

**PRICE BEHAVIOUR SURROUNDING BLOCK PURCHASES AND SALES:
ASYMMETRIC OR BID-ASK BIAS**

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Abstract

This paper analyses price effects of block trades for the 30 stocks that comprise the Dow Jones Industrial Average for the period January 1993 to October 2001. Previous research shows prices revert following sales, but remain high after buys, creating an asymmetry between block purchases and sales. Extant literature has offered several conjectures as to the source of the asymmetry. We replicate the asymmetry documented in previous literature and provide a new conjecture as to its source, specifically bid-ask bias. Results show that purging block trade price effects of bid-ask bias produces symmetry in the behaviour of block trade price effects. This suggests research design issues are driving the asymmetry documented in previous literature, and that purchases are not more informative than sales.

1. Introduction

In 2001, over 51 percent of total NYSE trading volume was executed in parcels of 10,000 or greater; in 1960 block trades represented just 2 percent of total NYSE volume. Given this significant rise, it is not surprising that block trading has received considerable attention in the academic literature. The interest stems from the practical implications of such research, including investigations of the mechanisms available to execute block trades and the roles they serve;¹ whether block trades disrupt the market and the speed with which markets adjust to the effects of these trades;² identification of technical trading strategies available to exploit associated price effects;³ and the costs of purchasing and selling such trades.⁴

Extant literature examining block transactions documents an engaging result that implies an asymmetry in the price effects of buyer and seller initiated trades on the NYSE, AMEX and NASDAQ markets. The asymmetry indicates that block sellers pay a liquidity premium while buyers do not, as price reversals accompany block sales while price continuations follow block purchases. An asymmetry has also been confirmed for markets other than the US, including the London Stock Exchange (Gemmill, 1996), and the Australian Stock Exchange (Aitken and Frino, 1996a, 1996b). The literature has described this asymmetry in price behaviour around block trades as “*intriguing*”

1 For example Brudett and O’Hara (1987), Easley and O’Hara (1987), Seppi (1990), Grossman (1992), Keim and Madhavan (1996), Madhavan and Cheng (1997), examine the upstairs and downstairs markets where block trades can be executed.

2 See for example Ball and Finn (1998), Dann, Mayers and Raab (1977), Aggarwal and Chen (1990), Holthausen, Leftwich and Myers (1987;1990), Kumar, Sarin and Shastri (1992), and Moulton (1998)

3 See Grier and Albin (1973), Dann, Mayers and Raab, (1977) and Carey (1977).

4 See for example Berkowitz (1988), Chan and Lakonishok (1993, 1995, 1997), Keim and Madhavan (1995, 1997, 1998), Aitken and Frino (1996), LaPlante and Muscarella (1997), Conrad, Johnson and Wahal (2001), and Jones and Lipson (2001).

(Holthausen, Leftwich and Mayers, 1990, p. 90; Chan and Lakonishok, 1993, p. 175) and emerging as “*a key puzzle*” (Chan and Lakonishok, 1993, p. 184), and has called for further research in the area.

The behaviour and measurement of the price impacts associated with block trades is of significant importance to regulators and policy makers in promoting market liquidity,⁵ and investors who seek significant investment returns with minimal implementation costs. The two costs faced by market participants can be categorised into two groups (i) explicit and (ii) implicit.⁶ Minimisation of explicit costs is difficult if not impossible as these are usually levied at predetermined rates. Implicit costs on the other hand can be minimised. Schwartz and Shapiro (1992) argue that institutional investors, who normally transact in large quantities, are more concerned with market impact and opportunity costs as they are more detrimental to returns than paying a higher quoted bid-ask spread. These market impact and opportunity costs are usually associated with block trades, where trade initiators offer ether inducements through price concessions or forego the opportunity to trade.

Motivated by the above suggestions, this paper re-examines the price impact of block trades, and conducts several novel tests in order to determine the cause of the asymmetry between block purchases and sales. The remainder of this paper is organised as follows. The data and method for testing the price impacts of block trades is outlined in sections 2 Section 3 documents and replicates the asymmetry documented in previous literature. An

5 Several exchanges such as the NYSE and Australian Stock Exchange have established alternative trading platforms for the execution of block trades, the upstairs and downstairs market. Derivative markets also have followed suit, establishing block trading facilities such as that which exist on the London International Financial Futures and Options Exchange and the Sydney Futures Exchange.

6 Explicit costs include brokerage and taxes. Implicit costs encompass bid-ask spreads, market impact costs and opportunity costs.

alternative explanation for the asymmetry is provided in section 4. Results and robustness tests are provided in sections 5 and 6. Section 7 concludes.

2. Sample and Methodology

This study focuses on block trades in the 30 stocks which comprise the Dow Jones Industrial Average. DJIA stocks are of particular interest as they account for a substantial fraction of total NYSE volume and market capitalisation. Block trades are sampled as defined by the NYSE, trades of 10,000 shares or greater. The data used in this study were obtained from the Trades and Quotes (TAQ) database for the period extending January 4, 1993 to October 5, 2001. Several filters are applied to the trades and quotes,⁷ excluded are also non-NYSE trades and quotes.⁸

Important to any analysis quantifying block price impacts is the determination of how trades are classified. Trades are designated as being seller or buyer initiated using the trade direction algorithm developed by Ellis, Michaely and O'Hara (2000), which states that if a trade occurs at the ask quote the trade reflects a purchase and if the trade is executed at the bid price then the trade is classified as seller initiated. Transactions which execute at neither the bid or ask price are classified using the tick test, such that if the last

⁷ Trades are omitted if they are indicated in the TAQ database to be coded out of time sequence, or coded as involving an error or a correction (TAQ error correction indicators of 2 or greater). Trades indicated to be exchange acquisitions or distributions, or that involve nonstandard settlement (TAQ Sale Condition codes A, C, D, N, O, R, and Z) are also omitted, as are trades that are not preceded by a valid same-day quote. Also omitted are trades that involve price changes (since the prior trade, and/or open price) of 50% or more if the prior price is over \$2 per share. Quotes are omitted if either the ask or bid price is non-positive, if the differential between the ask and bid prices exceeds \$5 or is non-positive, or if the change in the quote midpoint (since the prior trade or opening midpoint quote) exceeds 50% and the midpoint is more than \$2. Also omitted areas are quotes associated with trading halts or designated order imbalances, or that are non-firm (TAQ quote condition codes 4, 7, 9, 11, 13, 14, 15, 19, 20, 27 and 28).

⁸ Blume and Goldstein (1997) find that the NYSE usually determines or matches the best bid and ask quotes.

price change was an uptick the trade is buyer initiated, and vice versa for sales.⁹ Contemporaneous bid and asks are used in the study as suggested by Bessembinder (2002) and Peterson and Sirri (2002) who show the accuracy of trade classification techniques increases as the difference in times between trades and quotes decreases.

Table 1 profiles the block trades analysed in this study. The overall sample consists of 1, 548,535 block purchases, and 1,248,026 block sales. The sample is very large when compared with those used in previous studies. In terms of number of trades examined, Madhavan and Cheng (1997) only examine 16,343 blocks while Chan and Lakonishok (1993) analyse 1,215,387 transactions. The time period under analysis also spans the greatest number of years. The mean and median trade sizes were 20,394 and 15,000 respectively for block purchases, and 21,288 and 15,000 respectively for block sales. Madhavan and Cheng (1997) examine similar sized block transactions executed on the NYSE trading floor, while they find larger sized trades are typically executed in the upstairs market for DJIA stocks.

Table 1 Summary Statistics of Trade Size

This table reports the number of observations, the mean, median, minimum, maximum and standard deviation for block trade size. The sample consists of all NYSE trades in DJIA 30 stocks of 10,000 or more shares for the period January 4, 1993 to October 5, 2001.

	Descriptive Statistics					
	Number of observations	Mean	Median	Minimum	Maximum	Standard deviation
<i>Panel A Buy and Sell Blocks in DJIA Stocks</i>						
Block Buys	1,548,535	20,394	15,000	10,000	12,700,000	30,198.62
Block Sells	1,248,026	21,288	15,000	10,000	18,270,000	37,572.89

⁹ Bessembinder (2002) argues the merits of the Ellis, Michaely and O'Hara (2000) classification vis-à-vis the Lee and Ready method, quote method, and tick test for NYSE trade and quote data (see Lee and Ready,

Following previous literature block trade price effects are measured as follows:

$$\text{Temporary Effect} = \text{Ln}\left(\frac{P_b}{P_c}\right) \quad (1)$$

$$\text{Permanent Effect} = \text{Ln}\left(\frac{P_c}{P_p}\right) \quad (2)$$

$$\text{Total Effect} = \text{Ln}\left(\frac{P_b}{P_p}\right) \quad (3)$$

where P_p is the equilibrium market price prior to the block transaction, while P_c is the equilibrium price after a block trade has been executed. P_b represents the block price. Price effects measured using transaction prices, substitute the open and closing price for P_p and P_c , respectively. While this is consistent with past literatures methodology, it also attempts to capture the effect blocks being shopped and any information leakage as shown by Keim and Madhavan (1996) and Madhavan and Cheng (1997).

3. Price Impact Asymmetry

Table 2 summarises the price impact of block purchases and sales. Consistent with previous research, there appears to be a significant asymmetry in the price impact of buyer and seller initiated trades. Panel B suggests price behaviour surrounding block sales is consistent with all three price impact hypotheses.¹⁰ Reversals predicted by short run liquidity costs follow sales and consistent with the information hypothesis permanent price effects suggest block sales move the price of a stock on average by –35.11 basis

1991).

¹⁰ In less than perfect capital markets, three discriminating explanation developed by Kraus and Stoll (1972) and Scholes (1972) account for the price effects of block trades, these are short-run liquidity costs, imperfect substitutes and information.

points. Block purchases on the other hand execute at prices 0.2526 percent above the opening price, and exhibit a significant continuation, which is subsequently subsumed into the permanent effect of 28.55 basis points. This demonstrates that there is clearly a significant asymmetry in the price behaviour of buyer and seller initiated trades.

Table 2 Transaction Price Effects of Block Trades

This table reports transaction returns surrounding block trades of 10,000 shares or more executed on the NYSE DJIA stocks for the period January 4, 1993 to October 5, 2001, broken down by buyer (Panel A) and seller (Panel B) initiated trades. Three measures of price impact are reported: (1) Temporary, defined as the logarithmic return from the closing price on the day of the block to the block price; (2) Permanent, defined as the logarithmic return from the opening price on the day of the block to the closing price on the day of the block; and (3) Total, defined as the logarithmic return from the opening price on the day of the block to the block price. All numbers are denominated in basis points.

Panel A Buys (n = 1,548,535)

	Trade Returns		
	Temporary	Permanent	Total
Mean	-3.29	28.55	25.26
Standard Deviation	149.93	245.73	197.36
3 rd Quartile	64.59	162.08	162.08
Median	0.00	23.78	23.07
1 st Quartile	-68.14	-110.25	-68.73
<i>t</i> -statistic	-27.35**	144.59**	159.25**

Panel B Sells (n= 1,248,026)

	Trade Returns		
	Temporary	Permanent	Total
Mean	-1.26	-35.11	-36.38
Standard Deviation	150.22	245.30	197.12
3 rd Quartile	65.67	97.21	59.82
Median	0.00	-35.34	-28.53
1 st Quartile	-66.59	-166.52	-127.83
<i>t</i> -statistic	-9.39**	-159.92**	-206.17**

** 0.0001 level of significance

* 0.001 level of significance

Price effects reported in table 1 are relatively smaller than previous comparable research. Chan and Lakonishok (1993) document that prices following block purchases increase by 0.12 percent, while prices proceeding sales reverse by 0.10 percent. The price changes are perhaps less dramatic because of the relative liquidity of stocks sampled, reinforcing views expressed by Keim and Madhavan (1996) that attention be paid to the liquidity of stocks. Comparing results to those documented by Madhavan and Cheng (1997) price effects are similar in magnitude, however difference arise due to methodological discrepancies.

4. Bid-Ask Bias

Extant literature offers several possible conjectures as to the source of the asymmetric price behaviour (see Chan and Lakonishok, 1993; Madhavan and Cheng, 1997; and Saar, 2002), overlooked however have been microstructural biases in transactions data. Measurement error caused by systematic trading at the bid or ask has been used to explain a number of phenomena in the finance literature. For example, Harris (1989) and Foerster, Keim and Porter (1990) suggest that bid-ask bias may explain part of the intraday patterns in stock returns, while Bhardwaj and Brooks (1992) provide evidence which suggests that it may explain a portion of the turn-of-year effect. Lease, Masulis and Page (1991) also find that bid-ask bounce explains abnormal returns around seasoned equity offerings, while Cox and Peterson (1994) find that it explains price reversals following large one-day price declines.

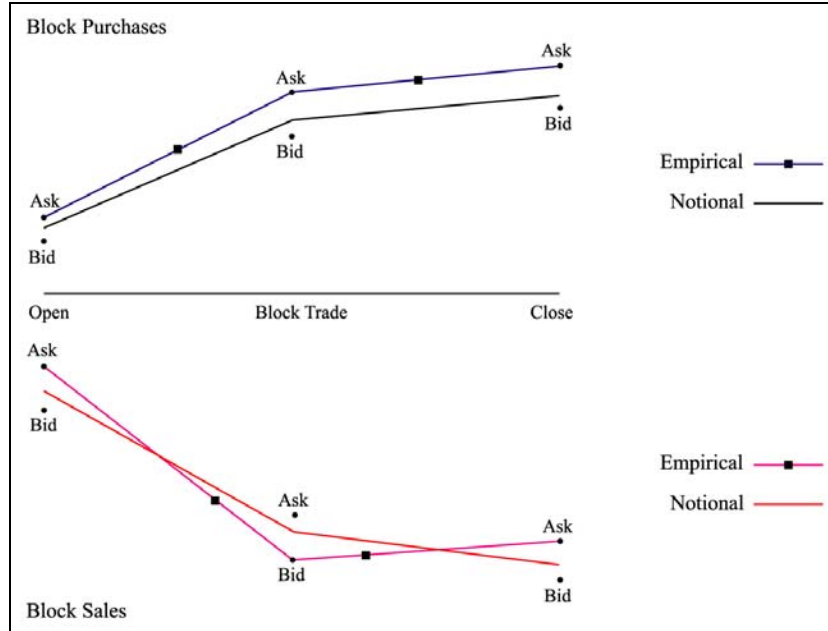
Extant block trading literature measures price impact using transaction prices. This implicitly assumes an equal probability of a trade at the bid or ask. If this is not the case, block trade price effects will be systematically biased. There is significant evidence that prices at the open and close of trade on the NYSE have a tendency to occur at the ask (Harris, 1989 and Porter, 1992).¹¹ This implies that returns measured using prices near the close will be upwardly biased. The asymmetry in the price behaviour of returns following block and institutional trades is consistent with such biases.

Figure 1 illustrates the possible and empirical price behaviour of a block purchase and sale. In the absence of bid-ask spreads, block purchases are executed at prices above the opening price, and traders earn a positive return to the close of trade, the opposite is true for block sales. Consistent with the theoretical modelling of block purchases and sales (see Easley and O'Hara, 1987, Seppi 1990, and Keim and Madhavan, 1996) block trades are associated with a predominant information effect, a view supported by the empirical literature, and price behaviour is symmetric. With the existence of the spread and previous literatures documentation of tendency for the opening and closing prices to be at the ask price (see Porter, 1992) and block purchases to transact close to the ask quote, and block sales to occur close to the bid quote,¹² it can easily be observed how the asymmetry between block purchases and sales arises. In particular for sales, where the revision in price is a consequence of the closing price on average being at the ask quote.

¹¹ Aitken, Izan, Hua and Walter (1995) document similar evidence for the ASX.

¹² While this is predominantly influenced by trader classification algorithms, the asymmetry is still observed in studies where trader classification algorithms are not implemented, see Chan and Lakonishok (1993).

Figure 1 Price Behaviour of Block Trades



In order to explore whether the asymmetry between block buys and block sells is attributable to the propensity to trade at the ask, we test for the impact of bid-ask bias on returns in two ways. Firstly, by determining the location of trade prices used to calculate block trade price effects. Secondly, by calculating returns which are purged of bid-ask effects.

The propensity to trade at the quotes is examined by documenting the frequency of trades (1) above and below the ask and bid quotes, (2) at the bid and ask, (3) between the quotes and midpoint quote, and (4) at the midquote. Further, the mean and median of the order flow ratio is calculated for the open and closing price on block trading days, as follows:

$$OrderFlowRatio = \frac{(ask - price)}{(ask - bid)} \quad (4)$$

As the order flow ratio approaches 1 the more likely the trade price is at the bid price, while the closer the ratio is to zero the greater the likelihood the trade is at the ask (see Lease, Masulis and Page, 1991).

The adoption of quote returns as suggested by Lease, Masulis and Page (1991) will mitigate the effects of systematic order flow imbalances biasing transaction prices. To purge transaction returns of bid-ask bounce quote return measures are devised. Jang and Venkatesh (1991) show that typically only one side of the market, the bid or ask, is revised following trades. Engle and Patton (2000) also note an asymmetry in the impact of buyer or seller initiated transactions on market quotes. They argue that purchases exhibit a greater impact on the ask side of the market, while the bid price leads the ask price following sales. In order to incorporate this, seller initiated block trade price effects are calculated using bid prices, while block purchase price effects are examined via ask quotes.

Quote effects, identified as bid-trade-bid/ask-trade-ask replace P_p in equations 2 and 3 with the opening bid/ask quote and P_c in equations 1 and 2 with the closing bid/ask price, while maintaining P_b as the block trade price, in order to gauge how much of the asymmetry is due to bid-ask bias in open and closing prices.¹³

13 The first closing quotes and opening quotes as identified in the TAQ dataset by mode 10 and 3, respectively are sampled.

5. Results

5.1 Propensity to Trade at the Ask Quotes

Table 3 Prices Relative to Bids and Asks on Block Trading Days

This table reports the distribution of opening and closing prices at the quotes on block trading days. Panel A provides the relative frequencies across the seven categories of trade position relative to quotes in addition to order flow ratios. Panel B provides chi-square tests of equality for the position of opening and closing transaction (1) across the seven categories (Equality across all categories), (2) on average being close to the bid or ask, given by the sum of percentages for ask/bids as greater than ask/bid, at ask/bid, and between ask/bid and midpoint (Equality across Aggregate) and (3) between bid and ask (Equality at Bid and Ask).

Panel A Distribution of Open and Closing Prices

Trade	Greater than Ask	At Ask	Between Ask and Midpoint	At Midpoint	Between Bid and Midpoint	At Bid	Less than Bid	Mean Order Flow Ratio	Median Order Flow Ratio
Open	0.27	14.87	17.83	49.11	8.08	9.67	0.17	0.4485	0.5
Close	1.97	33.07	5.38	23.22	5.81	29.74	1.45	0.4759	0.5

Panel B Tests of Percentages of Prices by Bid-Ask Position

Open Price	Equality across all categories	$\chi^2 = 63,794$	p value = 0.0001
Open Price	Equality across aggregate	$\chi^2 = 2,417$	p value = 0.0001
Open Price	Equality at bid and ask	$\chi^2 = 598$	p value = 0.0001
Close Price	Equality across all categories	$\chi^2 = 43,634$	p value = 0.0001
Close Price	Equality across aggregate	$\chi^2 = 115$	p value = 0.0001
Close Price	Equality at bid and ask	$\chi^2 = 95$	p value = 0.0001

Table 3 evaluates the percentage of opening and closing transactions at the ask quote on block trading days for DJIA stocks. Clearly there is a tendency for both the opening and closing prices to be at the ask, consistent with Porter (1992). In aggregate the opening transaction is closer to the ask price over the bid price by a margin of 15.05

percent. Similarly the frequency of the closing price to be approaching the ask quote is 40.42 percent vis-à-vis 37 percent for bid quotes. Tests of equal proportions based on chi-square tests show a significant difference across all categories in table 3. The mean order flow ratio also supports contentions that the opening and closing transactions have a propensity to execute at the ask quotes.

Given mean bid-ask spreads at the open and close of block trading days of 0.2046 cents and 0.1482 cents, respectively, severe microstructural biases are introduced in transactions price data used to calculate block trade price impacts. This may perpetuate an asymmetric response between block purchases and sales.

5.2 Price Impacts of Block Trade Purged of Bid-Ask Bias

The significance of the propensity for the open and closing price to be at the ask quotes is measured by changes in price effects using bid and ask quotes. Mean and median returns purged of bid-ask bias in table 4 depict a different impression of a block trade vis-à-vis those provided in table 2.

Turning firstly to ask-trade-ask returns, purchases are associated with a significant permanent price of 25.61 basis point, and a total cost of 0.1094 percent. Analogous to the continuation following purchase, block sales are associated with a continued price decline of 11.27 basis points. While this is not consistent with the reversal predicted by the short run liquidity costs hypothesis, it is in accord with the information hypothesis. Informed rational investors would expect a benefit from their information, which by the end of the

day should manifest itself in a favourable return as reflected in the temporary price effect as a positive return.

Table 4 Quote Price Effects of Block Trades

This table reports transaction returns surrounding block trades of 10,000 shares or more executed on the NYSE DJIA stocks for the period January 4, 1993 to October 5, 2001, broken down by buyer (Panel A) and seller (Panel B) initiated trades, based on matching purchases with replacement to sales on size, stock, time of day and weekday. Three measures of price impact are reported the (1) Temporary, for purchases (sales) is defined as the logarithmic return from the closing ask (bid) quote on the day of the block to the block price; (2) Permanent, for purchases (sales) is defined as the logarithmic return from the opening ask (bid) price on the day of the block to the closing ask (bid) quote on the day of the block; and (3) Total, defined as the logarithmic return from the opening ask (bid) price on the day of the block to the block price. All numbers are denominated in basis points

Panel A Buys (n = 1,548,535)

	Ask-Trade-Ask Returns		
	Temporary	Permanent	Total
Mean	-14.67	25.61	10.94
Standard Deviation	151.41	246.76	197.63
3 rd Quartile	53.74	159.03	106.61
Median	-10.26	21.62	4.18
1 st Quartile	-79.64	-114.03	-82.99
<i>t</i> -statistic	-120.59**	129.14**	68.86**

Panel B Sells (n= 1,248,026)

	Bid-Trade-Bid Returns		
	Temporary	Permanent	Total
Mean	11.27	-29.40	-18.14
Standard Deviation	152.15	248.15	197.96
3 rd Quartile	78.28	103.63	78.31
Median	10.41	-28.13	-10.53
1 st Quartile	-54.50	-160.74	-109.89
<i>t</i> -statistic	82.73**	-132.37**	-102.35**

** 0.0001 level of significance

* 0.001 level of significance

Table 4 implies bid-ask bias is the main explanation for the directional asymmetry in return between buyer and seller initiated block trades. Moreover the three hypotheses developed by Kraus and Stoll (1972) and Scholes (1972) to explain the impact of block trades are not necessarily all compatible representations of returns surrounding block trades, especially if information is divulged through block trades.

6. Robustness Tests

Several robustness tests are carried out to examine the persistence of the results from the previous sections. Firstly, results are analysed across block trade sizes, and on a year-by-year basis. Secondly, contemporaneous quotes at the time of the block trade are substituted for block trade prices, and finally, quotes in effect before the closing transaction are used to estimate temporary, total and permanent block trade effects.

Partitioning block trades into categories of 10,000 to 20,000, 20,000 to 50,000 and greater than 50,000, following Madhavan and Cheng (1997), the asymmetry documented in table 2 for trade price effects is observed consistently. Once quote returns are substituted for transaction prices, the asymmetric price response between purchases and sales is eliminated. Across the nine years examined, the asymmetry is observed for eight years, and insignificant in 2000. This consequently has implication for block trade impacts measured using quotes, however strong support is found for our conjecture that the asymmetry is a consequence of bid-ask bias.

All of the above analysis so far has been conducted with the block transaction price, however replicating results using contemporaneous quotes at the time of the block

trade provide analogous results, even across size partitions and years. This reinforces our contention that it is the propensity to trade at the ask during the open and close of trade on the NYSE that results in an anomaly in the empirical block trading literature.

Our final analysis to support the resolution of the asymmetry, is to replicate all tests discussed using the bid and ask quotes in effect before the closing price. The results are unambiguously and qualitatively similar. Block purchases and sales are associated with a significant total impact and continuation in price behaviour which is subsequently consumed into the permanent price impact.

7. Conclusion and Directions for Future Research

The impact of block trades on stock market behaviour has been the concern of a number of empirical studies. Broadly these studies have established that block transactions cause discontinuity in trading activity, and that an asymmetry exists in the price behaviour surrounding buyer and seller initiated trades.

In this paper an alternative explanation is provided to explain the asymmetry and a number of empirical tests are conducted. Specifically, an examination and measurement of temporary, permanent and total price effects purged of bid-ask bounce across trade sizes and trading years.

Considerable attention in previous literature has focused on the effects of firm size and relative trade size as determinants of the impact of block trades. Largely ignored however are biases introduced through the existence of the specialist's spread. Results reported in this study show that by, estimating block price effects using quote returns to

eliminate bid-ask bounce in transaction price returns produces symmetrical behaviour in price effects surrounding block trades. A significant positive price reaction followed by a continuation is reported for purchases, and a significant negative price reaction followed by a permanent price fall for sales. This suggests research design issues are driving the asymmetry documented in previous literature, and that purchases are not more informative than sales.

A number of possible avenues for future research follow from the results. An obvious extension of this study would be to confirm that the block price impact asymmetry documented in other US markets and comparative international evidence is a result of bid-ask bias, rather than institutional differences. It may also be interesting to re-examine previous researches findings using the new metrics to upstairs and downstairs block trades.

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