Trading Frictions and Market Structure: An Empirical Analysis

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Abstract

Market structure affects the informational and real frictions faced by traders in equity markets. We present evidence which suggests that while real frictions associated with the costs of supplying immediacy are less in order driven systems, informational frictions resulting from increased adverse selection risk are considerably higher in these markets. Firm value, transaction size and order location are all major determinants of the trading costs faced by investors. Consistent with the stealth trading hypothesis of Barclay and Warner (1993), we report that informational frictions are at their highest for small trades which go through the order book. Finally, while there is no doubt that the total costs of trading on order-driven systems are lower for very liquid securities, the inherent informational inefficiencies of the format should be not be ignored. This is particularly true for the vast majority of small to mid-size stocks that experience infrequent trading and low transaction volume.

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1 Introduction

Trading frictions in financial markets are an important determinant of the liquidity of securities and the intertemporal efficiency of prices. The importance of trading frictions and their concomitant impact on asset pricing is illustrated by the large number of studies that examine the interrelationship between transaction costs, expected returns, liquidity and informational efficiency (see for example, Amihud and Mendelson (1987), Harris (1989), Chowdhry and Nanda (1991), Foster and Viswanathan (1993), Draper and Paudyal (1997), Jacoby, Fowler and Gottesman (2000), Chordia, Roll, and Subrahmanyam (2000, 2001)).

An interesting branch of this research has investigated whether the trading system of an exchange may impact upon the frictions that are incurred when securities are traded. Studies of this kind normally compare the trading costs of order driven to comparable quote driven systems and present evidence on their relative benefits and costs (see for example, Cooper, Groth, and Avera (1985), Huang and Stoll (1996), Chan and Lakonishok (1997), Eleswarapu (1997), Bessembinder (1999), Naik and Yadav (1999), Stoll (2000), Conrad, Johnson, and Wahal (2003), and Hasbrouck (2003)).

An understanding of how different trading systems affect the way in which asset prices evolve over time, and their impact upon the trading costs and frictions borne by market participants is important for several reasons. First, trading frictions increase a firm's cost of capital. When a company seeks a

listing location it must consider whether the trading system is appropriate given its market characteristics, such as market value, trading volume and share price.

Second, market participants who trade on a regular basis must assess the relative costs and frictions of different systems so as to minimize the total costs of their trading activity. When measured on a round-trip basis, frictions such as the bid-ask spread become important determinants of the net return to investing.

Third, market regulators are responsible for ensuring that the secondary markets facilitate the flow of funds between economic agents; the efficiency of the trading system of the main stock exchange is particularly important in this regard.

Although there is substantial interest in examining the ways in which various trading systems affect frictions in financial markets, there is also considerable difficulty in constructing suitable datasets that can clearly separate out the real effects of different market formats. More specifically, in comparing different trading systems, earlier work (Huang and Stoll (1996) and Chan and Lakonishok (1997) are examples) had to utilize different securities to compare the nature of frictions on different exchanges. An approach of this kind may lead to a confounding of trading system frictions with trader and security characteristics on the different exchanges.

Other studies (see for example, De Jong, Nijman and Roell (1995) and Werner and Kleidon (1996)), which utilize cross-listing of securities on differ-

ent exchanges, also face the possibility that the behavior of a heterogeneous group of traders in each exchange may lead to different trading friction dynamics.

The final group of research (see for example, Barclay, Christie, Harris, Kandel and Schultz (1999) and Bessembinder (1999)) examines how trading frictions change when a system undergoes reforms. Whereas in this case, the same securities and traders are expected to be present within each trading system, a difficulty arises with the intertemporal difference in the samples. The obvious criticism that could be made of these studies is that the nature of frictions change over time and market conditions. As a result, it is difficult to make viable comparisons between systems.

Another problem facing research in this area is that the precise economic meaning of a cost or friction is not clearly defined. A cost or friction measure can encapsulate many factors including informational and real frictions[1], explicit costs such as commissions and implicit unobserved costs such as the price impact of large trades. Due to their complexity, it is not possible for a general measure to be developed that satisfactorily captures all the costs borne by traders in any one trading system.

In this paper, we attempt to address the above issues by examining various dimensions of trading frictions for the same group of securities, with the same group of market participants, during the same time period on two

[1] A real trading friction is the processing cost of undertaking a trade on an exchange whilst an informational friction is the compensation paid to suppliers of liquidity as a result of informational asymmetry in the market.

distinct trading systems. We also examine the evolution of trading frictions over time for the same sample to provide further robustness to our results.

For this purpose, we examine the trading frictions that arise for a sample of securities that are listed on the London Stock Exchange. The system on the London Stock Exchange is well suited to this objective because trading can take place either anonymously on an electronic order book or through a competitive dealer market. This hybrid system allows a strict comparison of trading frictions arising directly from differences in the respective approaches to trading. Moreover, to further examine the impact of different trading systems, we compare the frictions that arose for stocks prior to 1997, when the London Stock Exchange was a pure competitive dealership market, and post 1997, which is a hybrid order book/dealer market.

Consistent with earlier studies (see for example, Huang and Stoll (1996) and Stoll (2000)), our initial results suggest that the total cost of trading is lower on order driven systems. This is characterized by a significantly higher number of small transactions that go through the order book in contrast to a low number of large transactions with dealers. Whereas this finding could be taken as evidence of lower frictions on order driven systems, it could also suggest increased stealth trading activity (Barclay and Warner (1993). The distribution of small buy and sell trades by order location (order book and dealer) lends credence to the latter explanation.

We present evidence regarding the informational and operational efficiency of order driven and dealer systems. There is no doubt that for liquid

securities the real cost of trading is lower on order driven systems because of increased order flow and competition from public investors (through limit order placement) for the provision of liquidity. However, our analysis indicates that informational asymmetry is significantly higher on order driven systems, which could possibly be due to the anonymity of market participants (and naturally counterparties to transactions) or stealth trading by informed investors.

Significantly, order size has a major impact upon the level of informational and real frictions. Small trades have very high informational costs compared to large trades. We find that this is especially true for small trades that go through the order book, with up to 45% of the effective half spread attributed to adverse selection risk.

These results have implications for firms, investors and regulators who are all concerned with the efficiency of financial markets. From the evidence we present here, it is clear that the structure of trading systems is an important factor in determining the net investment returns to investors. However, cognizance should also be made of the fact that while total transaction costs may be lower for very liquid securities on order driven systems, their informational disadvantages are nevertheless significant.

The organization of the paper is as follows. Section Two outlines briefly the institutional characteristics of the LSE which are relevant to the current research. In Section Three we discuss our data and the friction measures used in the study. Results are presented in Section Four and Section Five

concludes.

2 Institutional Background

In the LSE securities are allocated to a particular trading mechanism based on a number of criteria, the most important of which is liquidity. Liquidity here is broadly defined as the volume and frequency of a stock traded. This liquidity measure is found to be highly correlated with the size of the listed company. There are currently three different mechanisms for the trading of stocks. They are SETS, SEAQ and SEAT plus. The SEAT plus system is used for the least liquid stocks listed on the LSE. Given the objectives of the paper, the sample used in the current study contains the most liquid stocks traded on the LSE. These stocks are traded under the SETS or SEAQ systems. Therefore, the following discussion concentrates on these two systems.

SETS, Stock Exchange Trading System, is an order driven market (also referred to as an auction or order book market). It was introduced to the LSE in October 1997. It is a fully automated, screen-based system for all of the securities in the FTSE 100 index and many securities in the FTSE 250 index, which are the most liquid shares on the LSE. The order book is based on an order matching system in which member firms display their bid (buying) and offer (selling) orders to the market. Public investors can also display their orders through member firms' systems. Orders entered into the system are displayed anonymously and are automatically executed during

continuous trading when the price details match one another.

The trading day for SETS securities now runs from 08.00 hours to 16.30 hours on each Stock Exchange business day, subject to a random opening and closing time adjustment[2]. The opening of the market is preceded by an opening auction.

Five types of orders can be submitted to the SETS system. First, a limit order allows participants to indicate their intention to trade at a given price by either executing an order against existing orders on the order book at no worse than the limit price and leaving the remainder on the order book, or entering an order for inclusion in an auction call period. Limit orders must be entered with a quantity and a limit price. Second, an execute and eliminate order is an order to execute as much of an order as possible up to a specified price. The remainder is deleted. Third, a fill or kill order is an order specifying a volume and maximum/minimum price. If the entire order cannot be executed at this price or better, the entire order is rejected. Fourth, an at best order is an order specifying a volume which is filled at the best price(s) on the order book. Finally, market orders have a specified size but are entered without a price. They can only be input during an auction call period (for example, opening and closing auctions). They take priority

[2]The business hours of the LSE have been changed several times in the last decade.

	Open	Close
Before 20 Jul 1998	0830	1630
20 Jul 1998 – 17 Sep 1999	0900	1630
20 Sep 1999 – current	0800	1630

over limit orders in the execution process.

For SETS stock the minimum order size is 1 share[3]. There is no maximum size of order that can be entered on the book. However, there is a system maximum of 99999.99 x NMS (see below for further explanation).

SEAQ, Stock Exchange Automated Quotation system, is a quote driven market (also referred to as a price driven, dealership or market-maker market). This system is supported by market makers who quote bid and offer prices for the securities in which they are registered, and the maximum transaction size to which these prices relate. These prices are firm to other Exchange member firms. Prices for larger transactions are subject to negotiation. Market makers are obliged to display this information to the market throughout the trading day. SEAQ is a multi-dealer system (that is, more than one market maker making a market for each stock). Market makers compete to offer the best quote and make their income by buying and selling stocks at a profit. Brokers wishing to respond to a bid or offer displayed on SEAQ must contact the displaying firm and arrange the transaction.

The maximum transaction size associated with a market maker's quote price is known as normal market size (NMS). In other words, NMS is the minimum number of shares that a market maker must make a firm price in. NMS is calculated based on each individual stock's average market turnover value in the previous 12 months. The NMS is measured as the number of shares, which range from 500 shares to 200,000 shares. Although, there is no

[3]The minimum order size was removed on 8 June, 1998.

minimum order size for SETS stocks as mentioned in the previous section, the notion of NMS is still used for calculating the trade size of each transaction which is relevant to post trade publication and other trading rules.

The main trading hours are between 0800hr to 1630hr which is referred as mandatory quote period (MQP) for SEAQ securities. During the MQP, market makers are required to quote prices which are firm up to one NMS. There are indicative quoting periods before and after the MQP when the quote prices are regarded as being indicative only.

The standard trade report deadline in the LSE is within three minutes of execution of the transaction or before the end of the trade reporting period, whichever is the earlier. When a transaction is effected outside the trade reporting period, the trade report must be submitted before 07.45 hours during the next trading reporting period. A trade report is automatically generated for the transaction by the electronic trading systems (for example, SETS). All trade reports are subject to immediate publication by the LSE, except for the block trade reporting[4].

At first glance it would be easy to conclude that, in the LSE, some stocks

[4]A block trade facility can be used by dealers and brokers in order to defer publication of a block trade in the quote driven trading system (SEAQ). A transaction is qualified as a block trade if it is at least 75 times the NMS for a security with NMS of 2,000 shares or above, or 50 times the NMS for a security with NMS of 1,000 or 500 shares. Worked principal agreements ("WPA") replaced the use of protection of block trades for transactions in SETS securities and portfolio transactions which include SETS securities. Any agreement to effect a transaction at some future time as principal, in either an individual SETS security in a size exceeding 8xNMS of the stock concerned or to transact a portfolio trade which includes SETS securities, will be eligible to be treated as a worked principal agreement.

(namely, the largest FTSE stocks) are traded via an order system (SETS) whilst others are traded through a dealer system (SEAQ). However, the ability of dealers still to quote for the largest stocks means that the distinction is not so clear-cut. For order book securities, members can still act as a counter-party for all order sizes and can conduct trades by phone, outside the central limit order book. Particularly large trades or trades with non-standard conditions can be negotiated away from the order book, enabling firms which commit risk capital to large trades to continue to do so. Those trades can be executed at any price, though, in practice, price formation is mainly established through the order book, with 75% of all business being conducted at order book prices (Demarchi and Foucault, 1999).

3 Data

The data is sourced from the TDS database that is provided directly by the London Stock Exchange.[5] The dataset contains every transaction, limit order and quote that took place on the exchange for two distinct periods, October 1994 to June 1996 and August 1998 to December 2001. Each transaction record includes the name of the traded stock, the transaction price, the date and time of the trade, the number of shares traded and the dealing capacity of the buyer and seller (that is, whether they acted as an agent representing

[5] Other studies that have used this data are Reiss and Werner (1995), Board and Sutcliffe (1995), Snell and Tonks (1995), Lai (1996), Gemmill (1996), Hansch and Neuberger (1996), Hansch, Naik and Viswanathan (1999) and Naik and Yadav (2003a 2003b).

an order from the public or as a principal in the transaction.)[6]

The early period of October 1994 to June 1996, which we will denote as the SEAQ period, is characterized by a pure competitive dealership market. The later period of August 1998 to December 2001 corresponds to a hybrid trading system where, for the most liquid securities (around 150 in number), traders could choose whether to post a market or limit order on an anonymous electronic order book (known as SETS) or alternatively deal directly with a dealer in the same way as the SEAQ system prior to the exchange reforms. For all other securities on the exchange, trading has continued under the SEAQ system.

Securities are included or excluded in our sample based upon strict selection criteria. First, to be included, a security had to exist both at the beginning of the sample period, October 1994 and at the end of the period, December 2001. Second, each security must have traded at least once every trading day during the combined sample periods. Finally, if a security underwent a stock split it was removed from the sample. After the filtering rules were implemented, 120 securities were left in the sample.

Of the 120 securities, 61 remained on the SEAQ system during both sample periods. 37 securities moved to SETS at the inception of the new system in October 1997 and 22 securities migrated from SEAQ to SETS during the 98-01 sample period. Because of the possibly problematic issues

[6] This is an explicit identifier unlike the inferred identifier developed by Lee and Ready (1991).

in measuring the trading frictions of these latter firms, we omit them from our analysis.

For each period, we utilize time-stamped trade, quote and limit order data. Transactions are time-stamped by the exchange to the minute, whereas for quote and order data, the information is time-stamped to the second. As a result of the inherent limitations in time-stamping prior to the trading reforms, we match transaction data with quote/order data to the minute for the SEAQ period and to the second for the SETS period.

To give as comprehensive analysis as possible, we define a number of friction measures that cover different aspects of the overall frictions faced by traders in financial markets.

3.1 Measures of Total Frictions

Following Stoll (2000), we define the Quoted Half Spread (QHS) to be a measure of the total cost of trading, which includes both real and informational frictions. In effect, the quoted spread is the total cost of a round trip trade assuming that trades take place at the inside bid and offer prices. The Quoted Half Spread then, is the cost of one transaction. In order to form comparisons with the order book, we also use the measure, described below, of Notional Quoted Half Spread (NQHS).

An alternative measure of the QHS is the Signed Effective Half Spread (SEHS). SEHS is a more accurate measure of total friction because it uses the transaction price instead of the inside quote, thus giving the actual gross

cost of trading which is faced by a demander of immediacy. Since trades normally take place inside the quotes in dealer markets, the SEHS will normally be less than the QHS. However, on order driven systems, it is likely to be higher because large orders may execute against more than one limit order. Formulae for the various measures are shown below:

- Quoted Half Spread (QHS): Half the quoted bid-ask spread associated with a transaction.

$$QHS_t = \frac{(a_t - b_t)}{m_t} \tag{1}$$

  Where a_t, b_t, and m_t are the best-ask, best-bid, and mid price at time t respectively.

- Notional Quoted Half Spread (NQHS): Available only for order book transactions. The measure is calculated as the weighted spread on the order book assuming that a transaction of a number of shares equal to one Normal Market Size (NMS) took place at the same time as each actual transaction. The measure provides a comparative measure of QHS on the order book in relation to the SEAQ system where quotes are solid up to 1 NMS.

$$NQHS_t = \frac{(oa_t - ob_t)}{om_t} \tag{2}$$

  Where oa_t, ob_t, and om_t are the best volume weighted ask, bid, and mid price respectively on the limited order book with accumulated size

up to on NMS.

- Signed Effective Half Spread (SEHS): Half the effective spread associated with the transaction. The SEHS is the difference between the transaction price and the midpoint of the prevailing inside bid-ask quotes. The measure is signed because the identity of the trade initiator is given in the data set.

$$SEHS_t = \left\{ \begin{matrix} \frac{(p_t - m_t)}{m_t}, \text{for public-buy} \\ \frac{-(p_t - m_t)}{m_t}, \text{for public-sell} \end{matrix} \right\} \tag{3}$$

Where p_t, and m_t are the trade and mid price at time t respectively.

3.2 Measures of Real Frictions

The SEHS can be decomposed into two components, the Signed Realized Half Spread (SRHS) and the Signed Adverse Selection Half Spread (SAHS). The Signed Realized Half Spread is a measure of the real frictions facing public investors and is the expected price change conditional on a trade being a public buy or sell transaction. In aggregate, the measure determines the real earnings made by suppliers of immediacy and is thus a measure of the real costs to public investors or demanders of immediacy.

- Signed Realized Half Spread (SRHS): Half the Realized spread associated with the transaction. The SRHS is the difference between the transaction price and the midpoint of the prevailing inside bid-ask

quotes sixty minutes after the transaction.

$$SRHS_t = \left\{ \begin{array}{c} \frac{(p_t - m_T)}{m_t}, \text{for public-buy} \\ \frac{-(p_t - m_T)}{m_t}, \text{for public-sell} \end{array} \right\} \tag{4}$$

Where p_t, and m_t are the trade and mid price at time t respectively, m_T is the mid price at time $t + 60$minutes.

The Traded Spread (TS) is another measure of real trading frictions, similar to the Signed Realized Half Spread (SRHS). Like the SRHS, the Traded Spread measures the aggregate revenues that suppliers of immediacy earn from their trading activities.

- Traded Spread (TS): The difference between the average price of public buy trades and the average price of public sell trades in a pre-defined period. Two measures of TS are calculated and are based on either equally weighting all trades or weighting each trade observation by the number of shares traded.

$$TS1 = \frac{(\overline{P_a} - \overline{P_b})}{2 \times \overline{P}} \tag{5}$$

Where $\overline{P_a}$ and $\overline{P_b}$ are the daily average price of public sell and buy trades. $\overline{P}$ is the daily average trade price.

$$TS2 = \frac{(\overline{P_A} - \overline{P_B})}{2 \times \overline{P}} \tag{6}$$

Where $\overline{P_A}$ and $\overline{P_B}$ are the daily volume-weighted average price of public sell and buy trades. $\overline{P}$ is the daily average trade price.

3.3 Measures of Informational Frictions

The Signed Adverse Selection Half Spread (SAHS) is a measure of friction attributed to the informational component of the SEHS. In effect, it measures the loss or gain, due to post-trade price movements, that suppliers of immediacy incur while holding the security in their inventory. A negative figure would indicate that the supplier of immediacy has incurred a loss on part of the spread revenue arising from a transaction.

- Signed Adverse Selection Half Spread (SAHS): Half the adverse selection half spread associated with the transaction. The SAHS is the difference between the midpoint of the prevailing inside bid-ask quotes at the time of the transaction and the prevailing inside bid-ask quotes sixty minutes after the transaction.

$$SAHS_t = \left\{ \begin{array}{l} \frac{(m_t - m_T)}{m_t}, \text{for public-buy} \\ \frac{-(m_t - m_T)}{m_t}, \text{for public-sell} \end{array} \right\} \tag{7}$$

Where m_t id the mid price at time t, and m_T is the mid price at time $t + 60$minutes

We further screened the data by filtering out obvious errors in the data.[7] These included cases where the Quoted Half Spread (QHS) and Notional Quoted Half Spread (NQHS) was negative; the absolute value of SEHS was greater than 200 basis points; a transaction by transaction return of twenty percent or more was recorded; and where the SEHS was of the wrong sign given the trade direction.

4 Empirical Characteristics of Trading Frictions

4.1 Levels of Trading Activity by Trading System

Table 1 presents summary statistics of market activity for different trading systems. Several dimensions of information can be taken from this table. First, we can examine the difference in trading activity for the sample of securities that remained on SEAQ during both test periods and compare this to securities that moved to SETS upon initiation of the new system.

To satisfy the criteria for inclusion on the SETS electronic order book, a firm had to be in the very largest group of securities listed on the exchange. This was initially capped by the Stock Exchange at only those firms which

[7] The TDS transaction data is effectively an audit trail of transactions, limit orders and quotes placed on the London Stock Exchange. As a result, whenever a data entry was typed incorrectly, a reversing transaction was made to cancel out the original erroneous one. The correct transaction would additionally be entered at a later time. This type of data collection problem would naturally lead to strange values for the spread measures.

were included in the FT 100 share index. As a result, the SETS sample of securities will be significantly more liquid than the SEAQ sample.

In the pre-reform period, SETS securities had greater than six times more trades per day as compared to SEAQ securities. The average trade size was substantially larger, with the mean trade in SETS securities being approximately £57,360 against £29,280 for the smaller firms in the SEAQ group.

The average number of buys and sells indicate that SETS stocks were traded more heavily than was the case for SEAQ stocks, and this is particularly true on the sell side. Whilst the number of buys was slightly higher than the number of sells in the case of SEAQ stocks, the situation is reversed for SETS stocks, with there being 65% more sells than buys - this suggests that on the buy side trades took place in bigger blocks than the sell side.

Subsequent to the October 1997 reforms, there appears to be a noticeable shift in the nature of trading that took place on the London Stock Exchange. During the later period, securities that were listed on SETS could also be traded off the order book. As a result, traders had an incentive to place their orders at the location that minimized their execution costs. SEAQ-listed securities had no option but to be traded in the dealer market.

The most striking change is that the number of trades that were made in SETS securities increased by over 280% compared to those on SEAQ, which remained similar to the earlier period. At the same time, transaction sizes fell in magnitude for both samples. The fact that trading activity increased

whereas average transaction sizes fell, would indicate, at first glance, that transaction costs fell during the 98 to 01 sample period. This may not be the whole picture, however, since consistent with Barclay and Warner (1993), it may also be evidence of stealth trading by informed traders who disguise trades through splitting up their orders.

An examination of the distribution of trades for SETS securities that took place on and off the order book may provide more information on this hypothesis. In terms of total number of trades and trade size, the distribution of these measures is very similar for both trade locations. However, an examination of the distribution of buys and sells shows a significantly higher number of buy transactions taking place on the order book. Taken together with the fact that higher buying activity, which is normally *more* associated with informed trading than selling activity[8], occurred on the anonymous electronic order book, we suggest that the perceived gains in efficiency may not be all they first seem.

4.2 Levels of Frictions by Trading System

Table 2 presents summary statistics associated with various frictions on different trading platforms in each sample period. As suggested by the change in trading activity in Table 1, there is also a major shift in the level of trading

[8]Insider trading research (Seyhun (1986), Hillier and Marshall (2002), among others) has examined the differential share price reaction to corporate insider buy and sell trades. The consensus findings are that buy trades are associated with significant positive price movements whereas sell trades lead to a much smaller fall in prices.

frictions.

We will again approach the analysis from various perspectives. First, because of the difference in size and trading liquidity of the SEAQ and SETS sample, all the friction measures are significantly smaller for SETS securities. This is a consistent finding across both sample periods. For example, Quoted Half Spreads for SETS securities in the 94-96 period were just under fifty percent of the trading frictions experienced by investors in SEAQ securities.

In the 94 to 96 period, real frictions contributed roughly similar proportions to the total spread for large and small firms alike. For SETS securities, approximately 93% of the SEHS was caused by real frictions (SRHS) compared to 95% for SEAQ securities.

The move to a hybrid trading system brought with it different dynamics in the informational and real components of the spread. Moreover, it does not appear that these changes were entirely for the benefit of public investors. For SEAQ securities, total frictions (SEHS) increased by 17.84% from 66.36 basis points to 78.20 basis points. For SETS securities, the effect was the opposite with the average SEHS falling from 32.45 basis points to 22.66 basis points, a decrease of approximately 30%.

While the fall in total frictions at first glance appears to be beneficial for SETS securities, an analysis of the informational component of the spread indicates that this increased significantly for order book trading. To be more specific, approximately 50% of the total frictions faced by investors in SETS securities in the post-reform period was a result of informational frictions or

adverse selection risk. This compares to only 7% for the pre-reform period.

A further analysis of the cause of such a large increase in frictions attributed to informational risk, indicates that this comes almost completely from trading that took place on the order book. By decomposing all trades for SETS securities into those that took place off and those on SETS, one can see that for public trades that took place off SETS, the informational component of the spread was roughly similar in both pre and post reform periods. Comparing this to order book trades, it can be seen that approximately 75% (16.28 basis points for SAHS as compared to 21.80 points for SEHS) of the spread is caused by information or adverse selection risk.

4.3 Trading Frictions by Firm Size

Table 3 shows the empirical distribution of firm sizes in the sample. As stated previously, SEAQ firms are smaller than SETS firms because of the SETS inclusion criteria that was imposed by the London Stock Exchange. To determine whether trading frictions are an issue that is more closely related to size than trading system, we split our sample into five equal sized groups of approximately twenty securities each.[9] This stratification of companies by size leads to three portfolios that consist almost entirely of SEAQ securities and two portfolios with mostly SETS securities.

Trading frictions of securities by market value are presented in Table 4. Panel A records the trading frictions of securities in the pre-reform period and

[9] The largest firm size grouping is an exception with eighteen securities only.

Panel B presents the same information for the post-reform period. An examination of both panels in Table 4 shows that total frictions are a decreasing function of market value. Similarly, while SEHS falls for both periods as size increases, the hybrid trading system seems to significantly improve the total costs of trading for SETS stocks. The same cannot be said of SEAQ stocks, where the move from obligatory quote setting by market makers under the pre-reform SEAQ system to a voluntary one subsequent to the reforms has led to a significant increase in trading frictions for securities groups 1 and 3.

A decomposition of the total trading friction (SEHS) into the real (SRHS) and informational (SAHS) components shows that the relative proportion of real frictions to total frictions stayed fairly constant over the two periods. The only exception to this is the largest securities (portfolios 4 and 5), where the information component of the spread was significantly higher after the reforms.

4.4 Trading Frictions by Transaction Size

Barclay and Warner (1993) hypothesize that informed trading may take place on exchanges in such a way that the most informative trades are likely to be those that are hardest to detect. One such method of avoiding detection is to split orders up into smaller amounts. In addition, if an informed trader has a choice of trading location, he will opt for the one which minimizes the risk of detection.

The London Stock Exchange is a particularly good laboratory in which to

test this hypothesis because traders are able to determine where their order is executed: an anonymous electronic order book or trading directly with a dealer. In the present context, if the Barclay and Warner (1993) stealth trading hypothesis is valid, more informed trading will take place on the order book. The main outcome of this is that the information component of the spread will be proportionately larger for small to midsize transactions on the order book.

An examination of panels A and B in Table 5 shows that, consistent with earlier tables, total frictions increased for SEAQ securities over the time period but fell for SETS securities. This is a result which stands for all trade sizes. The main reason for the fall in spreads in the SETS sample is that real frictions fell significantly as a result of the changeover to the new trading system. This was not the case for SEAQ securities which actually saw an increase in real frictions.

Strikingly, the information component of the spread becomes proportionately more significant for both SEAQ and SETS securities for the two smaller groups of trade sizes (0-1NMS and 1-6NMS) post reform. In particular, those firms that traded on the SETS system experienced substantially high increases in adverse selection risk. For the smallest size transactions, most closely associated with the stealth trading hypothesis, the proportion of the spread attributable to information risk grows from 5% to 45%. Furthermore, when the information spread component (SAHS) is examined off and on book in Panel C of Table 5, it is noticeable that it is almost four times larger 'on

book' as compared to 'off book' for the smallest trade sizes – thus confirming the presence of stealth trading via choice of trading location.

5 Conclusions

Market frictions arise for many different reasons. Market participants face real frictions that are incurred directly in order to compensate suppliers of immediacy for their beneficial activities. In addition to providing valuable liquidity, suppliers of immediacy also incur inventory risk for securities that they have been bought or sold from demanders of immediacy.

Another group of frictions relates primarily to information risk. First, it could be argued that suppliers of immediacy or liquidity provide a free trading option for market participants to exercise at will. Second, in the presence of asymmetric information, a supplier of immediacy faces the possibility that they will lose out to a more informed trader. As a result, liquidity suppliers are paid compensation for overcoming real and informational frictions in the form of a bid-ask spread.

We find that the trading system in which securities are bought and sold has a major impact on the frictions faced by market participants in their trading activity. Based on theoretical and empirical reasoning, we presented several measures of market friction that encapsulated both concepts of real and informational frictions and examined their dynamic characteristics under a variety of different conditions.

Whereas real trading frictions fell for securities that moved from being traded in a competitive dealership market to a hybrid anonymous electronic order book/competitive dealership market, frictions associated with information or adverse selection risk increased significantly. In addition, securities that remained solely within a dealership market, faced higher trading frictions in general.

A particularly interesting result is that different trades elicited different trading frictions. More specifically, small to medium size trades incurred a much higher informational friction than other comparable trades. This result is suggestive of the possibility of stealth trading in the market for these size trades.

The present research has identified some systematic differences in trading frictions across market systems, securities and trade characteristics. An obvious extension is to look at the issue from the perspective of the public trader and examine the role of trading frictions in determining order placement.

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Table 1: Characteristics of Transactions in the Different Exchange Samples

Number of Trades is the average daily number of trades during the sample periods. Trade Size is the average trade size over the sample periods and is denominated in thousand pounds sterling. Number of Public Buys and Public Sales is the average daily number of public buys or sales respectively. Buys/Sales is the net purchase ratio over the period. Data is presented for pre- and post- SETS periods and on (ON) and off (OFF) order book trades (where applicable). The SEAQ sample consists of 61 firms that traded under the SEAQ system in both periods. The SETS sample consists of 37 firms that switched from SEAQ to SETS at the initiation of the SETS trading system.

Period	94-96		98-01			
FTSE	SEAQ	SETS	SEAQ	SETS	SETS	SETS
Trade type					Off	On
Number of Trades	19.68	129.46	22.19	492.02	233.09	259.28
Trade Size	29.28	57.36	19.71	41.97	35.35	47.94
No. Public Buys	10.12	48.93	10.56	218.28	95.17	123.28
No. Public Sales	9.55	80.54	11.63	263.54	131.66	132.06
Buys/Sales	0.87	0.94	0.55	0.80	0.55	0.97

Table 2: Summary of Spread Measures for Different Exchange Samples

In terms of total frictions, this table presents quoted half spreads (QHS), notional quoted half spreads (NQHS) and the signed effective half spreads (SEHS) In terms of real frictions, the signed realised half spread (SRHS) and traded half spreads (TS1 and TS2) are reported. The traded half spread (TS1 and TS2) is the difference between the average price of trades on the ask side less the average price of trades at the bid side. The trade prices are equally weighted (TS1) or weighted by shares traded (TS2). The signed adverse selection half spread (SAHS) is used to capture information frictions. The SRHS and SAHS measures are calculated with a 60 minute lag. All the spreads are relative measures in basic points. Data is presented for pre- and post- SETS periods and on (ON) and off (OFF) order book trades (where applicable). The SEAQ sample consists of 61 firms that traded under the SEAQ system in both periods. The SETS sample consists of 37 firms that switched from SEAQ to SETS at the initiation of the SETS trading system in 1997.

Period	94-96		98-01			
FTSE	SEAQ	SETS	SEAQ	SETS	SETS	SETS
Trade Type					Off	On
Total Frictions						
QHS	77.68	36.60	95.15	26.26	31.33	21.19
NQHS				154.60	158.94	150.79
SEHS	66.36	32.45	78.20	22.66	23.39	21.80
Real Frictions						
SRHS	63.08	30.04	72.49	11.84	17.96	5.52
TS1	62.91	30.04	75.37	13.81	13.19	12.22
TS2	61.68	30.15	74.57	13.40	11.93	12.56
Information Frictions						
SAHS	-3.28	-2.41	-5.71	-10.35	-4.43	-16.28

Table 3: Summary of Market Capitalisation Categories

This table presents the distribution of firms in the total sample of 98 securities as categorised into 5 market capitalisation groups. Groups are constructed so as to ensure that 20 firms are in each grouping with the largest (5) group having only 18 firms. The SEAQ sample consists of 61 firms that traded under the SEAQ system in both periods. The SETS sample consists of 37 firms that switched from SEAQ to SETS at the initiation of the SETS trading system in 1997.

	94-96		98-01	
MarketCap Group	SEAQ	SETS	SEAQ	SETS
1 (Smallest)	20	-	20	-
2	20	-	20	-
3	19	1	19	1
4	2	18	2	18
5 (Largest)	-	18	-	18

Table 4: Spread Distribution by Market Value Groupings

In terms of total frictions, this table presents quoted half spreads (QHS), notional quoted half spreads (NQHS) and the signed effective half spreads (SEHS). In terms of real frictions, the signed realised half spread (SRHS) and traded half spreads (TS1 and T2) are reported. The traded half spread (TS1 and TS2) is the difference between the average price of trades on the ask side less the average price of trades at the bid side. The trade prices are equally weighted (TS1) or weighted by shares traded (TS2). The signed adverse selection half spread (SAHS) is used to capture information frictions. The SRHS and SAHS measures are calculated with a 60 minute lag. All the spreads are relative measures in basic points. Data is presented for pre- and post- SETS periods and on (ON) and off (OFF) order book trades (where applicable). The SEAQ sample consists of 61 firms that traded under the SEAQ system in both periods. The SETS sample consists of 37 firms that switched from SEAQ to SETS at the initiation of the SETS trading system in 1997.

Panel A 94-96					
Marketcap Group	1	2	3	4	5
Total Frictions					
QHS	113.16	67.46	50.29	48.88	28.26
SEHS	97.11	58.01	41.79	42.58	26.06
Real Frictions					
SRHS	92.85	55.26	39.06	39.49	24.22
TS1	92.11	55.67	39.03	40.12	23.89
TS2	90.25	53.88	39.67	38.20	25.44
Information Frictions					
SAHS	-4.25	-2.74	-2.73	-3.08	-1.85
Panel B 98-01					
Marketcap Group	1	2	3	4	5
Total Frictions					
QHS	168.40	63.20	61.44	30.97	19.29
NQHS			147.44	142.29	169.31
SEHS	144.73	50.10	46.28	26.50	16.90
Real Frictions					
SRHS	136.83	45.10	40.55	16.14	7.42
TS1	145.45	47.91	42.52	17.83	9.52
TS2	143.46	47.35	42.41	16.37	10.43
Information Frictions					
SAHS	-7.90	-5.00	-5.65	-9.84	-9.17

Table 5: Spread Distribution by Trade Size Groupings

This table presents quoted half spreads (QHS), signed effective half spreads (SEHS), notional quoted half spread (NQHS), signed realised half spread (SRHS), signed adverse selection half spread (SAHS). The SRHS and SAHS measures are calculated with a 60 minute lag. The traded half spread (TS1 and TS2) is the difference between the average price of trades on the ask side less the average price of trades at the bid side. The trade prices are equally weighted (TS1) or weighted by shares traded (TS2). All the spreads are relative measures in basic points. Data is presented for pre- and post- SETS periods and on (ON) and off (OFF) order book trades (where applicable). The SEAQ sample consists of 61 firms that traded under the SEAQ system in both periods. The SETS sample consists of 37 firms that switched from SEAQ to SETS at the initiation of the SETS trading system in 1997.

Panel A SEAQ

Period		94-96			98-01	
Sizegroup	0-1NMS	1-6NMS	6+NMS	0-1NMS	1-6NMS	6+NMS
Total Frictions						
QHS	77.43	75.34	77.16	95.37	95.71	102.89
SEHS	66.51	60.75	74.85	77.96	82.53	97.61
Real Frictions						
SRHS	64.61	53.05	61.91	73.31	68.6	84.5
TS1_NewQ2	63.02	54.62	57.7	74.87	77.37	100.12
TS2_NewQ2	60.94	54.78	57.79	73.71	77.47	100.65
Information Frictions						
SAHS	-1.9	-7.68	-12.72	-4.65	-13.93	-13.11

Table 5 Continued

Panel B SETS						
Period	94-96			98-01		
Sizegroup	0-1NMS	1-6NMS	6+NMS	0-1NMS	1-6NMS	6+NMS
Total Frictions						
QHS	36.63	35.56	38.5	26.2	30.41	37.66
NQHS				154.55	143.54	130.96
SEHS	32.21	36.04	55.04	22.64	31.58	46.07
Real Frictions						
SRHS	30.42	23.26	42.85	11.86	14.24	33.24
TS1	30.04	27.19	40.93	13.82	10.81	16.41
TS2	27.77	27.59	41.66	13.07	11.08	16.8
Information Frictions						
SAHS	-1.79	-12.78	-11.87	-10.36	-12.26	-8.03

Panel C SETS 98-01 Trade Type						
Trade Type	Off			On		
Sizegroup	0-1NMS	1-6NMS	6+NMS	0-1NMS	1-6NMS	6+NMS
Total Frictions						
QHS	31.34	30.66	37.71	21.19	32.3	19.09
NQHS	158.93	146.5	131.1	150.82	64.24	87.83
SEHS	23.32	31.46	46.12	21.79	42.45	25.7
Real Frictions						
SRHS	18.1	14.53	33.35	5.53	7.56	13.82
TS1	13.21	10.48	16.41	12.22	34.77	NULL
TS2	11.29	10.8	16.8	12.52	33.84	NULL
Information Frictions						
SAHS	-4.33	-11.7	-7.97	-16.26	-34.89	-11.89