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Transparency and Liquidity: A Study of Block Trades on the London Stock Exchange under Different Publication Rules

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ABSTRACT

This article examines whether reducing a market's transparency, by delaying the publication of prices for block trades, has any impact on liquidity. The analysis uses a sample of 5987 blocks from the London Stock Exchange that cover three different publication regimes: immediate (1987/88), 90 minutes (1991/92), and 24 hours (1989/90). Delaying publication does not affect the time taken by prices to reach a new level, which is rapid under all regimes. Spreads differ across years, but their size relates more closely to market volatility than to speed of publication. There is therefore no gain in liquidity from delayed publication.

SINCE THE LONDON STOCK EXCHANGE became a competitive dealership in October 1986, there have been three different regimes for the publication of last-traded prices: from October 1986 to February 1989, prices were published immediately; from February 1989 to January 1991, the prices of trades which exceeded £100,000 were subject to a 24-hour delay; and from January 1991 to January 1996, there was a 90-minute delay in publication for trades which exceeded three times normal market size (NMS).[1,2] Including small shares, which have not always been subject to the same rules, it is estimated that immediate publication covered 78 percent of all trades by value in the first period, only 6 percent in the second period (London Stock Exchange (1991)), and 49 percent in the third period (Securities and Investments Board (1995)).

The objective of this article is to discover whether the different publication rules for block trades have had any impact on market liquidity. Since the

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[1] Each share is allocated to one of twelve NMS bands, based upon customer turnover in the last 12 months.

[2] It is important to distinguish between the reporting of trades and their publication. All trades are reported to the exchange immediately, but not all are published. It should also be noted that "immediately" means within five minutes of execution before January 29, 1992 and within three minutes thereafter.

largest 1 percent of trades account for more than one third of turnover by value, even a small impact could be financially significant. There are widely differing views on the importance of rapid publication. On the one hand, some marketmakers and the Stock Exchange have argued that immediate publication of the details of large trades would damage liquidity. As they see it, "The undoubted strength of London's market is the commitment of capital to provide liquidity. This commitment could not continue if the positions of marketmakers were effectively on display—which is what total transparency means" (Wells (1993), p. 13). The influential Financial Times concurs that, "If marketmakers are to expose themselves to the risk of adding large amounts of inventory in a system of competing dealers, they cannot be expected to reveal their hand to the market. Without this, London could not offer greater liquidity than the order-driven systems of continental Europe" (Financial Times, June 12, 1995). On the other hand, the Office of Fair Trading (the government agency that is concerned with competition), has argued that large trades have a permanent impact on the level of prices, so that, "Delayed last-trade publication provides marketmakers undertaking large trades with an informational advantage which can be exploited" (Office of Fair Trading (1994), p. 42). The result is extra profit for those who know about block trades, but a corresponding loss for all other participants.

There appears to have been no previous empirical study on any market of the hypothesized trade-off between transparency and liquidity. In addition, while there have been several studies of the impact of block trades on U.S. markets, there have been none for the London market. It is interesting to see whether a different market organization changes the results. One particularly important difference between London and New York relates to the way in which blocks are traded. In London, dealers are willing to accommodate relatively large blocks out of their own inventory. Hence there is no delay between a customer placing an order and its execution, resulting in a high level of immediacy. By contrast, on the New York Stock Exchange and Nasdaq, the largest block trades are routed through upstairs brokers who then search for counterparties, a process which may take hours or even days.

As indicated by the extract from the Financial Times above, marketmakers in London argue that the immediacy of a dealer market makes it better than a continuous auction market for placing large blocks. The success of the London Stock Exchange's international trading system, SEAQI, in executing deals in foreign (non-U.K.) shares, seems at first to support this view. For example, the Paris Bourse has a narrower spread in French shares for all but the very largest size of trade (de Jong, Nijman, and Röell (1995)), yet SEAQI is used quite widely for block trades in French shares. However, the difference is not just that London offers a dealer market and Paris an auction, but that only in 1996 has SEAQI been obliged to publish any prices *at all*. As both Röell (1992) and Madhavan (1993) have noted, there will be a tendency for large transactions to gravitate toward the least transparent available market, which in this case is London. Recognizing this, in August 1994 the Paris Bourse introduced a delay in publication for large trades and there have been suggestions that Frankfurt should do the same (Gerke (1992)).

Our results can be summarized as follows. Using the standard event-study methodology, we find that price effects of block trades in London are similar to those found in the United States. However, we are surprised to find that prices reach their new permanent level just as quickly when publication is delayed by 90 minutes or 24 hours as when publication is immediate. Although the cost of executing a large trade differs significantly across years, this is related to market volatility rather than delay in publication. Delaying publication does not change block spreads and so does not improve liquidity. Although marketmakers have argued vehemently for a delay, these results imply that competition has prevented them from exploiting the potential advantage that a delay provides. A possible explanation of this contradictory position (in which marketmakers argue for a policy from which they do not appear to benefit) is that delayed publication hinders the development of an upstairs (auction) market. It may therefore help to protect the marketmakers' niche in block trading.

The article is organized as follows. Section I reviews, very briefly, the complicated history of publication rules on the London Stock Exchange since Big Bang of October 1986. Section II develops the hypotheses to be tested, taking account of the theoretical arguments and previous research on block trades. Section III discusses the data and methods used. Section IV presents the results, and Section V draws together the conclusions and implications.

I. Background to the Controversy over Publication

In October 1986, the London Stock Exchange adopted a dealership system for transacting shares based upon competitive marketmakers. In the period immediately following, there was general agreement that liquidity was good (see Ingram (1987)). Firm quotes were available in the largest stocks for up to 100,000 shares and the average touch (best bid/ask combination) for such deals was 0.7 percent. Although some marketmakers expressed their dislike of immediate publication, the Exchange's own view was that, "The faster information is disseminated to the market at large, the better. Preliminary work indicates little evidence to support the view that instant trade publication has an adverse effect on the market" (London Stock Exchange (1987)).

After the stock market crash of October 1987, trading volume declined and it became apparent that there was excess capacity in market-making. In August 1988, a price war broke out. Two of the largest marketmakers reduced their quote size, arguing that they needed protection from smaller competitors who would buy or sell blocks of shares from customers that were then offloaded on the large marketmakers. However, in a battle for market share, other large marketmakers increased their quote sizes and soon losses were said to be accumulating at a rate in excess of £500 million per annum (Hugh-Smith (1990)).

In February 1989, these conditions led the Exchange to introduce a 24-hour delay in the publication of prices (but not of quantities) for trades above

£100,000. It was argued that this emergency measure was necessary because immediate publication was reducing the liquidity of the market. In other words, there was presumed to be a trade-off between post trade transparency and market liquidity.

In May 1989 the Elwes Committee of the Stock Exchange suggested a refinement of the publication rules, in which the delay in publication would relate to the size of a trade relative to normal market size (NMS). In April 1990, the Office of Fair Trading reported to the Secretary of State for Trade and Industry that delayed publication was significantly anticompetitive. A review for the Secretary of State by Franks and Schaefer (1990) followed and found that the case against the Exchange was not proven. Nevertheless, new rules were introduced in February 1991 under which the delay in publication of prices was reduced from 24 hours to 90 minutes for trades that exceeded three times NMS. At the same time, publication of quantities would also be delayed for 90 minutes.

In December 1993, an additional rule was introduced under which trades exceeding 75 times NMS need not be published for up to one week. Finally, after further reports early in 1995 from the Office of Fair Trading and the Securities and Investments Board, the Exchange agreed that from January 1996, the delay in publication would fall from 90 minutes to 60 minutes and would apply to trades exceeding six times NMS rather than three times NMS. If less than 75 percent of all trades by value are not published immediately, the Exchange will take further action to meet this target in Autumn of 1996.

II. Theory and Hypotheses to be Tested

In this section we summarize the arguments for and against disclosure. In order to focus the discussion and analysis, we develop four particular hypotheses, which can then be tested in Section III. At the outset we need to observe that publication is less important in a dealer market, such as the London Stock Exchange or Nasdaq, than in an auction market, such as the Paris Bourse or NYSE. The competitive quotes on a dealer market provide a level of pretrade transparency that is higher than that on an auction market. Nevertheless, auction markets also have quite high levels of pretrade transparency, either provided by the specialists' quotes (NYSE) or the public limit-order book (Paris Bourse). It is therefore a simplification just to say that auction markets need posttrade publication because they have no pretrade transparency. In addition, the quotes on a dealer market may not be very informative about the prices at which trades can actually be done. For example, on the London Stock Exchange, 60 percent of trades above £100,000 are done within the best quoted spread (London Stock Exchange (1992)), so quotes are only an approximate guide to the current price level for transactions.

When a delay was first introduced in 1989, the initial argument made by the Stock Exchange was that block trades are not associated with information. Prices may be temporarily affected after such trades due to inventory effects, they claimed, but a block trade does not lead to a revised estimate of the fair price for a share, and so there is no permanent price effect.

This view runs counter to the results of a large number of studies in the United States, (Scholes (1972), Kraus and Stoll (1972), Mikkelson and Partch (1985), Holthausen, Leftwich, and Mayers (1987, 1990), Choe, McInish, and Wood (1992a, 1992b), Keim and Madhavan (1991), Chan and Lakonishok (1993, 1995)), and Australia (Ball and Finn (1989)), all of which find a permanent effect. However, there has been no comparable study of London prices, and Franks and Schaefer (1990) considered that the case was not proven. The first hypothesis to be tested in this study is therefore that:

HYPOTHESIS 1: *A block trade has a temporary impact on the price level, but no permanent impact.*

Assuming that there is an information effect, then a delay in publication gives a temporary advantage to the two parties to a block trade: the marketmaker accepting the deal and the institution making the deal. The price that is agreed between them will be the result of bargaining over the potential profit. The marketmaker will bid aggressively for a block deal because, in the absence of immediate publication, he is compensated with valuable information. Even if no profit is made on this trade, he may use the information to develop a strategy in subsequent trades. This leads to the prediction that spreads on block trades will narrow if publication is delayed. At the same time, there is a greater risk than before for all other participants that ordinary-sized trades are based upon information: a single trade could be part of a larger block of which they are not yet aware. Consequently the spreads on trades of normal market size will widen if publication is delayed. Combining the impacts on block and normal-sized trades leads to the hypothesis that:

HYPOTHESIS 2: *Delayed publication leads to narrower spreads for block trades, relative to spreads on normal-sized trades*

Röell (1988) and Pagano and Röell (1996) develop theoretical models to support this change in the relative sizes of spreads on small and large trades. Breedon (1993) tests for such a change for a small sample of London shares and concludes that the premium on large trades relative to small trades increases when transparency falls.

Thus far it has been assumed that the dealer market is initially competitive. Marketmakers argue, however, that their number is sufficiently small that it is possible to identify which of them has taken a block trade. While there are up to 18 marketmakers in any one share, 70 percent of all trades by volume are conducted by the five largest of them (Board and Sutcliffe (1995)), so trades are not completely anonymous. They say that rapid publication lets other marketmakers engage in spoiling tactics, in which quotes are adjusted such that it becomes impossible to unwind a large position at a profit. This argument leads to the same prediction as Hypothesis 2 (a narrowing of block spreads with delayed publication), because it involves the same redistribution of information.

Another argument is that, with immediate publication, information causes abrupt price movements and that these movements are smoothed when publication is delayed. Such abrupt movements are evidence of pricing efficiency, but the Exchange used this argument in 1989 to support a delay in publication. A similar argument about volatility and information has been reported by the International Organization of Securities Commissions (IOSCO). It is suggested that, "... where retail investors free-ride on institutional transactions in the belief that the latter reflect a reassessment by insiders of a company's prospects, and this belief is mistaken, the volatility of share prices may increase to the detriment of retail investors themselves" (IOSCO (1993), p. 60). In other words, small investors may mistake a temporary change in price that follows a block trade for a permanent one and take action that exacerbates the price movement. If investors are prevented from seeing price movements from block trades, they cannot engage in such destabilizing speculation. These considerations lead to the hypothesis that:

HYPOTHESIS 3: *Delayed publication leads to smoother price transitions and so less volatility after block trades.*

Similarly, if information is revealed more slowly, it can be anticipated that delayed publication results in a slower response of prices. Hence a longer period of time may elapse before a new equilibrium is achieved. This leads to the hypothesis that:

HYPOTHESIS 4: *Delayed publication results in a longer period of price adjustment following a block trade.*

These four hypotheses are predictions based upon the flow of information. The other factors affecting the spread are inventory costs and order-processing costs. There seems no reason to predict that delayed publication has an impact on either of these, and so no hypotheses are proposed concerning them. However, we will examine whether block size affects the spread, taking into account the effect of publication.

III. Method

The London Stock Exchange provided transactions data on the 50 most active shares for the month of May in each of the six years, 1987 to 1992. This sample is chosen because May 1987 and May 1988 fall into the immediate-publication regime, May 1989 and May 1990 fall into the 24-hour regime, and May 1991 and May 1992 fall into the 90-minute regime. By taking the same month in each year, seasonal effects can be avoided.

Each record consists of a matched buy/sell transaction at a given price, with information from both buyer and seller on quantity, time, and character of the trade: (i) whether the transactor is acting as a principal or as an agent; and (ii) whether the transactor is a marketmaker. There is no need to use a procedure such as the tick-rule in order to identify purchases and sales. Of the 50 companies, 26 have data for all of the years, and so these comprise the sample.[3]

Only trades initiated by a customer, and not those initiated by a marketmaker, are used for defining a large trade. This is because we are interested in the response of the market to total buying or selling pressure. The price response over time will then reflect whether such a trade is presumed to convey information or not. The 20 largest customer purchases and 20 largest customer sales are identified for each share in each month. Hence for each month a sample is assembled of 520 large customer purchases and 520 large customer sales, a total of 3120 blocks for each of purchases and sales. With an average of 20 working days per month, this represents about one purchase and one sale per company per day. Finally, all price data within 20 trades on either side of each block are visually inspected to correct typographical errors, and any price change exceeding 5 percent is assumed to be an error, leading to the removal of a block from the sample.[4]

Checking of the data and filtering result in the the loss of 4 percent of the original sample, leaving 3010 purchases and 2977 sales (see Table I),[5] with the average size of purchase (£1.322 million) slightly smaller than the average size of sale (£1.673 million). 11 purchases and 37 sales exceed £10 million. As proportions of the equity of the companies, the average trades are 0.038 percent for purchases and 0.031 percent for sales.[6] In the whole sample, only 10 purchases and 28 sales exceed 0.3 percent of a company's equity. One feature of the sample is that there is a wide range of block size within each company. For example, the smallest block purchase is £0.22 million, but the same company, Sainsbury, also has a block purchase of £7.08 million.

The chosen shares are among the most liquid on the London Stock Exchange, and there is on average only 2.2 minutes between trades (see Table I,

[3] Companies in the sample are Allied Lyons, Argyll, BTR, BAT, Barclays, Bass, BOC, Boots, BP, BT, Cable and Wireless, Cadbury Schweppes, GEC, Guinness, GUS, Hanson, ICI, Lloyds Bank, Marks and Spencer, Midland Bank, Reed, Reuters, Sainsbury, Tesco, Thorn EMI, and Wellcome.

[4] Only 10 observations (0.17 percent) in the filtered sample have a price change in excess of 4% at the time of the block trade, so setting the filter at 5 percent is not very stringent and unlikely to bias the sample. The data set includes both buyer and seller times: in most cases these times are the same, but if they differ, then the earlier of the two is taken to be correct. Ex-dividend trades are not excluded, because of technical difficulties in so doing. This leads to some extra "noise," but no particular bias should be induced.

[5] It should be noted that all of the sample blocks in 1987 and 1988 are subject to immediate publication, and all of the sample blocks in 1989 and 1990 are subject to 24-hour delay in publication of prices. Of the blocks sampled in 1991 and 1992, 74 of the 1009 purchases and 68 of the 992 sales are less than 3 × NMS: these are subject to immediate publication, whereas the remainder (93 percent of the total) are subject to 90-minute delay in publishing of either price or volume.

[6] Our blocks are smaller than those in most American studies. For example, in Holthausen *et al.* (1990) the proportions of equity average 0.15 percent for a sale and 0.12 percent for a purchase.

Table I

Blocks in the Sample and Frequency of all Trades

The table reports summary statistics for the sample of 3010 block purchases and 2977 block sales taken in May of each year, 1987 to 1992, for 26 large companies listed on the London Stock Exchange. It should be noted that in calculating the minutes between trades, only trades from 0900 to 1630 hours have been included. Official trading hours were 0900 to 1700 before March 26, 1990 and 0830 to 1630 hours thereafter.

	Purchases		Sales			Minutes Between Trades		
Year	Number of Blocks	Average Block Value £m.	Number of Blocks	Average Block Value £m.	Number of Trades of all Sizes	All Shares (Weighted)	Most frequently Traded Share	Least Frequently Traded Share
1987	506	1.407	482	1.424	130,337	1.879	0.374	8.082
1988	502	1.232	498	1.146	82,052	2.890	1.029	9.056
1989	493	1.102	497	2.005	96,054	2.623	1.000	7.961
1990	500	1.198	508	1.541	96,473	2.422	1.008	8.613
1991	500	1.156	490	1.382	105,895	2.225	0.718	9.440
1992	509	1.823	502	2.520	125,982	1.691	0.863	6.569
All	3010	1.322	2977	1.673	636,793	2.224	0.855	7.219

column 7). This average is the result of a range of 0.86 minutes for the most liquid share (British Telecom) to 7.22 minutes for the least liquid share (Reed International) (see Table I, columns 8 and 9).

Block trades occur mainly in the morning between 9:00 and noon, but there is also a smaller cluster of activity in the afternoon around 3:00 P.M. Speed of publication does not appear to affect the intraday pattern, which is similar across the three regimes. In particular, there is no tendency for blocks to be traded after 4.30 P.M. in 1989/90, which would have delayed publication until after the next day.

To identify the price impact of block trades, an event-study procedure is used, similar to that of Holthausen *et al.* (1990). The raw data consist of the prices for 41 trades centered on each block. The first step is to calculate 40 (logarithmic) returns from these trades, (which is equivalent to calculating the percentage price changes). Denoting the block as trade 0 in the sequence, the ten returns for trades -19 to -10 are then used to calculate a benchmark return per trade.

Let R_{kit} denote the return on the kth block (there being up to 20 blocks per firm in each of the six years), for the ith firm (there being 26 firms), measured at transaction t (there being observations over the range -19 to $+20$). The benckmark return measured over trades -19 to -10 is,

$$\mathrm{BEN}_{ki} = \frac{1}{10} \sum_{t=-19}^{t=-10} R_{kit} \tag{1}$$

Table II

Excess Returns Around Block Trades Across All Years Together

The results in this table are excess returns for block purchases (upper half) and block sales (lower half) over the transaction window −5 to +5, where transaction 0 is a block trade. The excess return is measured relative to a benchmark return from transactions −19 to −10. The sample comprises 3010 purchases and 2977 sales in 26 of the largest companies on the London Stock Exchange in May of each year, 1987 to 1992. In the table, mean t is the mean of the t-values for each company's average excess returns in each month, there being 156 company months in the sample. T-statistic is equal to {mean t/(std. (t))}/$\sqrt{156}$ and 5% critical value for t with n = 156 is ±1.96. Binomial significance is 2-tailed and based upon a population mean of half the sample (i.e., 156/2 = 78) and a binomial variance of (156 × 0.5 × 0.5 = 39).

	−5	−4	−3	−2	−1	0	1	2	3	4	5
Trade Relative to a Block Purchase											
Mean xs return %	0.016	0.004	0.016	0.026	0.023	0.305	−0.245	−0.002	0.000	0.005	0.005
Median xs return	0.019	−0.001	0.023	0.023	0.030	0.276	−0.238	−0.015	0.002	0.009	0.011
Mean t	0.149	−0.024	0.151	0.210	0.235	2.712	−2.203	−0.051	0.038	0.001	−0.011
T-stat	1.865	−0.315	1.794	2.722	2.989	22.760	−20.001	−0.652	0.446	0.013	−0.139
Number of companies with average xs returns > 0	91	74	89	88	93	150	11	72	80	82	82
Binomial significance	0.037	0.522	0.078	0.109	0.016	0.000	0.000	0.337	0.749	0.522	0.522
Trade Relative to a Block Sale											
Mean xs return %	0.016	0.003	−0.004	−0.001	−0.006	−0.218	0.176	0.013	0.018	−0.007	0.007
Median xs return	0.013	0.006	−0.001	−0.018	−0.009	−0.221	0.182	0.009	0.006	−0.004	−0.002
Mean t	0.129	0.019	−0.041	−0.097	−0.027	−1.816	1.494	0.177	0.060	−0.049	0.097
T-stat	1.629	0.239	−0.500	−1.133	−0.312	−17.917	15.673	2.031	0.657	−0.639	1.180
Number of companies with average xs returns > 0	86	81	76	71	73	14	139	82	79	76	76
Binomial significance	0.200	0.631	0.749	0.263	0.424	0.000	0.000	0.522	0.873	0.749	0.749

The second step is to calculate an excess return series for each of the trades −9 to +20, which for transaction t is

$$\mathrm{RX}_{it} = \mathrm{R}_{kit} - \mathrm{BEN}_{ki} \tag{2}$$

We examine these excess returns, which may be interpreted as the unexpected component of percentage price changes.

IV. Results

The results are divided into four subsections. In section A we examine the patterns of individual returns around block trades, both for all periods and for each reporting regime. In section B we look at whether volatility shows any pattern around blocks. In section C we examine the cumulative price changes and whether they are permanent or temporary. Finally, in section D we examine whether price changes are related to size of block.

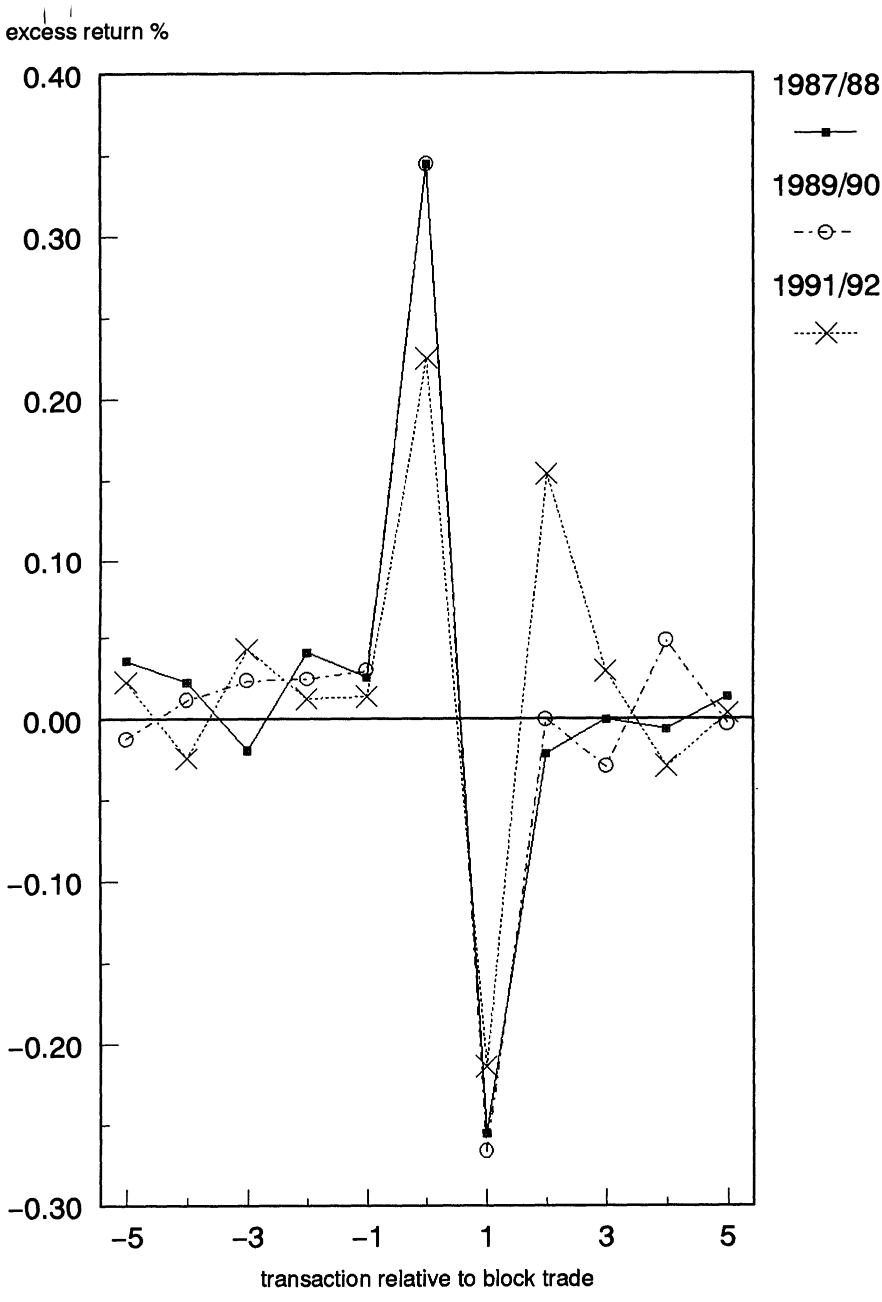

Figure 1a. Mean impact of block purchases (by publication regime). The three lines show excess trade-to-trade returns around block purchases under different regimes for publishing prices of last trades: 1987/88 is immediate publication; 1989/90 is publication with 24-hour delay; and 1991/92 is publication with 90-minute delay. The sample is 3010 block purchases with average value £1.32 million in 26 large companies, being 1008 blocks in 1987/88, 993 blocks in 1989/90, and 1009 blocks in 1991/92.

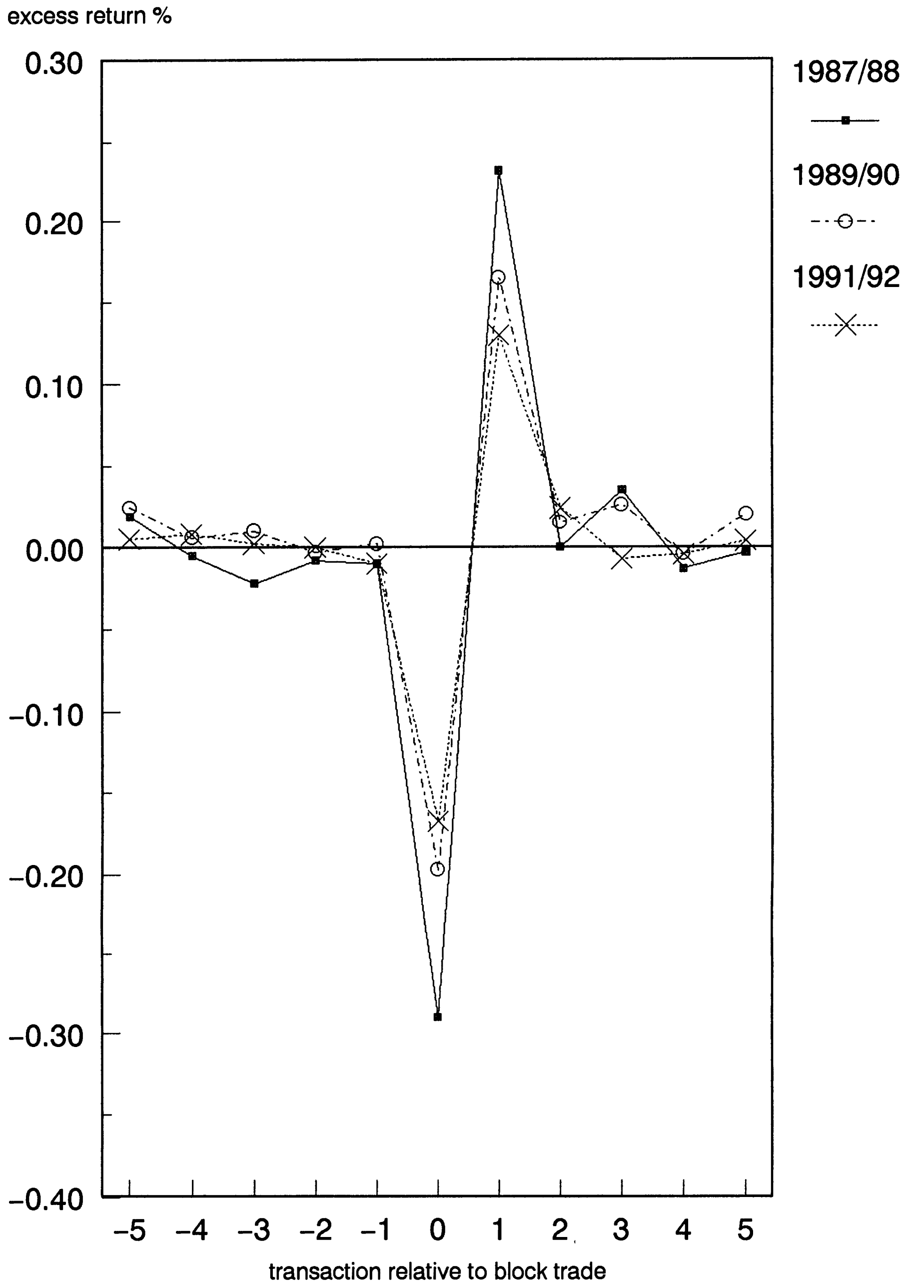

Figure 1b. Mean impact of block sales (by publication regime). The three lines show excess trade-to-trade returns around block sales under different regimes for publishing prices of last trades: 1987/88 is immediate publication; 1989/90 is publication with 24-hour delay; and 1991/92 is publication with 90-minute delay. The sample is 2977 block sales with average value £1.67 million in 26 large companies, being 980 blocks in 1987/88, 1005 blocks in 1989/90, and 992 blocks in 1991/92.

A. Individual Price Changes

The upper half of Table II gives the results for block purchases when all years are considered together. The first row indicates that there is, on average, a 0.305 percent increase in price associated with a block purchase, but this is followed immediately by a 0.245 percent fall in price. The t-statistics indicate that these moves are significantly different from zero at the 0.01 percent level. The results also suggest that there is a leakage of information prior to a purchase, since the rises of 0.026 percent at trade -2 and 0.023 percent at trade -1 are significantly different from zero (at the 5 percent level). No other trade has any significant price effect. The binomial test on the number of companies with positive returns in each month confirms that prices rise before a block trade, with trades -5, -3, and -1 having significant effects at the 5 percent, 10 percent, and 2 percent levels, respectively.

The lower half of Table II gives the equivalent results for block sales. These simply mirror the results for block purchases, except that the impacts are smaller and there is no indication of early leakage of information. At the time of the sale (time 0) there is an average fall of 0.218 percent, which is followed at time 1 by a rebound of 0.176 percent. The t statistics indicate significant (1 percent level) price movements at times 0 and 1 and a significant (5 percent level) price rise at time 2. The results for the median are very similar to those for the mean. The binomial test on number of companies with positive returns also indicates no significant price changes except at trades 0 and 1.

These patterns of impact and speeds of adjustment are remarkably similar to those found by Holthausen *et al.* (1990). This is surprising, given the contrast between the London Stock Exchange, on which all blocks are dealt, and the New York Stock Exchange (NYSE), where many blocks are brokered in the upstairs market. There is a large impact when a block purchase or sale occurs, followed by an immediate rebound. Significant adjustment takes only one or two trades, although there may be small effects for a little longer. As on the NYSE, there is evidence of leakage for purchases but not for sales.

The focus of this article is whether last-trade publication makes any difference. Figures 1a and 1b show how prices behave in each of the three publication subperiods. The price responses are similar in all periods and adjustment takes no longer than one postblock trade in any period.[7] We therefore can already reject Hypothesis 4: speed of adjustment does not appear to be affected by timeliness of publication.

B. Volatility

As Holthausen et al. (1990) suggest, it would be possible for returns, *on average,* to show no systematic pattern while their *variances* might show such a pattern. An analysis of trade-to-trade standard deviations for both purchases and sales, averaged over the whole data set, is therefore performed. The

[7] There are no significant excess returns in any subperiod for any trade except trades 0 and 1. (More detailed tables have been excluded here, but are available from the author).

results show a local peak of volatility at time -1 for purchases and time 0 for sales, but differences across all periods are small. A further analysis by individual year gives no indication that volatility is related to the publication regime in force.

An alternative to looking at individual returns by trade, (-1, 0, etc.), is to compare the variances of all pre- and postblock returns. For each year the variance of returns on trades -19 to -1 is compared with the variance of returns on trades $+1$ to $+20$. The ratio of the postblock variance to the preblock variance is less than unity for five of the six years for purchases and four of the six years for sales. (A full set of these results is available from the author). Similarly, the number of separate blocks with postblock variance less than preblock variance exceeds 50 percent for all purchases by year and for all sales in five of the six years. However, these results are not statistically significant. If delayed publication leads to smoothing, we would expect the highest variance ratios and proportions to occur in 1987 and 1988, when publication was immediate. There is no evidence to support that, so we reject Hypothesis 3.

C. Cumulative Impacts and Temporary/Permanent Effects

CUMULATIVE IMPACT

Even if individual returns are not significantly different from zero, together they may be. Figures 2a and 2b show cumulative excess returns, (i.e., price changes), for purchases and sales, respectively. A relatively clear pattern emerges. When a *block purchase* is made, prices begin rising at time -5, show a large jump at time 0, rebound at time $+1$, and then show a gentle upward drift. This pattern is the same across the different regimes, except that there is a larger permanent impact of a purchase in 1987/88 and 1989/90 than in 1991/92. When a *block sale* is made, there appears to be almost no permanent impact in 1989/90 and 1991/92, but a small permanent impact in 1987/88. No relationship between level of impact and delay in publication emerges from these results. In particular, for 1989/90 when the delay is 24 hours, there is a relatively large impact of a block *purchase* but the smallest impact of a block *sale* across all three periods.

TEMPORARY AND PERMANENT EFFECTS

In order to be more precise in estimating the temporary and permanent components of the price change, we need to choose a starting point at which there is no influence of the block trade and a finishing point at which all effects have occurred. Based upon the analysis of cumulative price changes, we choose the average of trades -5 to -3 to indicate the preblock price level and the average of trades $+4$ to $+6$ to indicate the postblock price level. We define the *temporary* impact as the percentage price change between trade 0 and trades $+4$ to $+6$. The *permanent* impact is defined as the percentage price change between the prior trades, -5 to -3, and the post trades, $+4$ to $+6$. The *total* price impact is defined as the sum of the temporary and permanent impacts,

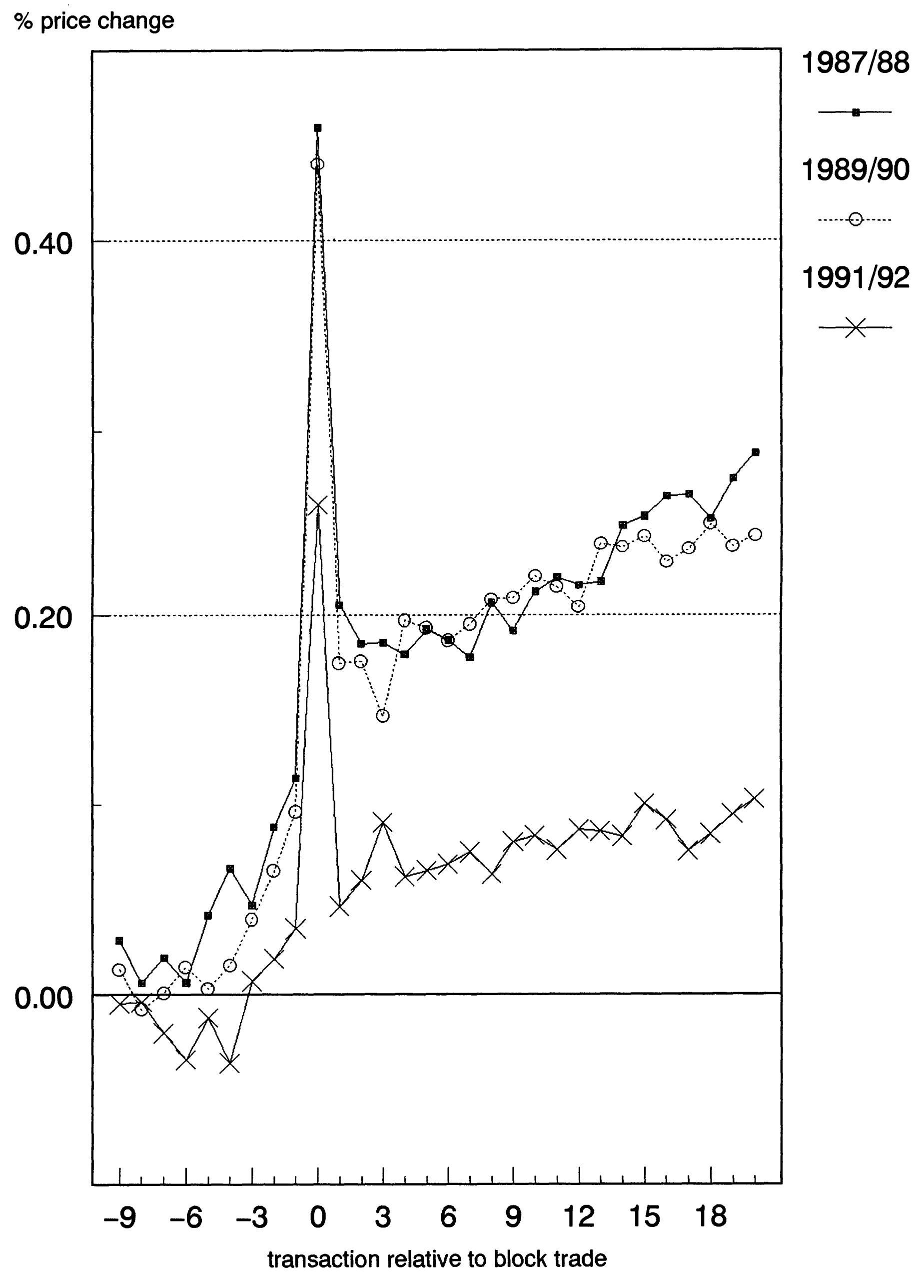

Figure 2a. Cumulative impact of block purchases (by publication regime). The three lines show cumulative excess returns around block purchases under different regimes for publishing prices of last trades: 1987/88 is immediate publication; 1989/90 is publication with 24-hour delay; and 1991/92 is publication with 90-minute delay. The sample is 3010 block purchases with average value £1.32 million in 26 large companies, being 1008 blocks in 1987/88, 993 blocks in 1989/90, and 1009 blocks in 1991/92.

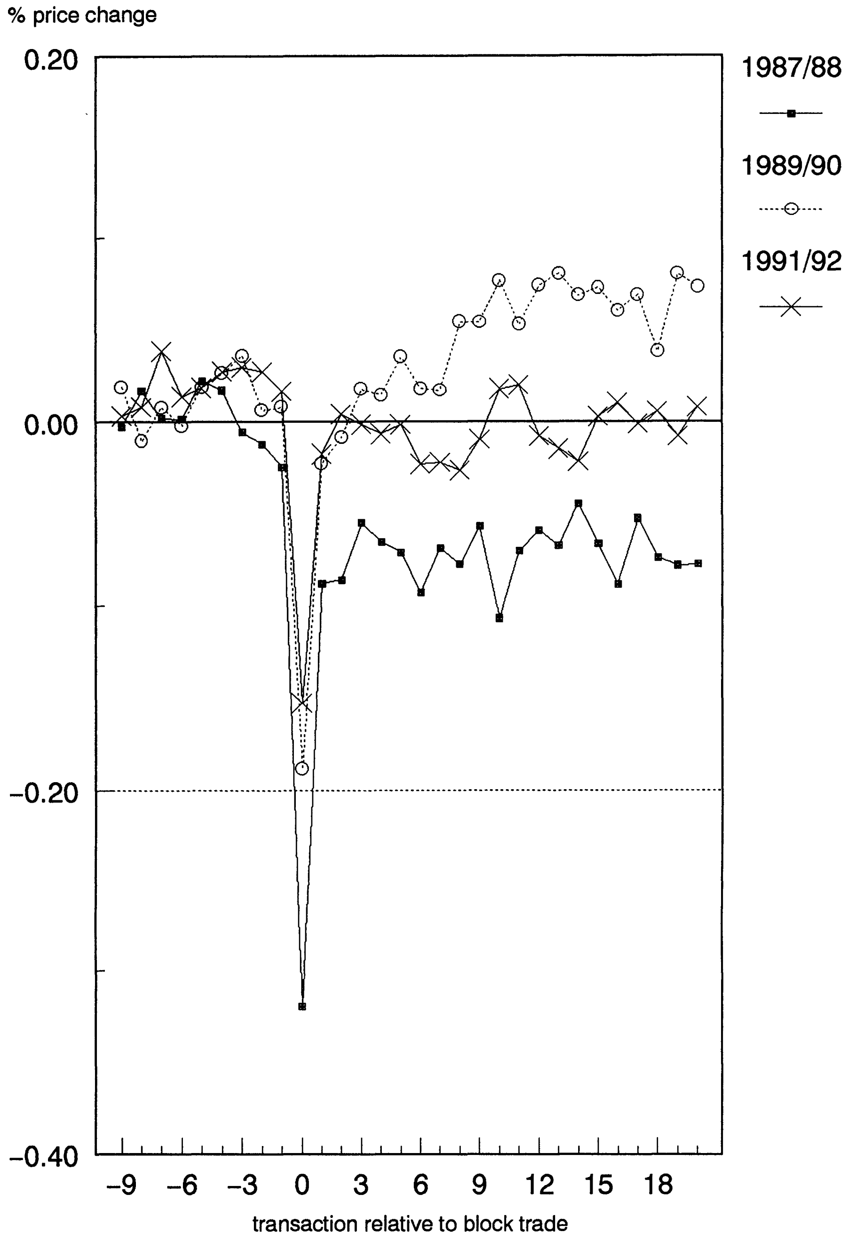

Figure 2b. Cumulative impact of block sales (by publication regime). The three lines show cumulative excess returns around block sales under different regimes for publishing prices of last trades: 1987/88 is immediate publication; 1989/90 is publication with 24-hour delay; and 1991/92 is publication with 90-minute delay. The sample is 2977 block sales with average value £1.67 million in 26 large companies, being 980 blocks in 1987/88, 1005 blocks in 1989/90, and 992 blocks in 1991/92.

Table III

Temporary and Permanent Effects of Block Purchases and Block Sales

Panel A examines the effect on the price level of 3010 block purchases in 26 of the largest companies on the London Stock Exchange in May of each year, 1987 to 1992. The results are based upon a comparison of trades −5 to −3 with trades +4 to +6, to give the permanent effect, and trades −5 to −3 with trade 0, to give the total effect. The temporary effect is the difference between total and permanent effects.

Panel B examines the effect on the price level of 2977 block sales in 26 of the largest companies on the London Stock Exchange in May of each year, 1987 to 1992. The results are based upon a comparison of trades −5 to −3 with trades +4 to +6, to give the permanent effect, and trades −5 to −3 with trade 0, to give the total effect. The temporary effect is the difference between total and permanent effects.

		Temporary Effect			Permanent Effect			Total Effect		
Year	Number of Observations	Mean	S.D.	*T*-Value	Mean	S.D.	*T*-Value	Mean	S.D.	*T*-Value
Panel A: Temporary and Permanent Effects of Block Purchases										
1987	506	0.3396	0.8013	9.53	0.0786	1.1453	1.54	0.4182	0.8237	11.42
1988	502	0.2073	0.9093	5.11	0.1892	1.2570	3.37	0.3964	0.8541	10.40
1989	493	0.1385	0.7569	4.06	0.1870	1.0852	3.83	0.3256	0.6526	11.08
1990	500	0.3576	0.6735	11.87	0.1575	0.9137	3.85	0.5152	0.6400	18.00
1991	500	0.2265	0.6192	8.18	0.0930	0.7785	2.67	0.3195	0.5819	12.28
1992	509	0.1639	0.5593	6.61	0.0653	0.6549	2.25	0.2292	0.5299	9.76
All	3010	0.2391	0.7332	17.89	0.1281	0.9949	7.06	0.3671	0.6961	28.94
Panel B: Temporary and Permanent Effects of Block Sales										
1987	482	−0.2027	0.7713	−5.77	−0.0775	1.0168	−1.67	−0.2802	0.8262	−7.45
1988	498	−0.2845	0.8834	−7.19	−0.0980	1.1231	−1.95	−0.3824	0.8431	−10.12
1989	497	−0.2309	0.7754	−6.67	0.0404	1.1093	0.81	−0.1905	0.6853	−6.60
1990	508	−0.1911	0.7799	−5.52	−0.0495	0.9701	−1.15	−0.2406	0.7379	−7.35
1991	490	−0.1204	0.6091	−4.37	−0.0384	0.7891	−1.08	−0.1588	0.5962	−5.90
1992	502	−0.1639	0.4732	−7.76	−0.0328	0.6340	−1.16	−0.1967	0.5081	−8.67
All	2977	−0.1990	0.7291	−14.89	−0.0425	0.9566	−2.42	−0.2415	0.7123	−18.50

which is also the percentage price change between the prior trades, −5 to −3, and the block trade, 0.

Table III, Panel A, shows that for block purchases both temporary and permanent impacts are significant across all years, with the exception of the permanent impact in 1987. On average, the total impact of a block purchase is a rise in price of 0.367 percent, of which 0.239 percent is temporary and 0.128 percent is permanent. Hence, on average, about one third of the initial price change is permanent. The total price impacts range from 0.229 percent in 1992 to 0.515 percent in 1990 and the permanent impacts range from 0.065 percent in 1992 to 0.189 percent in 1988.

Table III, Panel B, indicates that for block sales there are significant temporary impacts in each year, but no significant permanent impact in any single year. Nevertheless, over all years the average permanent impact of −0.042

percent is significant at the 2 percent (two-tail) level. This permanent impact is only about one sixth of the total price impact of −0.241 percent, which ranges from −0.159 percent in 1991 to −0.382 percent in 1988.

The choice of trades +4 to +6 to indicate the new permanent price level is somewhat arbitrary, but the plots of cumulative returns suggest that this choice is not very critical. This is confirmed by redoing the analysis with trades +14 to +16 instead of trades +4 to +6. For purchases, the estimated permanent impacts increase to an average of 0.175 percent across all years, which is highly significantly different from zero (t = 5.36). Four of the six individual years also have significant (5 percent level) permanent impacts. For sales, the estimated permanent effects are reduced even further by using trades +14 to +16 to an average of 0.021 percent across all years, which is not significantly different from zero. In no individual year is there a significant permanent impact of a block sale on the price level.

Another assumption that might affect the results is the choice of trades −19 to −10 to give the benchmark return. To test whether this is important, the analysis of temporary and permanent impacts is redone assuming that the benchmark return is zero. The result is a small increase in the estimated permanent impact of a purchase, from 0.128 percent to 0.140 percent (t = 11.97), and also an increase in the estimated permanent impact of a sale, from −0.042 percent to −0.061 percent (t = 4.92). These changes are so small that we can be confident that our approach to estimating the benchmark does not materially affect the results.

To summarize, the results on temporary and permanent impacts confirm what was less formally observed from the graphs of cumulative returns: the impact of a purchase is larger than the impact of a sale, both temporarily and permanently. Block purchases have significant permanent impacts, but block sales have small impacts that only border on significance when many years are pooled. It is also difficult to discern any consistency of response to pairs of years, (1987/88, 1989/90, and 1991/92), so we do not find any simple effect of publication regime.

LARGE VERSUS SMALL TRADES

One reason why we are unable to find any impact of publication may be that spreads have changed over the years due to other exogenous factors. For example, there is no doubt that the experience of the Crash of 1987 is reflected in the spreads that are estimated for May 1988. However, such exogenous factors also affect the spreads on small transactions, so by examining the difference in spreads charged on large versus small transactions we may be able to remove their influence.

In order to estimate the spreads on small trades, we use a complete record of the marketmakers' quotes in May of each year, which has been supplied by the London Stock Exchange. For each block trade, either purchase or sale, the best available bid and ask quotes are used to calculate the contemporaneous

Table IV

Comparison of Spreads on Small and Block Trades

The table compares the spreads on blocks and small-size transactions. For each of 3010 block purchases and 2977 block sales the contemporaneous best-available spread (touch) is obtained for a small transaction. The blocks are sampled from 26 of the largest companies on the London Stock Exchange in May of each year, 1987 to 1992. The percentage by which the spread on a block trade is less than that on a small trade is termed "price improvement" in the table. The Financial Times Stock Exchange (FTSE) 100 Index volatility is an annualized measure estimated from daily data for the working days of the whole month in which the sample was taken.

Year	Quoted Touch for a Small Transaction %	Spread for a Block Transaction %	Price Improvement of Block Over Small Transaction %		Volatility of FTSE 100 Index in May of Year %
1987	0.8565	0.6984	18.46	25.48	17.09
1988	1.1538	0.7788	32.50		11.67
1989	0.7874	0.5161	34.46	24.30	12.54
1990	0.8803	0.7558	14.14		16.34
1991	0.8641	0.4783	44.65	40.96	11.13
1992	0.6789	0.4259	37.27		8.93

spread on a small trade.[8] The resulting averages are given in column two of Table IV and range from 0.68 percent in 1992 to 1.15 percent in 1988. We already have estimates of the transactions spreads for block trades in each year, as they are equal to the sum of the total purchase and sale impacts given in Table III. These are summarized in the third column of Table IV and range from 0.43 percent in 1992 to 0.78 percent in 1988.

We had expected to find that large transactions are made at particularly advantageous prices relative to small transactions when transparency is at its lowest (consistent with hypothesis 2). If this hypothesis is correct, then the degree of price improvement, defined as the percentage reduction in spread paid on a large trade relative to a small one, should be greater in 1989/90 and 1991/92 than in 1987/88. The fourth column of Table IV shows that although price improvement for large trades is greater in 1991/92 (average 40.96 percent) than in 1987/88 (average 25.48 percent), it is almost the same in 1989/90 as in 1987/88 (average 24.30 percent). The particular year that does not conform to the hypothesis of less transparency giving more price improvement is 1990, which has only a 14.14 percent price improvement despite falling within the 24-hour publication regime. The evidence is therefore mixed and

[8] The best bid and ask combination, or touch, is a good indication of the transactions spread for a small trade, as confirmed in a recent paper by Reiss and Werner (1994) and by the London Stock Exchange (1992). Because the touch can be calculated for more than one size of deal, we use the first nine records for a company month to establish the most frequently occurring size. In one case this has to be modified, as quote size changes considerably during the month. It should also be noted that these quotes are firm for at least 10,000 shares, with a typical value of £50,000.

does not support the hypothesized behavior in all of the years studied.[9] Another factor that has a profound impact on the spread, but has so far been omitted, is the volatility of share prices. A risk-averse marketmaker will require a larger risk-premium on a block trade than on a small trade, because of the larger exposure to price changes while the inventory is held. Figure 3 compares price improvement (given in Table IV) with the volatility of the FTSE 100 Index in May of each year, (also listed as the final column of Table IV). Although there are only six observations, the close linearity of the relationship does suggest that price improvement may be explained by market volatility rather than by differences in publication rules.[10]

D. Block Size and Price Impact

The relation between price impact (either temporary or permanent) and block size is likely to be nonlinear. While a larger quantity reduces the fixed cost per share, it increases the risk-premium required on inventory and may also increase the risk that the deal is based upon information. The result should be that spreads at first decline with block size but then increase, as the risk-premium becomes significant.[11]

These considerations lead us to propose a model for total price impact, (i.e., for the spread), which is nonlinear with respect to block size, depends on the small-trade touch and which allows for individual year effects:

$$\begin{aligned}\%\Delta\mathrm{PTOT}_{kij} = a + b_1\mathrm{VAL}_{kij} + b_2\mathrm{VAL}^2_{kij} + c\,\mathrm{TOUCH}_{kij} \\ + d_{87}\mathrm{YDUM}_{87} + \ldots + d_{91}\mathrm{YDUM}_{91} + \epsilon_{kij}\end{aligned} \tag{3}$$

where

	$\%\Delta$PTOT	is the percentage change in total price
	VAL	is the value of shares traded
	YDUM	is a dummy variable for year, 1987 to 1991
	TOUCH	is half the touch, expressed as a percentage of the share price
	k	denotes kth block
	i	denotes ith company
	j	denotes jth year
and	ϵ_{kij}	is a disturbance term.

Another equation, equivalent to (3), is also estimated for the permanent percentage change in price, (in which $\%\Delta$PPERM is the dependent variable).

[9] Breedon (1993) also compares a period in the immediate-publication regime with a period in the 90-minute regime and finds that there *is* an increase in the spread for a large trade relative to a small one. If we compare 1987/88 with 1991/92, which is comparable with his test period, we also reach that conclusion, so our results are consistent with his.

[10] An equivalent plot of the touch against volatility reveals almost no relationship.

[11] A theoretical analysis of the price/quantity relationship is available from the author. Studies of the London market by Breedon (1993) and Reiss and Werner (1994) confirm that price and quantity are nonlinearly related.

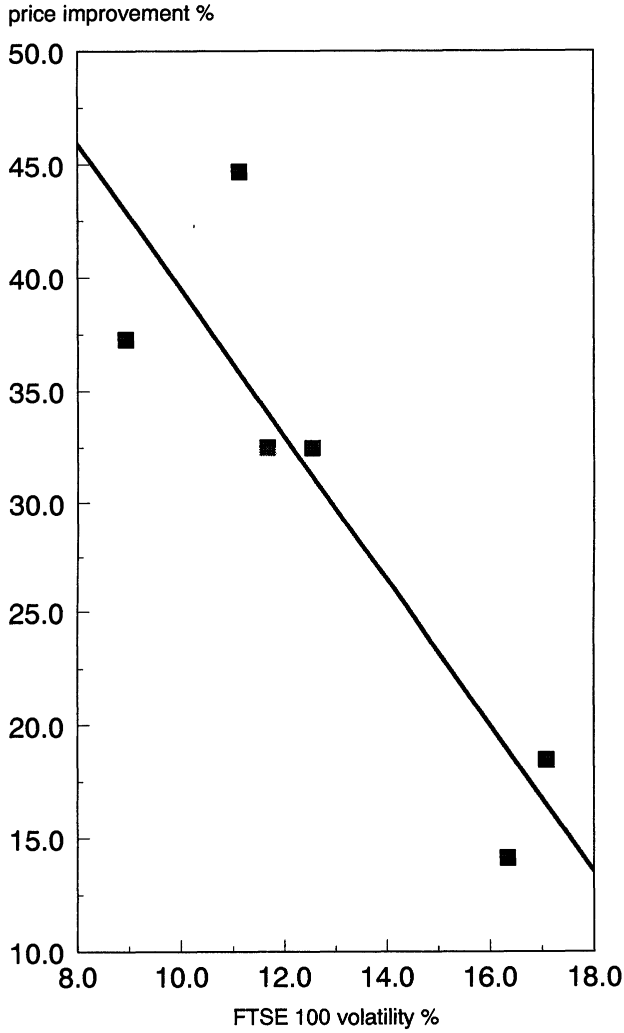

Figure 3. Market volatility and price improvement. Each point in the figure relates average price improvement to market volatility for all sampled block trades in May of a particular year. The straight line is a least-squares fit. Price improvement is measured as the percentage by which the spread on a block trade is less than that on a small trade. Market volatility is an annualized measure for the FTSE 100 Index estimated from daily data for the working days of the whole month.

To reduce the influence of a few very large blocks and to correct for heteroscedasticity, equations are estimated with the variance assumed proportional to block size.[12] Separate equations are estimated for purchases and sales, and the

[12] The test of White (1980) does not indicate significant heteroscedasticity. However, the hypothesis that variance is proportional to block size is more plausible than the alternative of no relationship.

Table V

Regression Results on the Relationship between Price Impact and Block Size

The equation being estimated is of the form: change in price = $a + b_1\ \mathrm{VAL}_{kij} + b_2\ \mathrm{VAL}^2_{kij} + c\mathrm{TOUCH}_{kij} + d_{87}\ \mathrm{YDUM}_{87} + \ldots + d_{91}\ \mathrm{YDUM}_{91} + \epsilon_{kij}$. Change in price is either total price, %ΔPTOT, or permanent price, %ΔPPERM. VAL is size of block (£m). TOUCH is half the small-trade spread (%). YDUM_j is a dummy variable for the jth year, with i = 1987, 1988, 1989, 1990, or 1991. t is the t-statistic. R^2 is the coefficient of determination. N is the number of observations. ϵ is a disturbance term. k denotes block. i denotes company. j denotes year. Estimation is by weighted least squares, with the variance assumed proportional to VAL (the size of block).

	Purchases				Sales			
	%ΔPTOT		%ΔPPERM		%ΔPTOT		%ΔPPERM	
	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t
a	0.283	6.66	0.119	2.07	−0.221	−5.42	−0.129	−2.51
b_1	-6.643×10^{-2}	−8.20	-3.408×10^{-2}	−3.12	-3.717×10^{-4}	−0.13	2.993×10^{-2}	8.19
b_2	3.068×10^{-3}	6.47	1.250×10^{-3}	3.02	5.083×10^{-5}	1.14	-4.237×10^{-4}	−7.56
c	0.208	2.66	8.848×10^{-2}	0.84	4.097×10^{-2}	0.48	0.110	1.02
d_{87}	0.175	4.22	-8.268×10^{-3}	−0.14	−0.201	−4.20	-6.608×10^{-2}	−1.09
d_{88}	-4.350×10^{-2}	−0.94	-7.217×10^{-2}	−1.15	0.152	2.79	7.255	1.05
d_{89}	3.805×10^{-2}	0.86	9.053×10^{-2}	1.51	4.229×10^{-2}	0.95	4.115×10^{-2}	0.73
d_{90}	0.221	5.14	4.929×10^{-3}	0.08	−0.189	−4.15	1.041×10^{-2}	0.18
d_{91}	6.736×10^{-2}	1.56	3.473×10^{-2}	0.60	8.872×10^{-2}	1.84	1.031×10^{-2}	0.17
R^2	0.0302		0.0038		0.0467		0.0343	
N	3010		3010		2977		2977	

results are given in Table V.[13]

The first regression for purchases indicates that the *total* price change (i.e., the buying spread) is significantly affected by block size, first falling as block size increases ($b_1 < 0$) and then rising ($b_2 > 0$), as expected. The coefficient on the touch is also significant ($c > 0$). The coefficients on the dummy variables (d_{87} to d_{91}) confirm that the buying spreads are significantly larger in 1987 and 1990 than in 1992 (the base case).

The second regression in Table V indicates that there is also a significant relationship between the *permanent* impact of a purchase and the size of block. The permanent component of the buying spread first falls ($b_1 < 0$) and then rises ($b_2 > 0$), in the same way as for the total buying spread. However, none of the year dummies is significant, nor does the touch have any impact.

The third regression in Table V indicates that for block sales there is no significant impact of size on the *total* fall in price (i.e., on the selling spread): the coefficients on size of block (b_1) and its square (b_2) are both insignificantly different from zero. Neither does the touch have any impact. The only signif-

[13] In principle the size of block should be measured as a proportion of the total equity. However, there are uniformly stronger relationships between the simple, monetary values of blocks and price movements than between equity proportions and price movements. Hence we report the results for monetary values. We also estimate equations with dummy variables for each company, but their inclusion does not change the magnitude of other coefficients, and so the results are not reported here.

icant variables are the dummies for years, (which mirror in size the results already given in Table III, Panel B).

The fourth regression in Table V indicates that block size is a significant (5 percent level) influence on the *permanent* impact of a sale, while individual years are not. The result is similar to that for the permanent impact of a purchase; (sales result in price falls, so the signs on the coefficients b_1 and b_2 are reversed). Once again, neither year nor the touch has a significant influence on the permanent price change.[14]

Another way to demonstrate the impact of block size is to examine portfolios that have been size-ordered. Each of the (maximally 20) blocks in each share in each year is allocated to one of 10 size-ordered portfolios; thus the two largest blocks go to the first portfolio, the next two largest to the second portfolio, etc. When price change is plotted against block size for the portfolios, the result is an almost horizontal line which indicates that block size has hardly any impact. This result holds for temporary and permanent price changes and for both purchases and sales.[15]

To summarize this section, there is only a small (but significant) impact of block size on spread. The most important determinant of the total spread is year, this being particularly the case for 1987 and 1990. However, year has no significant impact on the new (permanent) price level. These results do not lend support to the hypothesis that block spreads are affected by speed of publication, because the years in which spreads are large, 1987 and 1990, fall into immediate and 24-hour publication regimes, respectively. These are also the years in which market volatility is highest.

V. Conclusions and Implications

Conclusions may now be drawn on the original hypotheses, all of which are presented from the viewpoint of those marketmakers who want a delay in publication:

- We reject Hypothesis 1, which asserts that there are no permanent impacts of large trades in London. The data indicate that block purchases have a permanent impact equal to about one third of the buying spread, while block sales have a permanent impact that only borders on significance and averages about one sixth of the selling spread.
- We reject Hypothesis 2, which asserts that transactions spreads for large trades are smaller when publication is delayed. While spreads are narrower for large trades in three of the four years with delayed publication (both in absolute size and relative to spreads on small trades), in 1990 the

[14] Regressions are also conducted in which price improvement for each block is the dependent variable and market volatility is included as a factor. However, there is a very high degree of collinearity between year dummies and volatility, so that inclusion of both variables leads to standard errors that are huge. It follows that the estimated coefficients on the year dummies are mainly a reflection of the volatility.

[15] Plots are available from the author.

opposite result is found. It appears that market volatility, rather than publication regime, explains the size of spread on a block transaction relative to a small transaction.
- We reject Hypothesis 3, which asserts that delayed publication leads to smoother price transitions. The standard deviation of postblock returns relative to preblock returns is unaffected by speed of publication.
- We reject Hypothesis 4, which asserts that delayed publication slows down the attainment of a new permanent price level. The graphs on cumulative impacts of purchases and sales indicate similar speeds of adjustment in all years.

In sum, we find that delayed publication has surprisingly little impact on spreads, speed of adjustment, smoothing, or ultimate price level. Although in theory delaying publication gives parties to a large trade an advantage, in practice the information appears to leak out so rapidly that marketmakers are not able to exploit the advantage. Another possibility is that marketmakers have adapted to the changing rules, thus masking the impact. In particular, since the 90-minute rule was introduced in 1991, many blocks have been traded on a protected basis, whereby the marketmaker guarantees a particular price but will try to obtain a better one. This means that there is a delay between the trade being initiated and its execution, which would not appear in our data for 1991/92. However, protected trades did not exist in 1987/88, so they cannot explain the similarity of the results for that period (of immediate publication) with those for 1989/90 (when there was a 24-hour delay).[16]

This leaves us with the conundrum of explaining why marketmakers are so vehement in their desire for some delay. We suspect that it is not in the interest of marketmakers in London that an upstairs (auction) market develop, because their role would be diminished and institutions might develop alternative trading systems. Delayed publication may therefore not give marketmakers larger profits directly, but it deters entry and is in their long-term interest, (as Madhavan (1993) has argued). Another possibility is that a delay is valuable to them on smaller stocks, even if it has no value for the largest FTSE 100 stocks which are the focus of this study.[17] Whatever the explanation, the evidence of this study does not support a delay: rapid publication of prices has no measurable impact in reducing liquidity for block trades.

Apart from focusing on the effects of publication regimes, there are several other interesting results in this study. As in many of the U.S. studies, we find a much larger price impact of a block purchase than of a block sale. This does not appear to be related to a simple unwillingness by marketmakers to go short, because the temporary effect of a purchase (0.24 percent) is not much

[16] One of the largest marketmakers has told the author that half of all block trades are now done on a protected basis.

[17] Hansch, Naik, and Viswanathan (1993) find that inventory behavior by market-makers in the top third of the FTSE 100 stocks is different from that for other FTSE 100 stocks, which would support the view that the largest stocks are traded in a different way. Our shares are in the top half of the FTSE 100. Splitting our sample into two size classes does not affect the results.

larger than the temporary effect of a sale (−0.20 percent). Rather, a purchase has a larger permanent effect (0.13 percent versus −0.04 percent), implying that there are more informed buyers than sellers. Further research in this area, building on the theoretical work of Allen and Gorton (1992), would be interesting.

The speed of price adjustment after a block trade appears to be similar in London to that in New York. Prices fully adjust after three to five trades, except for a slow upward drift following purchases (which is not statistically significant). Information about block purchases appears to leak early, as prices start to rise two to three trades prior to the block. It seems that the different market structures—upstairs trading of blocks on the New York Stock Exchange and competitive dealership on the London Stock Exchange—lead to surprisingly similar outcomes.

Finally, for the large trades that constitute our sample, there is only a weak effect of block size on price change, either temporarily or permanently. It seems likely that over the range we observe there are two offsetting effects: large trades require a premium over small trades, because of both information and inventory effects, but the spreading of fixed costs over a larger quantity of shares leads to a reduction in the premium required.

One direction for further research would be to examine the behavior of marketmakers who take on blocks. Some recent work by Board and Sutcliffe (1995) indicates that only 15 percent of a block is retraded within 45 minutes, so there is no haste to rebalance the inventory. Further work on individual strategies would be interesting, including whether quotes are changed or kept the same (as indicated for U.S. markets by Choe *et al* (1992b)). We also do not know whether there is an additional price impact when publication actually occurs, because we have concentrated on the transactions immediately surrounding each individual block.

The most interesting avenue for further research may be to obtain data on institutional trades, (as Keim and Madhavan (1995) and Chan and Lakonishok (1995) have done in the United States). This may help us to understand what motivates institutional investors to demand immediacy, when their diversified portfolios should place them in the best position to bear the risk of waiting to find a counterparty. In addition, why is publication so closely tied to immediacy in London when in New York it is not? Recent research by Cheng and Madhavan (1995) indicates that many blocks are traded downstairs on both the NYSE and Nasdaq without having a larger price impact than occurs upstairs. This is further evidence against the view that immediacy can only be obtained in an opaque market.

REFERENCES

Allen, Franklin, and Gary Gorton, 1992, Stock price manipulation, market microstructure, and asymmetric information, *European Economic Review* 36, 624–630.

Ball, Ray, and Frank J. Finn, 1989, The effect of block transactions on share prices: Australian evidence, *Journal of Banking and Finance* 13, 397–419.

Board, John, and Charles Sutcliffe, 1995, The effects of trade transparency in the London Stock Exchange, Special paper No. 67, Financial Markets Group, London School of Economics.

Breedon, Francis, 1993, Intraday price formation on the London Stock Exchange, Discussion paper No. 158, Financial Markets Group, London School of Economics.

Chan, Louis K.C., and Josef Lakonishok, 1993, Institutional trades and intraday stock price behavior, *Journal of Financial Economics* 33, 173–199.

Chan, Louis K.C., and Josef Lakonishok, 1995, The behavior of stock prices around institutional trades, *Journal of Finance* 50, 1147–1174.

Cheng, Minder, and Ananth Madhavan, 1995, In search of liquidity: Block trades in the upstairs and downstairs markets, Working paper, University of Southern California.

Choe, Hyuk, Thomas H. McInish, and Robert A. Wood, 1992a, Block trades and specialist pricing, Working paper, Pennsylvania State University.

Choe, Hyuk, Thomas McInish, and Robert A. Wood, 1992b, Market microstructure effects on the measurement of the impact of block trades, Working paper, Pennsylvania State University.

de Jong, Frank, Theo Nijman, and Ailsa Röell, 1995, A comparison of the cost of trading French shares on the Paris Bourse and on SEAQ International, *European Economic Review* 39, 1277–1301.

Franks, Julian, and Stephen Schaefer, 1990, Large trade publication on the International Stock Exchange, report to the Department of Trade and Industry.

Gerke, Wolfgang, 1992, Block trading on the stock exchange, Working paper, University of Erlangen-Nuernberg.

Hansch, Oliver, Narayan Naik, and S. Viswanathan, 1993, Market making on the London Stock Exchange: An empirical investigation, Working paper, London Business School.

Holthausen, Robert W., Richard W. Leftwich, and David Mayers, 1987, The effect of large block transactions on security prices: A cross-sectional analysis, *Journal of Financial Economics* 21, 237–268.

Holthausen, Robert W., Richard W. Leftwich, and David Mayers, 1990, Large block transactions, speed of response, and temporary and permanent stock price effects, *Journal of Financial Economics* 26, 71–95.

Hugh-Smith, Andrew, 1990, The International Stock Exchange in Europe: An historical analysis, speech to the London School of Economics, 8th May.

Ingram, D.H.A., 1987, Change in the stock exchange and regulation of the City, *Bank of England Quarterly Bulletin* February, 54–65.

International Organization of Securities Commissions, 1993, *Transparency on Secondary Markets: A Synthesis of the IOSCO Debate* (II Sole 24 Libre, Milan).

Keim, Donald B., and Ananth Madhavan, 1991, The upstairs market for large block transactions: Analysis and measurement of price effects, Working paper, University of Pennsylvania.

Keim, Donald B., and Ananth Madhavan, 1995, Anatomy of the trading process: Empirical evidence on the behavior of institutional traders, *Journal of Financial Economics* 37, 371–398.

Kraus, Alan, and Hans R. Stoll, 1972, Price impacts of block trading on the New York Stock Exchange, *Journal of Finance* 27, 569–588.

London Stock Exchange, 1987, *Quality of Markets Quarterly Review* Summer, p 8.

London Stock Exchange, 1991, *Quality of Markets Quarterly Review* Spring, p 18.

London Stock Exchange, 1992, Price improvement and best execution, *Stock Exchange Quarterly* Spring, 25–31.

Madhavan, Ananth, 1993, Trade disclosure and the integration of international securities markets, Working paper, University of Pennsylvania.

Mikkelson, Wayne H., and Megan Partch, 1985, Stock price effects and costs of secondary distributions, *Journal of Financial Economics* 14, 165–194.

Office of Fair Trading, 1990, Trade publication and transparency on the International Stock Exchange, a report by the Director General of Fair Trading to the Secretary of State for Trade and Industry, April.

Office of Fair Trading, 1994, Trade publication rules of the London Stock Exchange, a report to the Chancellor of the Exchequer by the Director General of Fair Trading under the Financial Services Act 1986.

Pagano, Marco, and Ailsa Röell, 1996, Transparency and liquidity: A comparison of auction and dealer markets with informed trading, *Journal of Finance* 51, 579–612.

Reiss, Peter C., and Ingrid M. Werner, 1996, Transactions costs in dealer markets: Evidence from the London Stock Exchange, NBER Working paper No. 4727, May.

Röell, Ailsa, 1988, Regulating information disclosure among stock exchange market makers, Discussion paper No. 51, Financial Markets Group, London School of Economics.

Röell, Ailsa, 1992, Comparing the performance of stock exchange trading systems, in Fingleton, John and Dirk Schoenmaker, eds: *The Internationalisation of Capital Markets and the Regulatory Response* (Graham and Trotman, London).

Scholes, Myron, 1972, The market for securities: Substitution versus price pressure and the effects of information on share prices, *Journal of Business* 45, 179–211.

Securities and Investments Board, 1995, Regulation of the United Kingdom equity markets, London, June.

Wells, Stephen, 1993, Transparency in the equity market—the publication of last trades, *Stock Exchange Quarterly* Spring, 13–16.

White, H., 1980, A heteroskedastic-consistent covariance matrix estimator and direct test for heteroskedasticity, *Econometrica* 48, 817–838.