The information value of block trades in a limit order book market

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June 2005

Introduction

Some US traders have commented on the how the rise of algorithmic execution has reduced the frequency of block trades in the US markets [Brodie (2004)]. These traders note that the block trades contain important information for pricing. Compared to human traders, algorithms typically execute in smaller quantities and more often. As algorithms have become more popular, with both trading desks and investors, the market is seeing fewer block trades.

Bessembinder & Venkataraman (2004) studied block trades on the Paris bourse and concluded that the costs of block trades are some 35% lower than execution on the limit order book. This conclusion was based on an unrealistic trading assumption: that the price of a block trade can be compared to the average price to instantaneously fill the same quantity through executing through sufficient price levels of the limit order book. Traders rarely use such a strategy, preferring instead to execute patiently in smaller quantities over a period of time.

This is illustrated in figure 1: an order of quantity Q could be filled through sending a market order to take all the limit orders on the order book whose quantity sums to Q. Alternatively, the trader could be patient and take only the best priced limit orders at times t_0, t_1 … t_n until the total quantity filled reaches Q. In practise, the trader would also post limit orders, thereby hoping to improve the overall price as other traders take the price offered. In the academic literature, several empirical studies deal with order aggressiveness. For example, De Winne & D'Hondt (2005) show that, among all the client orders[3] submitted for 82 Euronext blue-chips over a three-month period, less than 15% affects the best opposite price at their arrival in the order book while around 35% does not modify the best quotes, neither in price or depth.

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[3] Client orders are orders submitted by market members on behalf of their customers.

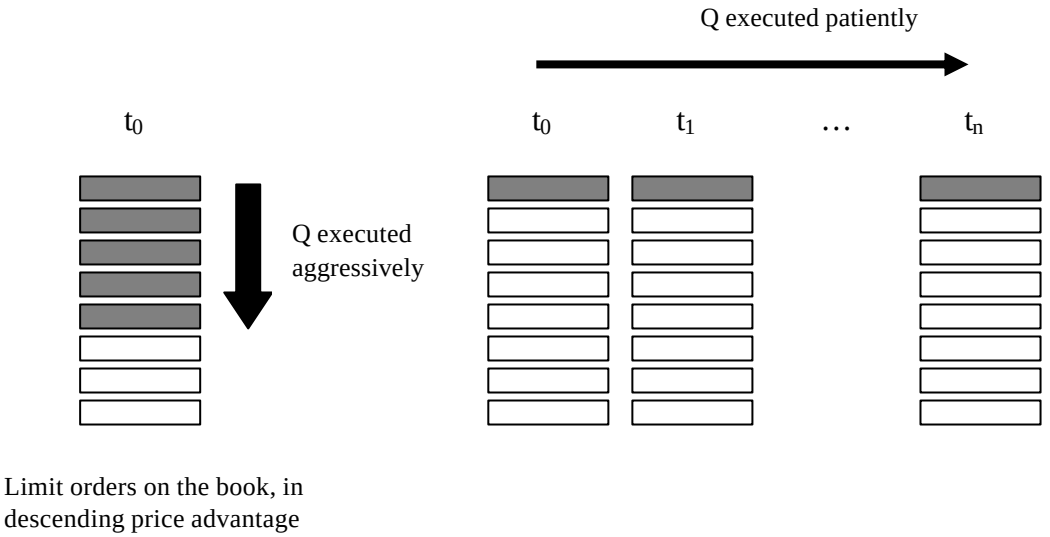


Figure 1: Aggressive vs patient execution strategies

This patient form of execution has the volume average price of all the executions, t_0 through t_n, as its overall execution price. This volume weighted average price (VWAP) is often compared, by both traders and investors, with the VWAP of all executions in the market over the same period to gauge the overall performance of the execution. For traders, it is also often a measure of the profitability of unwinding a block trade dealt for a client away from the order book.

In our investigation of the information value of block trades we compare the price of block trades against the VWAP of all the subsequent trades on the limit order book, reflecting this same patient, "unwinding", execution strategy.

Euronext Market Data

The market data we use are from Euronext. Euronext trading platform is an electronic order-driven system where trades results from the crossing of buy and sell orders. At present, Euronext includes the former exchanges of Amsterdam, Brussels, Lisbon, Porto, Paris and also the LIFFE. The current analysis deals with Dutch, Belgian and French stocks over the last three months of 2002.

For our investigation, we use both public and private market data about orders and trades. Public trade data include the time-stamp of any trade executed within the central order book,[4] with the price and the number of shares traded. Public order data contain the time-stamp of any order along with common features like the order direction (buy/sell), the order size, the order type (limit order, market order and others) and so on. Additional private information allows us to identify which orders are involved in a particular trade. By determining the most recent of both orders, we are able to sign the trade. So, in this approach, whoever places the last order is assumed to be the trade initiator. For example, if the buy order involved in a given trade was submitted before the sell order involved in the same trade, we consider the trade as sell-initiated. Indeed, it is the sell order which triggered the trade by hitting a standing

[4] We have no market data about block trades executed on the upstairs market.

buy order in the order book. In the infrequent case where both orders have exactly the same time-stamp, we sign the trade at random.

For the present study, 11 825 687 trades have to be signed. For 241 996 trades, we observe the same time-stamp for both orders. Consequently, our rate of trade misclassification is at least inferior to 2%. Traditional trade direction algorithms acknowledge less than 100% accuracy. The standard tick test rule and the famous Lee & Ready algorithm often lead to a rate of trade misclassification of approximately 10%. So, our approach provides better results.

Stock sample

This study deals with 82 Euronext blue-chips over the three-month period from October through December 2002. Precisely, the sample contains 40 French blue-chips (CAC40 stocks), 23 Dutch blue-chips (AEX stocks) and 19 Belgian blue-chips (BEL20 stocks). As a whole, the market value of our sample is about 1000 billion EUR.

To take into account the differences in terms of market activity or liquidity across the stocks, we classify them into 4 groups according to the total number of trades over the period. The first group (G1) includes any stock with a total number of trades equal or inferior to 55 760. Any stock in the second group (G2) has a total number of trades greater than 55 760 but equal or inferior to 101 611. The total number of trades for the third stock group (G3) is greater than 101 611 but equal or inferior to 202 690. Finally, the last group (G4) includes any stock with a total number of trades larger than 202 690. Actually, the thresholds we use are quartiles referring to the total number of trades over the period computed across all the 82 stocks. Table 1 reports cross-sectional statistics describing our sample of stocks.

Table 1: Cross-sectional statistics about the sample of stocks

Statistics	**All Stocks**	**G1 Stocks**	**G2 Stocks**	**G3 Stocks**	**G4 Stocks**
Number of stocks	82	21	20	21	20
Average price per stock	37.73	47.54	28.06	42.66	31.94
Average market capitalization (in EUR millions) per stock	12 615	3 679	6 709	14 575	25 846
Average daily volume (in EUR millions) per stock	57 041	4 987	20 929	53 813	151 200
Average number of trades per stock	144 216	22 255	79 881	148 640	331 963
Average number of trades per stock per day	2 253	348	1 248	2 322	5 187
Average number of trades per stock per hour	265	41	147	273	610

Methodology for assessing the information value of "block trades"

To examine the information value of block trades, we compare the price of block trades against the volume weighted average price (VWAP). We use the VWAP as a proxy for the objective stock price. Traders also often use a VWAP figure as a measure of trading profitability, typically measured over three times the block quantity. Using three times the traded quantity is a proxy for working the block quantity in the market such that the trades are equivalent to a third of the market volume – a reasonably aggressive rate of execution. In the present study, we compare the price of block trades to the VWAP for both three times the volume and ten times the volume, the latter representing a more patient execution rate at 10% of total market volume. The use of the the VWAP at ten times the volume ($VWAP_{10}$) also

reduces the transitory price impact of the block trade itself on the following prices and, consequently, of the resulting VWAP figure.

So, for any block trade, we compare the trade price with the corresponding VWAP. Then, if the block trade is buy-initiated and the trade price is lower than the VWAP, we assume the block trade is informed because the buyer made a good forecast (she bought before the price rose). Symmetrically, if the block trade is sell-initiated and the trade price is higher than the VWAP, the block trade is assumed to be informed because the seller made a good forecast (she sold before the price fell). Consequently, the key points in our analysis are identifying buy and sell-initiated block trades and computing the appropriate VWAP for each one.

While Euronext operates with a centralized trading system, block trades may be carried out outside the central order book if they reach a given size. So, to identify block trades, Euronext defines for each market segment a threshold called "Normal Block Amount" (NBA).[5] So, for Euronext, block trades mean transactions that are equal or exceed the following NBA:

- 500 000 EUR for stocks included in the Euronext 100 segment;
- 250 000 EUR for stocks included in the Next 150 segment;
- 100 000 EUR for all other stocks traded on a continuous basis.

As real block trades on Euronext can be decentralized, we redefine "block trades" as large trades carried out within the order book. So, in the current study, the size of "block trades" for a given stock ranges from 1 NBS to 0.01 NBS where NBS is the number of shares corresponding to NBA divided by the opening stock price.[6] Precisely, we consider any trade as a "block trade" if its size is equal or exceeds a particular threshold which is defined with respect to NBA. All the thresholds we focus on are the followings: 0.01 NBS, 0.05 NBS, 0.1 NBS, 0.25 NBS, 0.5 NBS, 0.75 NBS and 1 NBS. In our sample, 67 stocks are included in the Euronext 100 segment, 12 stocks are included in the Next 150 segment and the remaining 3 stocks are traded on a continuous basis.

Working with varying sizes for block trades has several advantages. First, as the NBA is defined in EUR according to the stock liquidity, it makes possible relevant comparisons across stock groups. Indeed, a fixed number of shares to define a block trade can be less suitable when analysing a large sample of stocks. For example, 2000 shares can be associated with a block for a stock with a high price level. It is less obvious for a stock for which the mean trade size is approximately 2000 shares because its price level is low. Next, varying the block size from 1 to 0.01 NBS makes possible to consider different "block trades" (relatively large vs. small block trades). It is a way to investigate whether very large "block trades" are more informed than smaller ones.

Results

Table 2 presents the summary results when the price benchmark is VWAP over three times the block trade size while Table 3 exhibits findings with VWAP over ten times the block volume as price benchmark. In each table, we report, for any block size analyzed (relative NBS), the percentage of trades defined as a good forecast in each stock group. A buy-initiated

[5] Euronext reviews the NBA set at least annually or whenever market conditions require an earlier change.
[6] NBS is defined each day according to the opening price for the stock.

(sell-initiated) trade is defined as a good forecast if its trade price is lower (higher) than the corresponding VWAP. The tables also give, for each block size considered, the minimum, mean and maximum of the median trade sizes (expressed in number of shares) computed across all the stocks. These figures evidence that our analysis covers small and large trades executed within the order book.

Table 2: Results with 3 times volume VWAP

Selling with 3 x volume VWAP							
Relative NBS	Min size	Mean size	Max size	G1	G2	G3	G4
0,01	30	1 299	5 700	38,6%	39,0%	37,0%	35,3%
0,05	128	3 097	23 000	43,8%	45,3%	42,8%	41,4%
0,10	300	5 500	43 600	45,7%	48,6%	45,7%	44,1%
0,25	759	13 966	100 000	50,0%	52,3%	49,6%	47,8%
0,50	2 000	30 917	237 983	48,7%	54,0%	50,6%	50,2%
0,75	2 413	47 253	300 000	44,2%	54,2%	51,6%	50,7%
1,00	2 500	63 596	400 000	41,6%	54,0%	50,4%	50,0%
Buying with 3 x volume VWAP							
Relative NBS	Min size	Mean size	Max size	G1	G2	G3	G4
0,01	33	1 316	5 900	37,8%	38,3%	36,0%	34,9%
0,05	130	3 118	23 000	42,9%	44,2%	41,9%	40,9%
0,10	240	5 566	41 376	45,0%	47,1%	44,9%	43,7%
0,25	839	14 004	100 000	48,1%	49,3%	48,7%	47,9%
0,50	1 500	30 175	187 099	51,0%	51,5%	49,8%	50,3%
0,75	2 881	46 678	250 000	53,2%	52,0%	50,3%	51,4%
1,00	4 085	61 525	375 000	53,1%	50,5%	49,3%	51,1%

Table 3: Results with 10 times volume VWAP

Selling with 10 x volume VWAP							
Relative NBS	Min size	Mean size	Max size	G1	G2	G3	G4
0,01	27	893	5 600	43,5%	44,7%	46,0%	42,6%
0,05	112	2 992	22 700	48,3%	50,1%	49,0%	48,3%
0,10	250	5 285	41 109	50,0%	52,2%	50,5%	50,1%
0,25	500	13 306	98 750	52,9%	53,6%	51,9%	51,3%
0,50	1 300	29 807	300 000	52,7%	53,2%	51,8%	51,9%
0,75	2 413	45 278	300 000	51,7%	53,1%	51,6%	51,9%
1,00	2 500	60 234	350 000	48,0%	53,3%	50,1%	51,5%
Buying with 10 x volume VWAP							
Relative NBS	Min size	Mean size	Max size	G1	G2	G3	G4
0,01	31	892	5 775	43,3%	45,2%	45,1%	42,3%
0,05	130	3 032	22 900	46,4%	48,9%	48,1%	48,1%
0,10	220	5 347	40 000	47,6%	50,9%	49,7%	50,0%
0,25	590	13 236	100 000	47,5%	52,1%	51,4%	51,8%
0,50	1 000	28 548	170 000	44,5%	53,7%	51,6%	52,3%
0,75	2 798	44 170	250 000	43,0%	53,4%	51,5%	51,9%
1,00	5 000	57 639	250 000	43,7%	51,3%	50,4%	51,7%

To make interpretation easier, the results are also plotted in Figures 2 and 3.

Figure 2: Proportion of better prices than $VWAP_3$ and $VWAP_{10}$ when selling

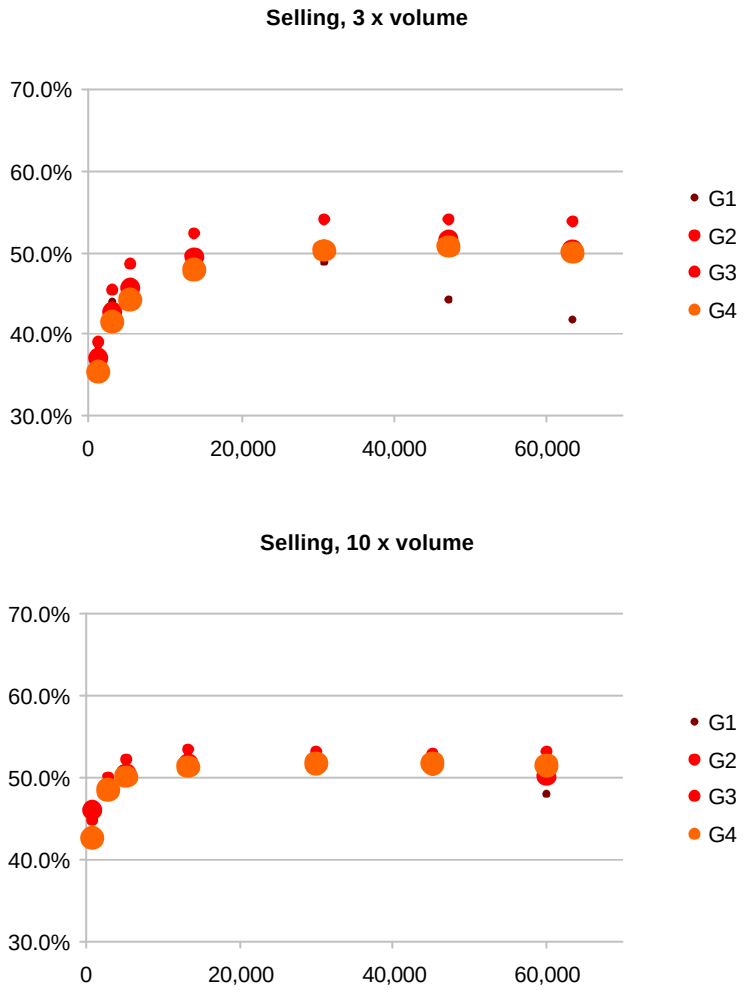
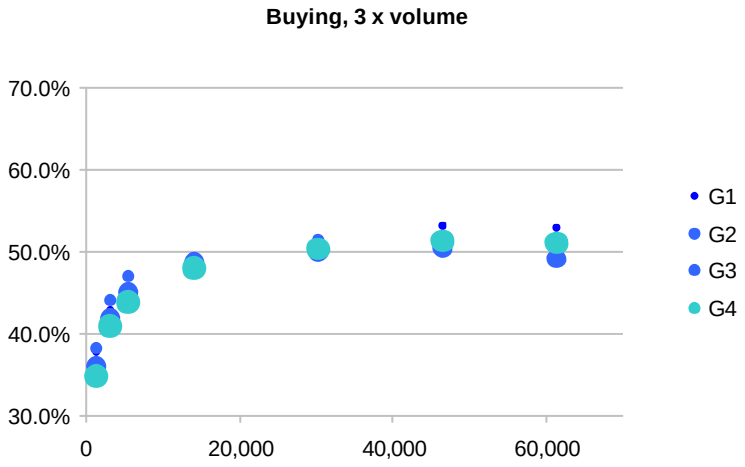
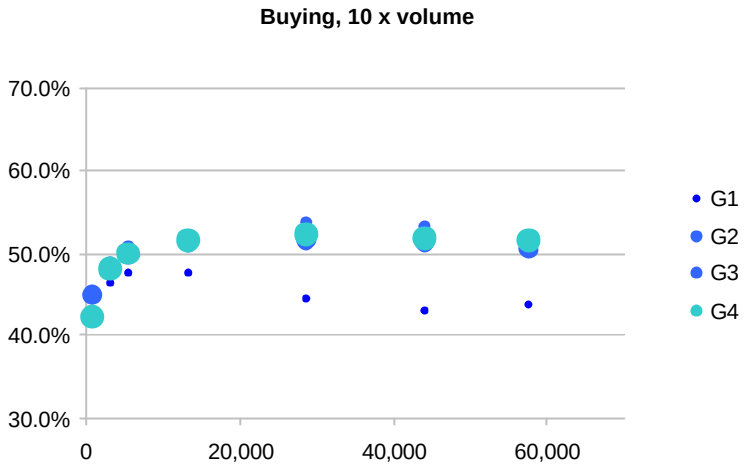


Figure 3: Proportion of better prices than $VWAP_3$ and $VWAP_{10}$ when buying





If block traders and the market were engaged in a fair game we would expect that the mean good forecast of price would approach 50%. Some block traders will trade at an advantageous price; others will not. The market average forecast would be neutral.

When the block is sufficiently large our analysis shows this is the case. When block trades are 0.25 times NBS or above, the mean good forecast is around 50%, whether buying or selling, and irrespective of whether $VWAP_3$ or $VWAP_{10}$ are used as the price benchmark.

At sizes below 0.25 NBS however, the price forecast becomes biased: more blocks are traded at a disadvantageous price than an advantageous price compared to either VWAP measure. When buying, the price of a smaller block trade will tend to be higher than VWAP; when selling, the price of the block will be lower than VWAP. The degree of this bias increases as the block size shrinks: at 0.01 times NBS the mean good forecast is only 40%, so more block trades have a worse price than the VWAP. This finding suggests that smaller block trades do convey information about the future volume weighted average price.

This effect is more pronounced for $VWAP_3$ than $VWAP_{10}$ and, when we focus on $VWAP_3$, for more frequently traded stocks. The results for less frequently traded stocks are also biased at larger block sizes when selling compared to $VWAP_3$, and when buying compared to $VWAP_{10}$.

These results could be explained as follows. Block trades occur because of the investors need for immediate execution, so they are symptomatic of haste. We would expect the consequences of the trade to be considered more carefully as the size of the block trade increases: larger investors typically have to justify their trading to others. We would also expect that the smaller block trades result from a wider group of investors and traders: some of whom are less informed; some of whom may be under pressure to complete an order; some of which may even be algorithms having to execute larger quantities in a shorter time in order to prevent slippage over a lengthy execution schedule. Our results show that the information of these smaller block trades is higher than that for larger blocks: small buy-initiated (sell-initiated) block trades announce the likelihood of a price increase (decrease) in the short term, whereas larger block trades give no such indication. Consequently smaller block trades convey more information than large block trades.

Trading a small block sends a signal to those investors who have limit orders on the book. A block purchase would trade at the best asking price or worse: those with limit orders on the bid side of the book will be keener not to trade aggressively, by using market orders to take the limit orders on the ask side of the book, in case they raise the market price. Consequently they would wait for sellers to hit their bids. The market will trade around the bid price thus reducing the volume weighted average price. Once three times the block size has traded, $VWAP_3$ still shows the reluctance of bidders to be aggressive: at $VWAP_{10}$ the market is more likely to have "forgotten" the original block.

Block trades in stocks that trade less frequently reveal more information at all block sizes. Block trade sales keep the price biased at $VWAP_3$ but this disappears once ten times the volume has traded. Block trade purchases keep the price biased even at $VWAP_{10}$. The market seems to notice a hasty buyer of these stocks more than a hasty seller.

Concluding remarks

Market traders appear to be correct when they remark that block trades have information value. However, contrary to expectation, it is the small block trades that have the most information for these traders and the market. These small block trades are a contra-indicator of price direction for these traders: the volume weighted average price for period after the block trade is more likely to be unfavourable compared to the price of the block trade. Moreover, we have shown this effect in a market that has used a limit order book execution mechanism for some time, rather than the dealer and specialist based market mechanisms in the US. Although the effect is significant across a variety of stocks and VWAP measures, we are disinclined to believe the effect offers a persistent profitable trading opportunity, not least because we have not factored trading costs into our analysis.

The proportion of good forecasts has the form that appears exponential. At least for $VWAP_3$ an approximation is

$$P(x) \approx 0.5 \times \frac{\ln x}{\ln NBS}$$

where x is the size of the block. This nature of this relationship is a subject for further study.

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