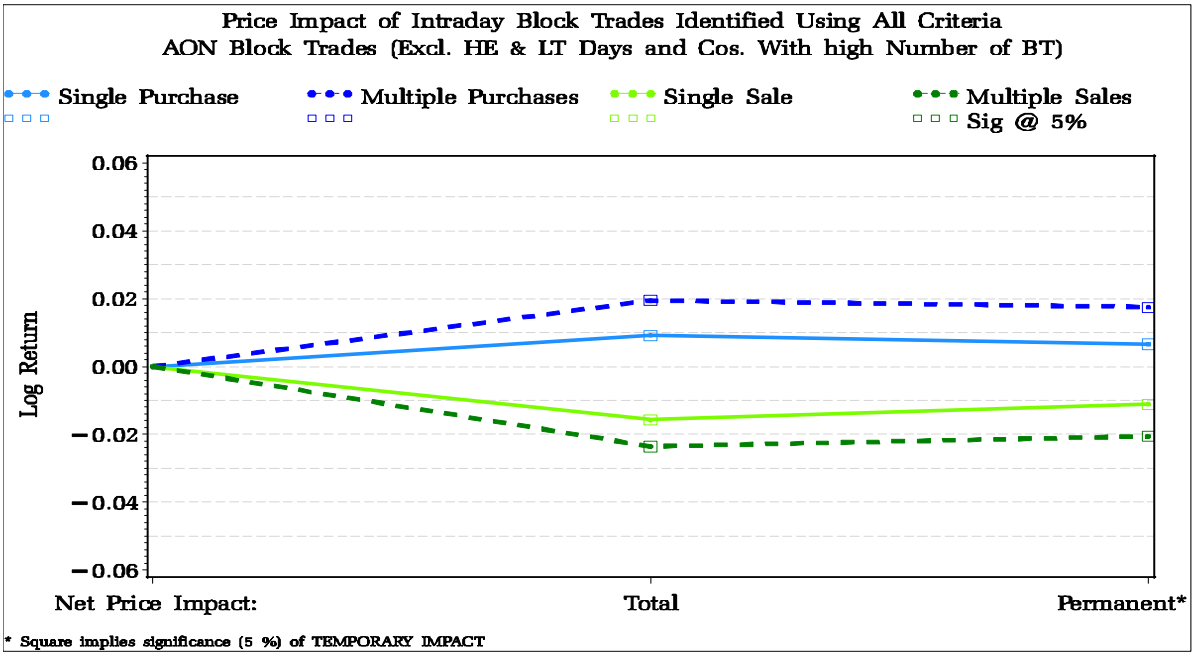
The figure shows distribution of block trades across the trading hours in a day. The first period covers a period of 65 minutes and the last period covers a period of 30 minutes. All other intervals are of 1-hour duration.

Figure 5: Price Impact of Single and Multiple Block Purchases and Block Sales



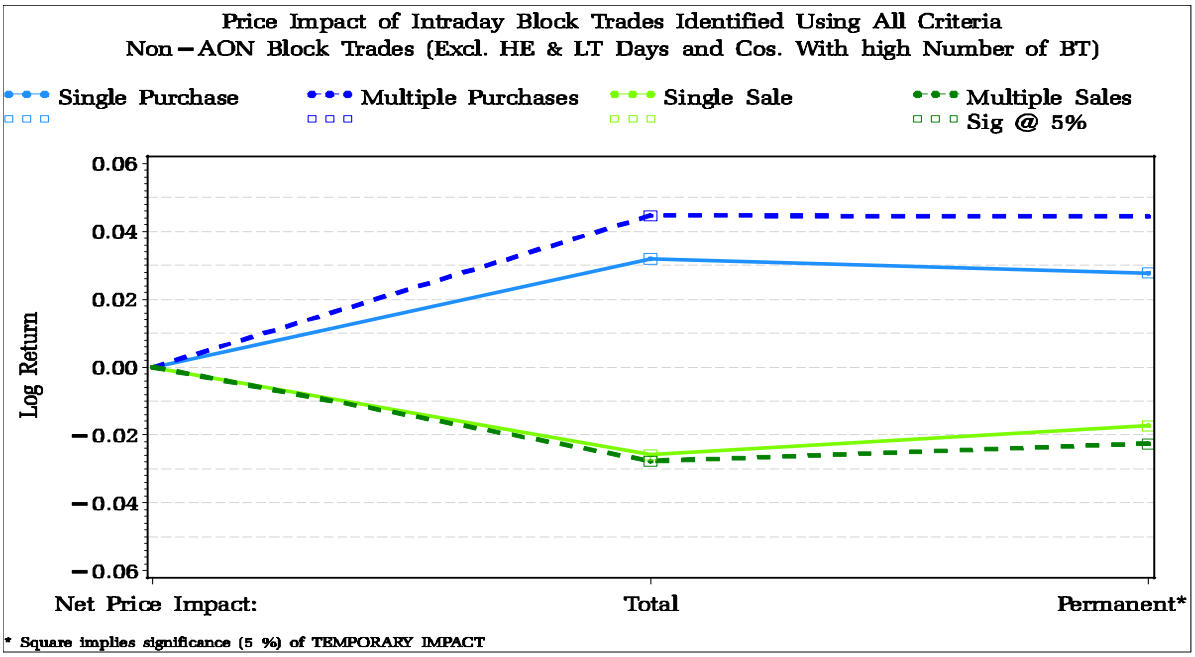
The figure shows the price impact of intraday block trades identified using criteria 1 and criteria 2. Number of block trades falling under various categories: Single Purchase (4864), Single Sales (4282), Multiple Purchases (3463) and Multiple Sales (2528).

Figure 6: Price Impact of AON Block Trades



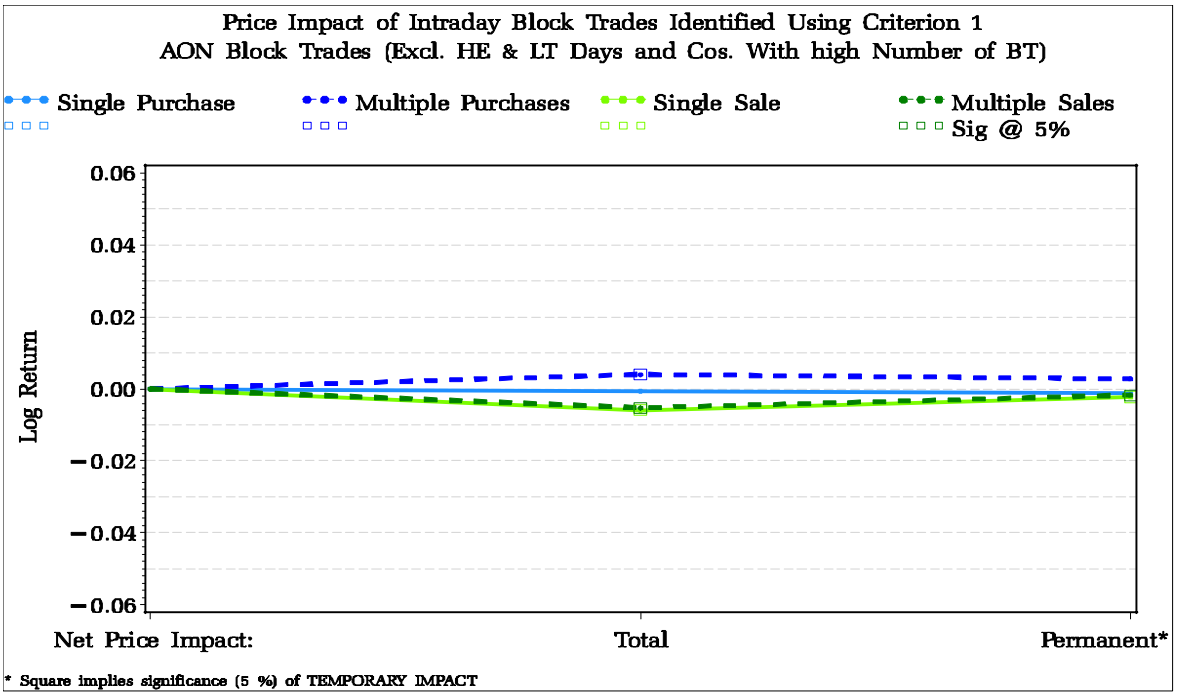
The figure shows the price impact of intraday AON block trades identified using both the criteria. Number of block trades falling under various categories: Single Purchase (3444), Single Sales (3260), Multiple Purchases (1944) and Multiple Sales (1686).

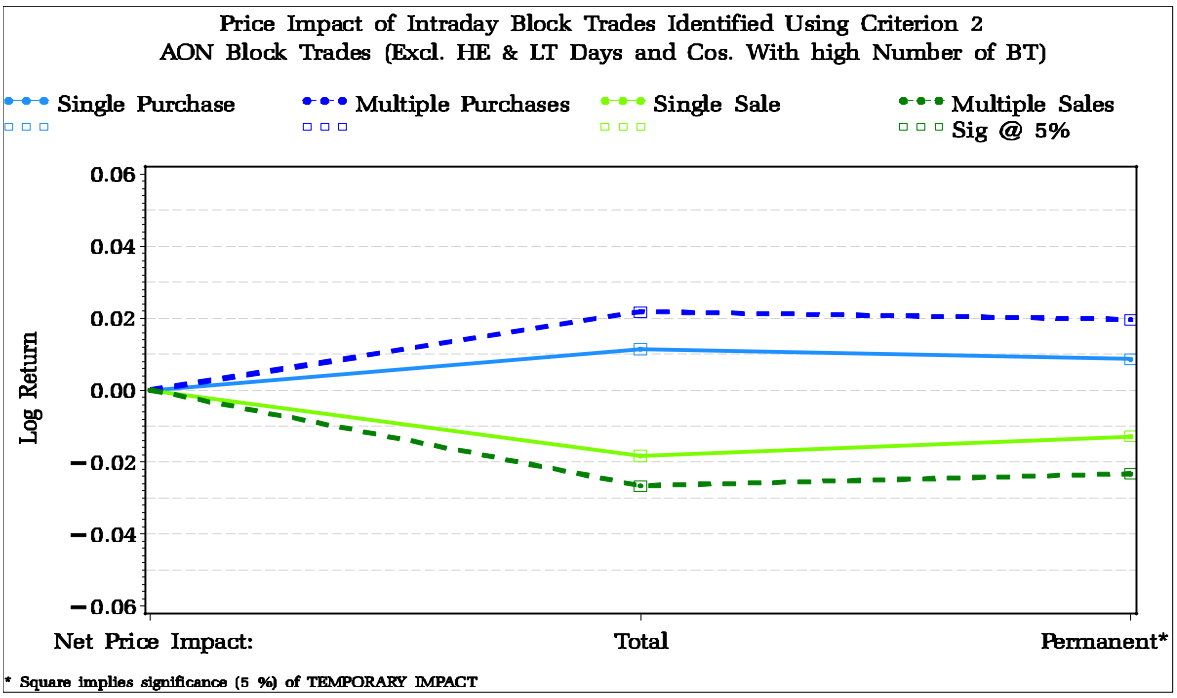
Figure 7: Price Impact of Non-AON Block Trades



The figure shows the price impact of intraday Non-AON block trades identified using both the criteria. Number of block trades falling under various categories: Single Purchase (1420), Single Sales (1022), Multiple Purchases (1055) and Multiple Sales (514).

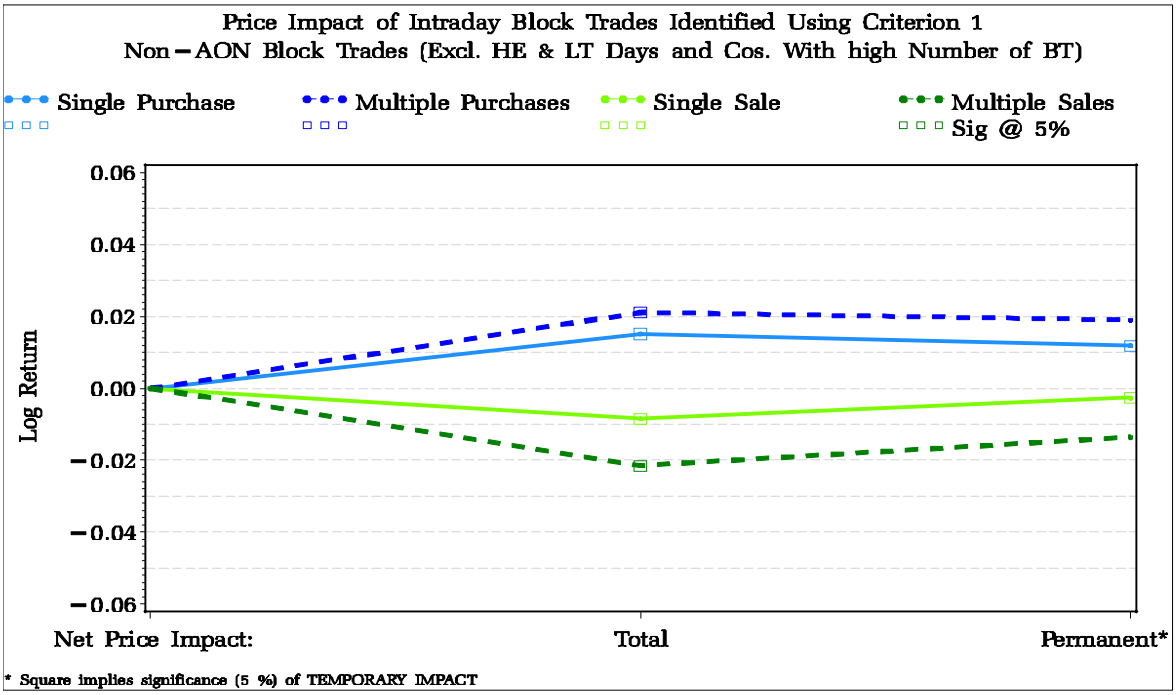
Figure 8: Criteria-Wise Analysis of Price Impact (AON Blocks only)

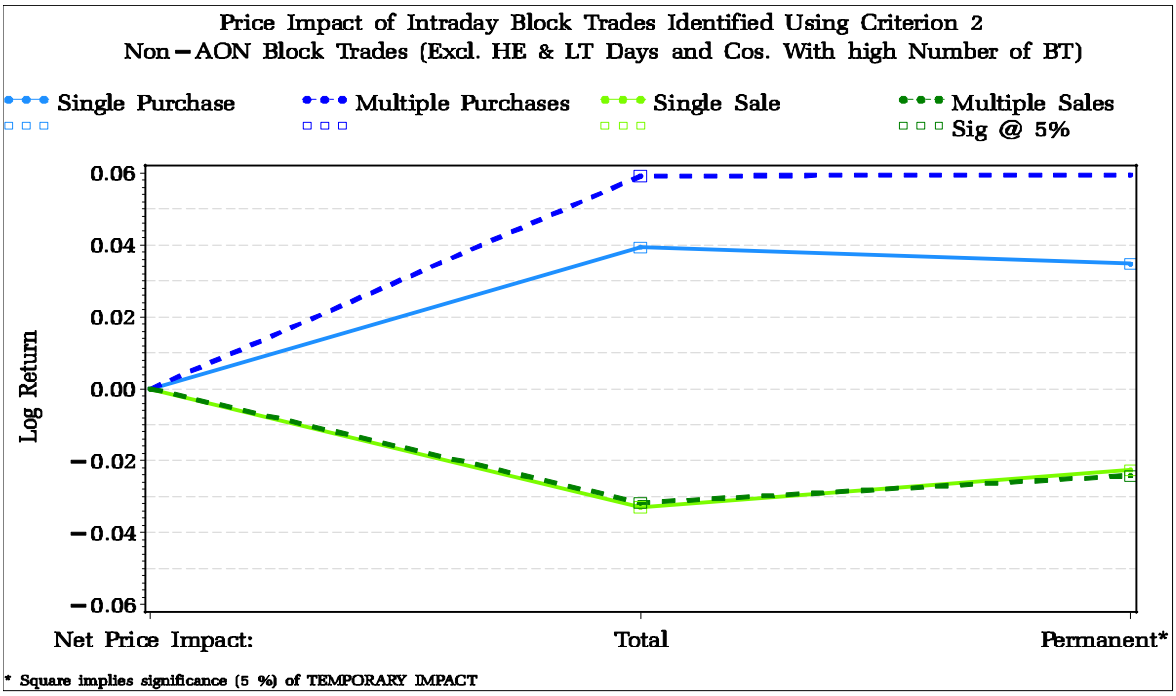




The two figures compare the price impact of AON block trades identified using criterion 1 and Criterion 2. The price impact is higher in all the cases for block trades identified using Criterion 2. Number of block trades falling under various categories under criterion 1 and criterion 2 respectively: Single Purchase (1007, 2867); Single Sales (903, 2711); Multiple Purchases (349, 1707) and Multiple Sales (320, 1472).

Figure 9: Criteria-Wise Analysis of Price Impact (Non-AON Blocks only)





The two figures compare the price impact of intraday Non-AON block trades identified using criterion 1 and Criterion 2. The price impact is higher in all the cases for block trades identified using Criterion 2. Number of block trades falling under various categories under criterion 1 and criterion 2 respectively: Single Purchase (500, 979); Single Sales (321, 743); Multiple Purchases (414, 662) and Multiple Sales (149, 387).

Figure 10: Excess Return around Block Trades on Days with Single Block Trade

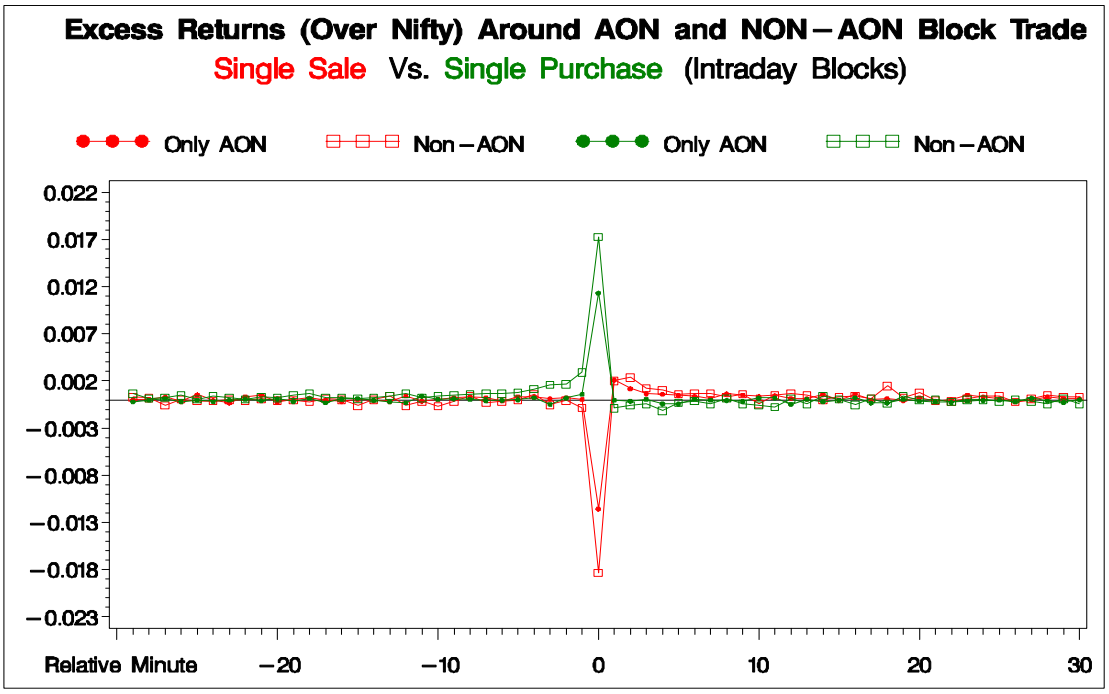


Figure 11: Cumulative Excess Returns on Days with Single Block Trade

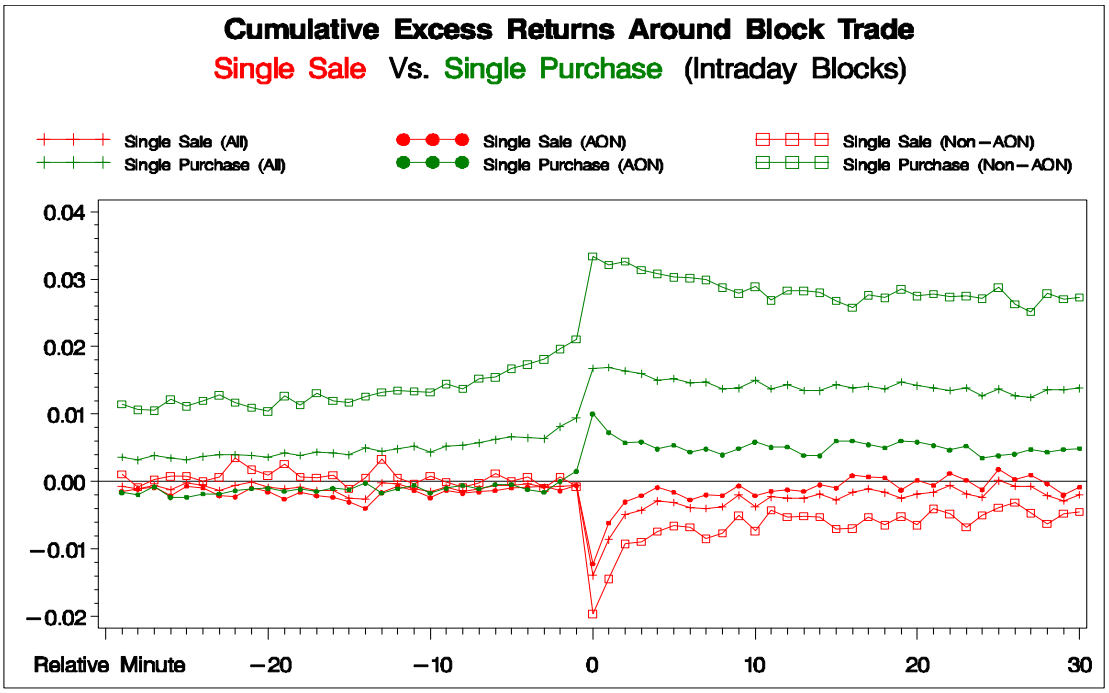


Figure 12: Excess Volatility around Block Trades on Days with Single Block Trade

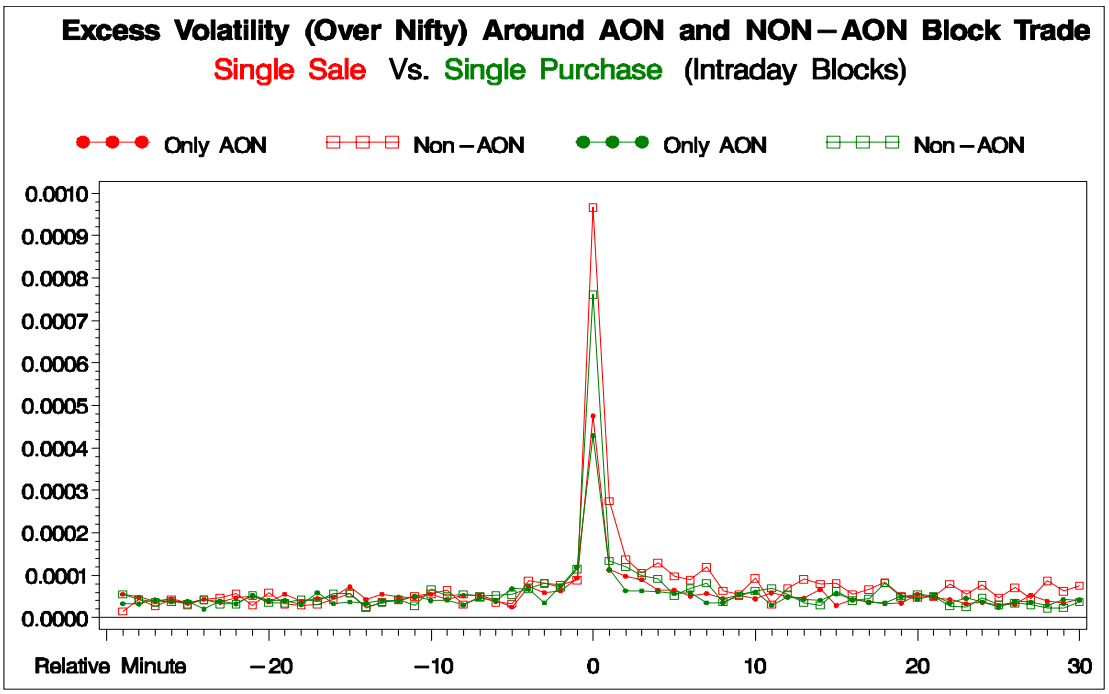


Figure 13: Excess Return around Block Trades on Days with Single and Multiple Block Purchases

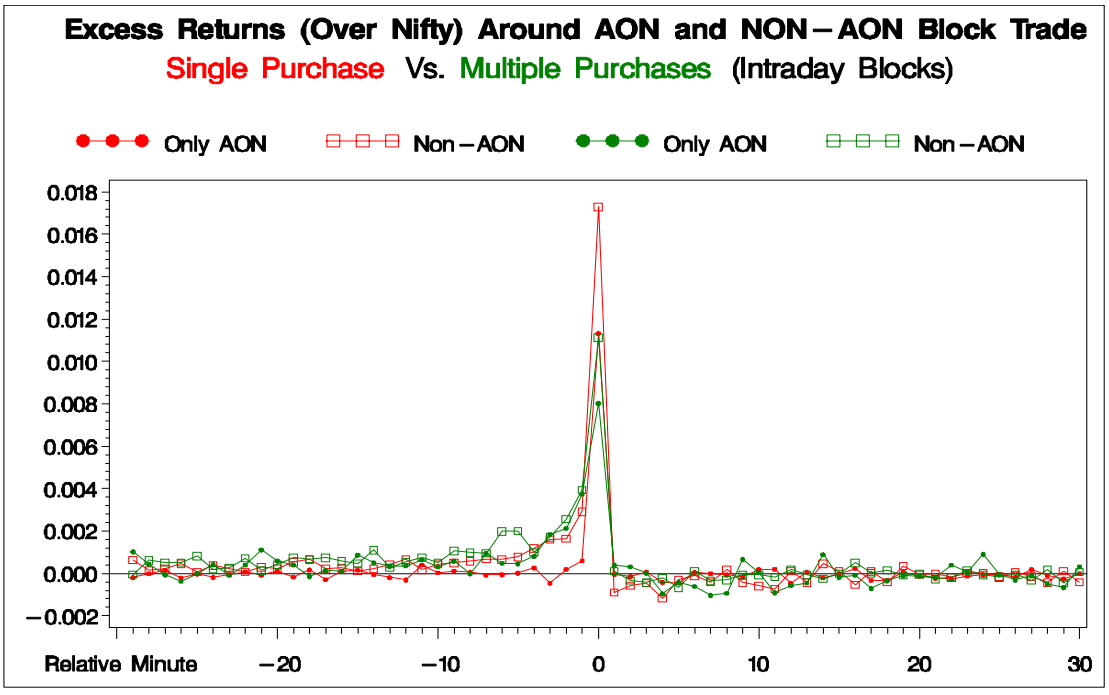


Figure 14: Cumulative Excess Returns for Days with Single and Multiple Block Purchases

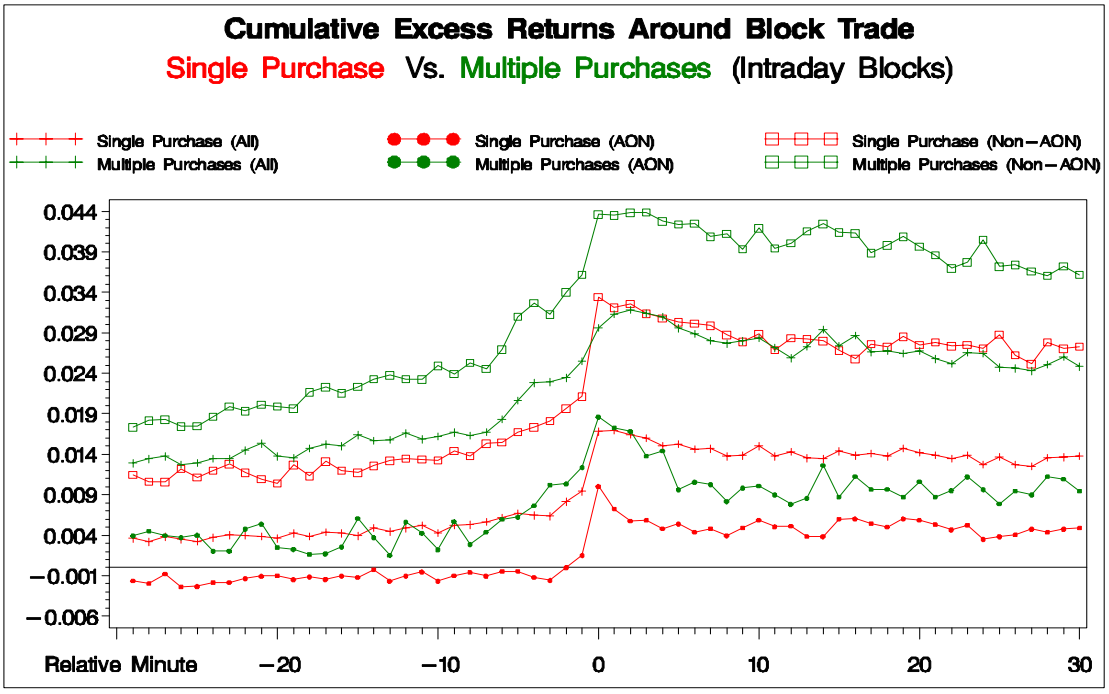


Figure 15: Average Excess Volatility around Block Trades for Days with Single and Multiple Block Purchases

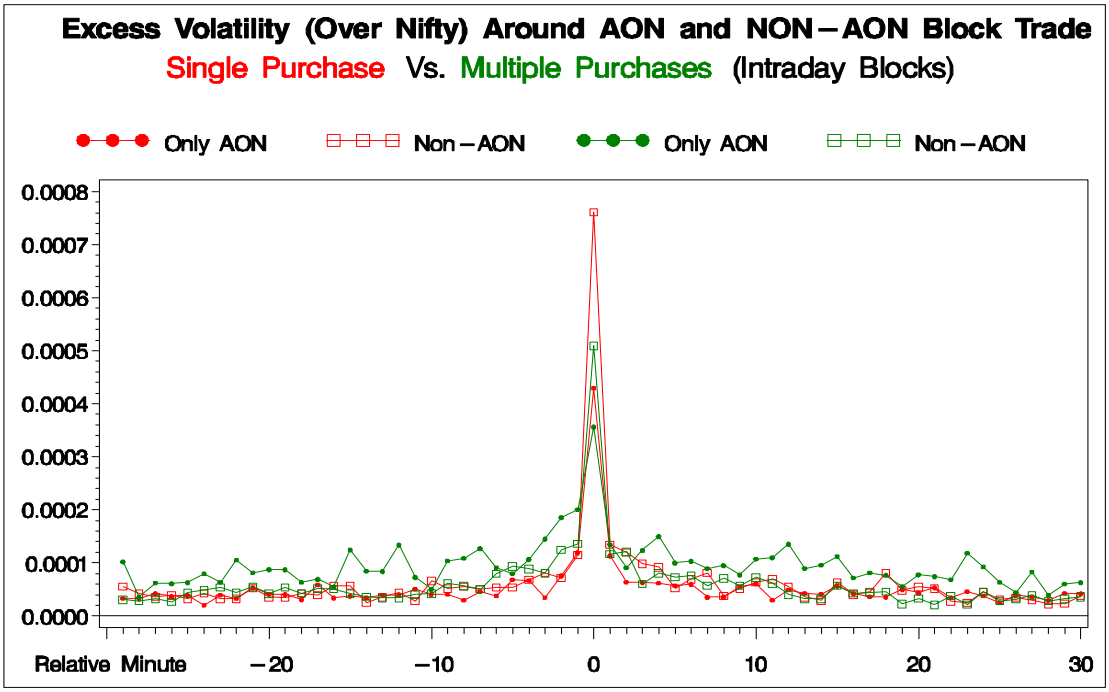


Figure 16: Excess Return around Block Sales (Single and Multiple Blocks in a Day)

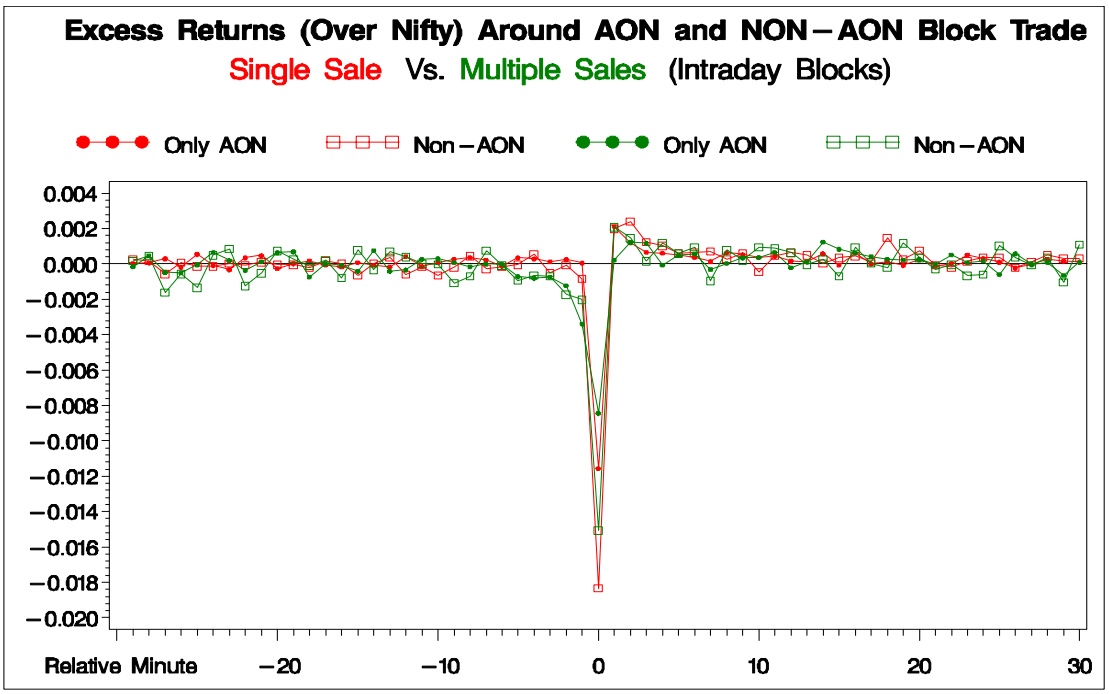


Figure 17: Cumulative Excess Returns for Days with Single and Multiple Block Sales

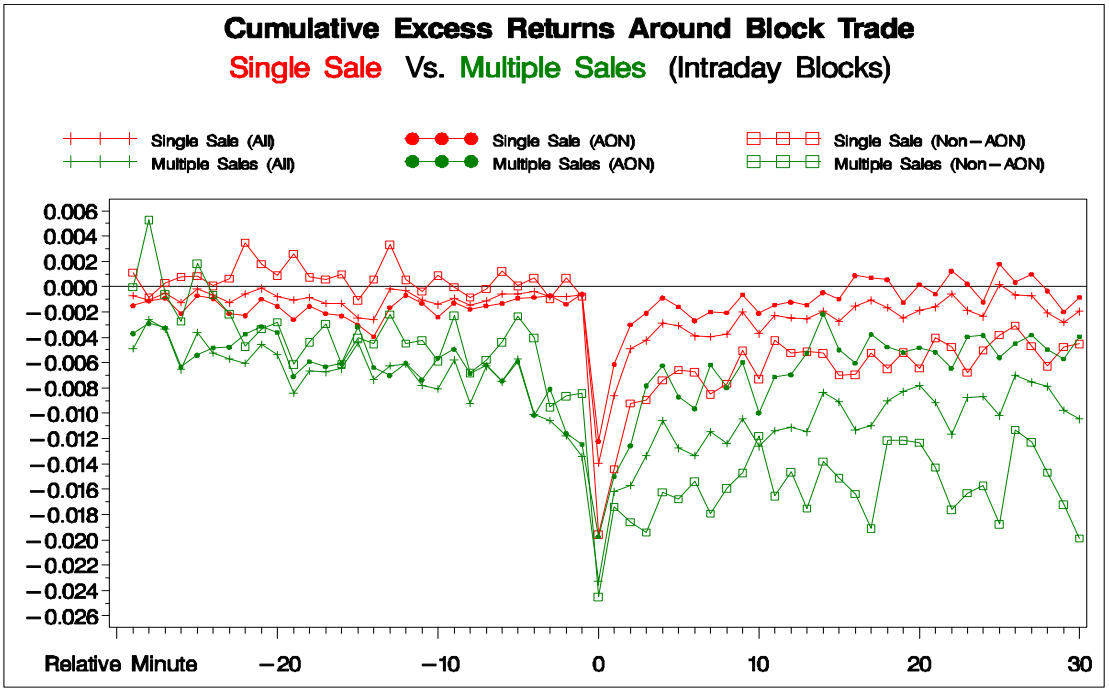


Figure 18: Excess Volatility around Block Sales