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INSIDER TRADING, REGULATION AND THE COMPONENTS OF THE BID-ASK SPREAD

ABSTRACT

Insiders pose a risk to providers of liquidity, who require compensation for this and consequentially widen spreads. In this paper we investigate the relationship between insider trading regulation and the cost of trading by decomposing the components of the spread before and after the enactment of strict new laws. We find a significant decrease in information asymmetry, which is mainly observed in illiquid and high pre-change information asymmetry companies. Results are robust to model specification. We also see a decrease in the contribution of information asymmetry to price volatility. Overall, our results may have implications for markets with similar characteristics.

JEL Codes : C22, D82, G18.
Keywords: Insider Trading Laws, Bid-Ask Spread Decomposition, Regulatory Change.

INTRODUCTION

The bid-ask spread, or the difference between the lowest offered price to sell and highest price to buy, is a measure of the price concession a trader must make for immediacy in a transaction (Demsetz, 1968). This spread is generally seen as consisting of three cost components, order-processing, inventory-holding and information asymmetry costs. While the first two costs, often referred to as real frictions, are directs costs the provider of immediacy incurs, the last component is compensation for trading with a better informed counterpart (Stoll, 2000). If unregulated, insider trading (trades by directors, executives and large shareholders) can represent a large proportion of the last component and can increase the cost of trading markedly. In illiquid markets, where insiders may represent a substantial proportion of trades, the impact on spreads would be even more detrimental for the market as a whole. In such markets, effective regulation may reduce information asymmetry, spreads and increase overall market efficiency.

Because of the damaging effects of insider trading, 80% of countries with financial markets have regulations that limit this behavior (Bhattacharya and Daouk, 2002). It has also been shown that such laws reduce the harm from insider trading in a number of areas such as reducing the cost of capital (Bhattacharya and Daouk, 2002), increased liquidity, more accurate prices and wider share ownership (Beny, 2005), and increased analyst following (Bushman, Piotroski and Smith, 2005). Further, Chung and Charoenwong (1998) find that firms with more prevalent insider trading have wider spreads. This supports the theoretical models of Copeland and Galai (1983), Kyle (1985) and Glosten and Milgrom (1985) and others, that establish a positive relationship between informed trading, information asymmetry and spreads. While the relationship between informed trading and spreads has been well established, the role of regulation and its impact on the components of the spread remains unexplored. The effect reduction such regulation may have on information asymmetry is of particular relevance to small and illiquid markets. In this paper we address this issue within such a setting.

Our first and main contribution is to explore the effect insider trading regulation has on the cost of trading. In particular, we are interested in how a change in regulation affects the information asymmetry component of the spread. Changes in regulations are not observed frequently. However, in 2002, New Zealand changed its legislation with respect to insider trading (Securities Market Amendment Act 2002) providing a prime opportunity to investigate this issue. We apply the Madhavan, Richardson and Roomans (1997), hereafter MRR, decomposition model to a sample of 70 of the most liquid New Zealand Stock Exchange listed companies before and after the introduction of significantly stricter insider trading regulations. We find a significant drop in the proportion of information asymmetry following the introduction of the new legislation. Conjointly, we observe a decrease in the spread and a significant decline in the contribution of information asymmetry to price volatility. As our second contribution, we separate the sample based on liquidity (number of trades) and pre-change information asymmetry. We find a large significant decrease in the most illiquid firms and those with the largest asymmetry, indicating that the regulation was most effective for these firms. Finally, because estimated components are sensitive to model specification (see De Jong *et al*., 1996) we employ Glosten and Harris (1988) as a robustness check. Our results confirm the notions of La Porta et al. (2000), who state that government intervention is vital in reducing the prevalence and problems associated with insider trading.

The purpose of the Securities Market Amendment Act 2002 (SMAA), enacted in December 2002 was to correct major weaknesses in the previously enacted legislation. Before the enactment, enforcement was left to individual traders and the issuing company, and only large block holders were obliged to disclose in a timely fashion. As a consequence, these laws were never successfully enforced and insider profitability was large. Among other changes, the new laws required continuous disclosure by all insiders and allowed the Securities Commission to prosecute insiders.[i] These were significant changes over the previous system and were enacted to reduce the prevalence of insider trading. The public enforcement by the Securities Commission should increase the chance of detection and prosecution making insider trading more costly. In addition, the continuous disclosure regime aims to reduce insider's trading and their profits.

The changes enacted in December 2002 demonstrated a renewed political will to address this problem as well as fixing glaring weaknesses which had undermined the previous legislative regime. These represent key problems in a number of markets around the world (Stamp and Walsh, 1996) and evidence of the impact of policy changes may prove useful for those markets. Also as suggested by our results, the impact of regulation is particularly important as insiders make up a relatively greater proportion of trades in an illiquid market.

The remainder of the paper is structured as follows. Section 2 describes the model applied in this paper. Section 3 details the data employed and gives some summary statistics on the sample. Section 3 lays out our findings while in section 4 we conclude the paper.

THE MODEL

To compare information asymmetry components of the spreads we employ a decomposition model. Two common types of models have been developed. The first type relies on serial covariances of the time series of trades and quotes to decompose the spread (e.g. George, Kaul and Nimalendran (1991), Stoll (1989), Roll (1984)). The components could be inferred by analyzing how dealers update their quotes after a trade occurred. One weakness of these models, however, is their use of quoted spread rather than the more relevant traded spread, which is a better measure of the actual cost of trading. For this reason we use the second type of decomposition models, the trade indicator models.

Trade indicator models rely on identifying whether a trade was buyer or seller initiated and relating that to changes in prices. Of this type there are three main models, Glosten and Harris (1988), MRR and Huang and Stoll (1997). Huang and Stoll (1997) propose a model which explicitly decomposes prices into all three of the costs commonly associated with spreads, order-processing, inventory-holding and information asymmetry. The explicit decomposition of the inventory-holding costs however, makes the model of Huang and Stoll (1997) inappropriate for use in a market with an electronic limit order book (LOB). In these markets inventory costs play little or no role in the setting of prices. (Ahn, Cai, Hamao and Ho, 2002; Chung, Van Ness and Van Ness, 2004). The models of Glosten and Harris and MRR, which have been applied to LOB markets (e.g. Ahn et al., de Jong, Nijman and Roell, 1996), are more suitable as they model only two components, permanent price impacts, which cover information asymmetry, and transitory price effects, which covers both order-processing and any inventory-holding costs. The difference in the treatment of the inventory holding costs is the reason we prefer the Glosten and Harris and MRR models to that of Huang and Stoll. The Huang and Stoll model also results in a high proportion of implausible estimates providing another reason to rely on MRR and Glosten and Harris (Van Ness, Van Ness and Warr, 2001).

Both MRR and Glosten and Harris (1988) rely on the assumption that the unobserved efficient price (μ_t) is affected by two sources of information, private information held by informed traders and public market-wide information (ε_t). When informed traders are present, the revelation of their information through order flow has a direct impact on revisions in the efficient price. Let x_t be a trade indicator that is equal to 1 if a trade is buyer initiated, -1 if it is seller initiated and zero if a trade occurs within the spread. MRR argue that part of the order flow is predictable, therefore information asymmetry should be related to the proportion of order flow that comes as a surprise. They assume this surprise can be measured by x_t - $E\lfloor x_t \mid x_{t\ 1} \rfloor$, where $E\lfloor x_t \mid x_{t\ 1} \rfloor$ is the expected trade direction conditional on the previous trade indicator and is measured by the first-order auto-correlation (i.e. $E[x_t \mid x_{t-1}] = \rho x_{t-1}$).[ii] Therefore the innovation in the efficient price is

$$\mu_t = \mu_{t-1} + \theta(x_t - \rho x_{t-1}) + \varepsilon_t\,, \tag{1}$$

where θ measures the information asymmetry.

Liquidity providers, who face order processing and inventory costs associated with trading, provide quotes for the ask (p_t^a) and bid (p_t^b) prices at time *t* such that the post-trade expected transaction price is adjusted for their costs. The quoted prices can thus be defined as

$$p_t^a = \mu_{t-1} + \theta(x_t - \rho x_{t-1}) + \phi + \varepsilon_t$$
$$p_t^b = \mu_{t-1} - \theta(x_t - \rho x_{t-1}) - \phi + \varepsilon_t$$

for ask and bid, respectively, where ϕ is the per share compensation for these costs. The traded price is a consequence of these quoted prices and is given as

$$p_t = \mu_{t-1} + \theta(x_t - \rho x_{t-1}) + \varepsilon_t + \phi x_t + \xi_t , \qquad (2)$$

where ξ_t captures the effects of price discreteness. Expressing (2) in first differences we obtain

$$p_t - p_{t-1} = \theta(x_t - \rho x_{t-1}) + \phi(x_t - x_{t-1}) + u_t \qquad (3)$$

where $u_t = \varepsilon_t + \xi_t - \xi_{t-1}$.

To estimate (3), we employ Generalised Methods of Moments (GMM) using the orthogonality conditions

$$E\begin{pmatrix} x_t x_{t-1} - x_t^2 \rho \\ u_t - \alpha \\ (u_t - \alpha)x_t \\ (u_t - \alpha)x_{t-1} \end{pmatrix} = 0 , \qquad (4)$$

where α captures the drift in returns and u_t follows from (3). The orthogonality conditions applied are essentially OLS conditions with an additional condition to identify ρ. The advantage of using GMM is that it places no distributional assumptions resulting in more accurate standard errors. Since, the error term in (3) is auto-correlated, we control for heteroskedasticity and auto-correlation in the standard errors using a Newey-West (1987) correction. In the estimation of the model we scale all price data by 100.

III. DATA AND SAMPLE

The New Zealand Exchange is one of the smallest and least liquid, developed market around the world (see Bhattacharya and Daouk, 2002). Over the course of our sample period, the exchange had between 149 and 164 domestic issuers of equity, with a market capitalisation in August 2004 of $NZ 37 billion. It also averaged between 40,000 and 60,000 trades per month valued at around NZ$2 billion. The market runs an electronic limit order book with no designated market makers. There are, however, a number of market participants that do act to provide liquidity in the market, although they have no regulatory obligation to do so. The exchange also runs a pre-opening session (between 9-10am) during which buys and sells can cross and the opening price is set to clear the market. There is also a post-close period (between 5-5:30pm) to allow for post-trading adjustment of orders, although price and trade changes are governed by a tight set of rules. As prices are set under different mechanisms in these periods we exclude all trades that fall outside the normal trading hours.

We obtain intraday transaction data including the bid and ask quotes at the time of the trade from the New Zealand Exchange (NZX). The data contains the transaction price, volume, time of the trade (rounded to the nearest second) and the best bid and ask quote at the time of the trade. We restrict our sample to the 70 most liquid companies to ensure enough data is available to estimate the model. The selected companies had at least 5 trades per day over the total sample period. As the data does not contain information about whether trades are buyer or seller initiated, we use quotes to determine the trade indicator. This is accomplished by comparing the trade price to the prevailing bid/ask prices. Under this method trades inside the spread are left as undetermined. The matching classification rule of Lee and Ready (1991) cannot be applied in this case, because quotes were only available at the time of the trade.

We examine the period from January 2001 to August 2004 which covers a period of roughly 2 years either side of the date of enactment, 1 December 2002. We examine two periods, pre-change and post-change. We employed two pre-change periods for both the 12 and 18 month samples. This was a robustness check to test for possible potential pre-emption of the benefits of the act as the probability of its enactment increased. The first pre-change samples ran from December 2001 (12 month sample) and June 2001 (18 month sample) to November 2002 while the second sample ran from July 2001(12 month sample) and January 2001 (18 month sample) to June 2002[iii].

The post-change period runs from March 2003 and ends at the end of February 2004 (12 month sample) or August 2004 (18 month sample). The delay in starting the post-change period following the introduction of the act is to control for delays in the implementation of the act. By the start of March the provisions of the SMAA had been completely introduced, therefore, the full impact should be observed in the estimated parameters.

Table 1 gives sample summary statistics on a number of indicators over both the full sample period and pre/post-change subsamples. As can be seen the average number of trades are around 19 per day, with a median value of 11, substantially smaller than the median value of 66 observed in MRR for US stocks. The average dollar spread for the sample is relatively low at 2.6c per share, however, given the low share prices (around NZ$3 per share), we observe a very large percentage spread, averaging 1.19%. These percentage spreads are much higher than spreads observed in other studies. MRR observe a percentage of around 0.6%, similar to results found by Ahn et al. (2002) and Brockman and Chung (1999) who consider markets with limit order books. When we separate the sample into pre- and post-change we observe a significant drop in both absolute and percentage spreads. However, we do not observe a significant change in the other market variables (number of trades and price level) implying that market conditions have remained similar. Dollars spreads drop by nearly a quarter, with a 0.25% decline in average percentage spread. Finally, we observe evidence of a significant downward trend in the median volatility in daily prices pre- and post-change, although we observe a slight increase in average volatility. This implies that absent a handful of companies, the majority of the sample appears to be less volatile following the new regulations.

V. RESULTS

If the change in legislation has reduced the incidence and profitability of insider trading, it would be expected that the proportion of the spread accounted for by information asymmetry would have decreased between the pre- and post-change subperiods. Table 2 gives details of the parameter estimates employing both the full sample period, and the pre and post-change sub-periods. Overall, all parameter estimates have low standard errors suggesting the parameters are estimated with great accuracy. Hence the low liquidity of stock in the sample causes no estimation problems. Further, Van Ness, Van Ness and Warr (2001) find that MRR gives improbable values 18% of the time. In our sample, however, we find on average implausible component estimates in only around 5%.

The full sample estimates show that the average proportion of information asymmetry is over 58%, although the median value is higher at 60%. This suggests that a handful of stocks have a lower proportion, which has driven the average down. This pattern is common across the estimates regardless of the length or timing of the sample period.

The influence of the change in regulations that occurred can be seen in the differences in the parameter estimates in the pre- and post-change sub-samples. The information asymmetry component, θ, is lower after the introduction of the laws with a decrease of nearly 0.2. This effect is also observed in the decrease in the median value. The decrease in θ has also resulted in a reduction in the proportion of information asymmetry (IA) between the pre- and post-change periods despite the concurrent decrease in the mean value of ϕ, representing order-processing and inventory holding costs.

In the pre-change subperiod, nearly 59% of the spread is attributable to adverse selection costs. This is higher than has been found in most other studies of the components of the spreads. IA has typically been observed to make up less than 50% of the spread regardless of the model followed and the markets studied. For the US studies have found IA proportion between 35-50% (Stoll (1989) 43%, MRR 35-

51%, Affleck-Graves, Hedge and Miller (1994) 43%, Lin, Sanger and Booth (1995) 39.2%, Kim and Ogden (1996) 50%). Similar results are found for London (Menyah and Paudyal (2000) 47%), Tokyo (Ahn et al. (2002) between 44-57%) and Hong Kong Stock Exchanges (Brockman and Chung (1999) 33%).

After the regulatory change, the IA component has decreased by approximately 4% to 55%, still higher than found in other markets. This indicates that while the changes have had an impact, insider trading is either still more prevalent here than in other markets. Another possibility is that, as was observed in Bushman et al. (2005), there is some confidence effect where improvements aren't fully realised until the laws have been enforced. The decrease in the proportion of IA is also apparent in the median value which decreased by 5%. The Wald statistics, contained in Panel B, support the decrease observed in both θ and the proportion. Nearly half of the sample had a significant decrease in their θ parameter, while close to 60% had a significant decline in the proportion of the spread made up of information asymmetry costs.

An interesting point though is the decrease in ϕ. This represents a reduction in the order-processing and inventory costs. This could indicate a possible increase in the amount of liquidity in the market in the absence of other changes affecting these costs. This is in line with the major proposed benefit of the SMAA, an increase in confidence in the market and by extension liquidity. However, this improvement appears limited to a handful of companies, as indicated by the contrary median figures and the results of the Wald statistics. The Wald statistics show that while more companies had decreases in ϕ than had increases, the majority of companies had no significant change.

A number of studies have argued that insider trading is greater in smaller and less liquid companies (Friederich, Gregory, Matako and Tonks, 2002; Lakonishok and Lee, 2001). The lack of attention received by these companies from the market allows greater movement from the true price which insiders can exploit to earn larger profits. If the new regulations have been effective, therefore, we would expect to see the greatest reductions in the information asymmetry component from those companies where the changes will have resulted in the largest negative impact on insiders. To examine this we sort the results into two sub-samples based on the number of trades made over the sample period. We took the top and bottom 30 firms leaving the remaining 10 out of the examination to create a clear distinction between the groups. These results are shown in Panel C and conform to the belief that those companies with the greatest IA have been impacted most. The companies with low trades start with a much higher level of information asymmetry, 66% of the spread compared to 52% for high liquidity stocks. The impact of the new laws is also much greater with around a 7% reduction in both the mean and median for the low liquidity stocks, while high trade stocks see a less than 1% decrease in the mean and just over 4% in the median.

We also sort parameter estimates based on the proportion of asymmetry in the pre-change period to see if the effects were greatest for those stocks with the most asymmetry. Again we consider the top and bottom 30 firms. The results are even more pronounced in this case with virtually all of the reduction in the information asymmetry costs of spreads coming from those firms with high asymmetry to start with. What is interesting is the increase in the proportion of IA observed in the median of the low asymmetry group. This is a result of a quite large decrease in the order-processing and inventory holding costs observed in this group making IA a proportionally larger cost. Both sorts show strong evidence of relationship between the level of asymmetry and the level of improvement following the introduction of the new laws.

Finally, Figure 1 shows the proportion of IA plotted on a 12 month rolling basis. The sample is again split and the rolling proportions for the low and high trade groups are plotted along with the full sample results. The graph shows a steep and long-lived decline in the average proportion of both the full sample and the low trade firms starting almost immediately after the introduction of the new laws. High trade firms on the other hand show only a very slight decrease in the IA component around the time of the introduction of the new laws and towards the end of the sample period have higher proportions than the pre-change period. The timing of the decreases for the low trade firms and the size of the decrease certainly suggest the new regulations have been effective in reducing the IA component of the spreads.

As a robustness check we examine the information asymmetry cost component of the spreads using an alternate model. In this case we employed the Glosten and Harris (1988) model which has similar advantages to that of MRR for estimating spread components in a limit order driven market. Their model is also a trade indicator model with the added feature that both the information asymmetry and transitory component (which combines the effects of order-processing and inventory holding costs) are linear functions of the volume traded. The basic model can be expressed as

$$\Delta p_t = \phi_0 \Delta x_t + \phi_1 \Delta x_t V_t + \theta_0 x_t + \theta_1 x_t V_t + \eta_t \qquad (5)$$

where V_t is the volume of the trade at time *t*, and η_t captures the arrival of new information and the effects of price discreteness. Under this model the information asymmetry cost component is $2(\theta_0 + \theta_1 V_t)$ and the transitory component is $2(\phi_0 + \phi_1 V_t)$. We estimate (5) using ordinary least squares. Similar to (3), there is auto-correlation in the error term of the model, therefore we compute standard errors with Newey-West adjustments. We also truncated the sample as per de Jong, Nijman and Roell (1996) by removing all transactions that had twice the median volume traded. This is to remove the effect of large trades as discussed in Hausman, Lo and MacKinlay (1992).

The results in Table 3 present the Glosten and Harris (1988) models parameter estimates and the proportion of information asymmetry. As per the findings of the MRR model we find that the introduction of the act has had an impact on the spread cost components. The Glosten and Harris (1988) estimates are however lower than those found with the MRR which is consistent with other studies (Ahn *et al*., 2002). We do observe significant decreases in both the components making up the information asymmetry component, θ_0 and θ_1. The reduction in these values results in a significant reduction in the proportion of the spread IA composes, down by 1.5%. The patterns that we observe are therefore virtually identical between the Glosten and Harris (1988) and the MRR estimates.

The model of bid-ask decomposition from MRR also allows the influence of the various sources of price volatility to be determined. They note that price volatility is driven by variance in public news shocks and by microstructure frictions. In particular there are 3 major frictions that work on the variance in prices, price discreteness, trading costs and information asymmetry. If the SMAA has been effective in reducing the amount of informational asymmetry in the market, then it would be expected that the portion of price volatility caused by IA should also have been reduced.

As per Madhavan et al. (1997) we add two extra parameters to equation 4. The first is a term to measure volatility caused by news shocks, σ_ε^2, while the second measures the effect of price discreteness on volatility, σ_ξ^2. The variance of price changes follows from (3) as

$$\mathrm{var}[\Delta p_t] = \sigma_\varepsilon^2 + 2\sigma_\xi^2 + (1-\lambda)[(\theta+\phi)^2 + (\rho\theta+\phi)^2 - 2(\theta+\phi)(\rho\theta+\phi)\rho], \quad (6)$$

where λ measures the variance of the trade indicator. To identify the additional parameters, two extra orthogonality conditions are added

$$E\begin{pmatrix} (u_t-\alpha)^2 - (\sigma_\varepsilon^2 + 2\sigma_\xi^2) \\ (u_t-\alpha)(u_{t-1}-\alpha) + \sigma_\xi^2 \end{pmatrix} = 0\,. \quad (7)$$

The first defines the variance of the transaction price changes and the second deals with serial covariances in the pricing errors.

Rearranging (6) to solve for each of the price volatility components we get the following terms: news shocks (σ_ε^2); price discreteness ($2\sigma_\xi^2$); information asymmetry ($(1-\lambda)(1-\rho^2)\theta^2$); trading costs ($2(1-\lambda)(1-\rho)\phi^2$); and the interaction term ($2\phi\theta(1-\lambda)(1-\rho^2)$) which measure the contribution of each source of volatility to the total variance observed.

Table 4 sets out the relative contributions to price volatility as well as the mean and median values for each of the five components. Following the introduction of the new laws, we find a drop in total price volatility. The proportion of volatility attributable to market frictions has increased by about 5%. However, the percentage of information asymmetry to market frictions has decreased significantly over the two sub-periods. The increase of the proportion of market frictions is mainly driven by an increase in trading costs and a decrease in the public information component.

Panel B presents the number of firms that had increases or decreases in the proportion of each cost making up price volatility. Nearly 70% of companies had a reduction in the contribution of IA to price volatility providing further support for the notion that the new regulations have reduced information asymmetry in the markets generally. The worsening in mean trading costs is also reflected in the 40 companies that had an increase in the proportion suggesting this increase is also a global effect. The other decreasing components, news announcements and price discreteness, both had marginally more decreases than increases while the reverse was true for the interaction term.

We also sorted the contributions to volatility by both the number of trades and the pre-change proportion of asymmetry in the spreads. As can be seen in Panel C, while the mean proportions of IA between the low and high trades has decreased by similar amounts, the median decreases are vastly different. High trades see only a 1% decrease after the introduction of the new laws, low trades however observe a 5.5% decrease suggesting a much more profound impact on a wider number of firms. The results for the high and low asymmetry sorts show little impact on those firms with the least asymmetry but nearly an 8% decrease for those with the most asymmetry pre-change. Again the results suggest that while there has been a general decrease in the impact of IA on price volatility, the effect seems to be related to the level of insider trading before the change.

VI. CONCLUSION

In this paper we examine the impact of a significant tightening in regulations targeting all aspects of insider trading and dealing. We explore this issue in the context of New Zealand, a small, illiquid and previously poorly regulated market with respect to insider trading. Recent changes in the regulatory regime provide an ideal setting to examine the impact of effective government intervention on the cost of trading. We decompose the separate components of the spread and find evidence of a strong relationship between the efficacy of insider trading rules and proportion of the spread attributable to information asymmetry. These results are robust over different model specifications. Splitting the sample on the basis of liquidity (number of trades) and pre-change information asymmetry, we find that these results are mainly driven by illiquid firms who suffer form high information asymmetry, which implies that government intervention is most beneficial for these firms. Lastly, we find a significant drop in the percentage of market frictions that is attributable to information asymmetry.

Overall the results showed a decrease in trading costs that are mainly driven by a decline in information asymmetry. The market setting of New Zealand suggests the experience of introducing effective measures to limit insiders may be widely applicable. Many countries suffer a similar lack of appropriate regulation and/or political will to address insider trading. While the liquidity of the New Zealand market is not representative of other developed markets, a majority of stocks listed on these markets may suffer from a similar lack of market attention. For these stocks and countries effective government intervention may be beneficial.

Table 1: Descriptive statistics for the sample companies

	Full Sample	Pre Change	Post Change	
Average Transactions Per Day				
Mean	18.82	18.66	19.54	
Median	11.21	12.02	11.88	
Std Deviation	20.90	22.59	20.79	
1st Quartile	5.94	5.41	6.51	
3rd Quartile	23.19	22.68	24.34	
Average Prices				
Mean	3.14	3.17	3.16	
Median	2.04	2.01	1.97	
Std Deviation	3.71	3.88	3.71	
1st Quartile	1.11	1.10	1.05	
3rd Quartile	3.52	3.30	4.25	
Average Spread				
Mean	0.0255	0.0290	0.0222	***
Median	0.0160	0.0175	0.0142	**
Std Deviation	0.0288	0.0313	0.0253	
1st Quartile	0.0105	0.0109	0.0097	
3rd Quartile	0.0318	0.0373	0.0260	
Average Percentage Spread				
Mean	1.19%	1.35%	1.10%	***
Median	0.88%	1.04%	0.74%	**
Std Deviation	1.03%	1.13%	0.99%	
1st Quartile	0.63%	0.67%	0.54%	
3rd Quartile	1.31%	1.67%	1.16%	
Volatility in Daily Prices				
Mean	0.0260	0.0256	0.0275	
Median	0.0165	0.0177	0.0138	***
Std Deviation	0.0012	0.0009	0.0017	
1st Quartile	0.0138	0.0144	0.0115	
3rd Quartile	0.0246	0.0255	0.0226	

Full Sample includes all trades between January 2001 and August 2004. Pre-Change includes all trades between January 2001 and November 2002. Post-Change includes all trades between March 2003 and August 2004. *Average Prices* was measured as the cross-sectional average of the average daily closing share price over the sample period. *Average Spread* is the cross-sectional average of the bid-ask spread at the time of a trade. *Average Percentage Spread* wais measured as the cross-sectional average of the bid – ask price divided by the midpoint of the spread. *Average Effective Spread* is measured as per MRR as $(1-\lambda)(2\phi+\theta)$. *Volatility in Daily Prices* was measured as the standard deviation of the change in the closing daily price. *** indicates significant at 1%, ** indicates significant at 5%. Significance of means were calculated between the pre and post change samples using the matched pairs t-test. Significance of the medians were calculated using the Mann-Whitney-Wilcoxon test.

Table 2: GMM Parameter Estimates

Panel A: Parameter Estimates	Full Sample	Pre Change	Post Change		Panel B: Wald Statistics of Difference	
θ						
Mean	0.1614	0.1558	0.1369	*	Sig Decrease 5%	31
Std Err (average)	*0.0109*	*0.0174*	*0.0140*		Sig Decrease 1%	21
Std Dev	0.1573	0.1136	0.1343		Sig Increase 5%	5
Median	0.1188	0.1199	0.1036	*	Sig Increase 1%	5
Φ						
Mean	0.1436	0.1649	0.1415		Sig Decrease 5%	17
Std Err (average)	*0.0123*	*0.0199*	*0.0159*		Sig Decrease 1%	14
Std Dev	0.1645	0.2528	0.1690		Sig Increase 5%	12
Median	0.0663	0.0568	0.0681		Sig Increase 1%	7
ρ						
Mean	0.4135	0.4120	0.4081		Sig Decrease 5%	16
Std Err (average)	*0.0104*	*0.0174*	*0.0154*		Sig Decrease 1%	13
Std Dev	0.0888	0.0951	0.0924		Sig Increase 5%	12
Median	0.3932	0.3939	0.3877		Sig Increase 1%	11
Proportion of Information Asymmetry						
Mean	0.5801	0.5893	0.5518	**	Sig Decrease 5%	40
Std Err (average)	*0.0238*	*0.0587*	*0.0638*		Sig Decrease 1%	39
Std Dev	0.2161	0.2266	0.2213		Sig Increase 5%	16
Median	0.6063	0.6246	0.5743	**	Sig Increase 1%	16

Panel C: Parameter Estimates Sorted by Number of Trades	Low Trades			High Trades	
	Pre-Change	Post-Change		Pre-Change	Post-Change
Proportion of Information Asymmetry					
Mean	0.6650	0.5992	**	0.5210	0.5121
Std Err (average)	0.0692	0.0767		0.0504	0.0498
Std Dev	0.2053	0.2247		0.2264	0.2092
Median	0.7240	0.6526	**	0.5567	0.5103

Panel D: Parameter Estimates Sorted by Pre-Change Proportion of Information Asymmetry	Low Asymmetry		High Asymmetry		
	Pre-Change	Post-Change	Pre-Change	Post-Change	
Proportion of Information Asymmetry					
Mean	0.4131	0.4045	0.7716	0.6934	***
Std Err (average)	0.0199	0.0233	0.0997	0.1029	
Std Dev	0.1527	0.1851	0.0890	0.1483	
Median	0.4338	0.4597	0.7511	0.6741	**

Panel A presents the parameter estimates for the sample of 70 companies over the indicated time period (month and year) for the three parameters of interest, θ, the asymmetric information component of the spread, Φ, the cost per share of trading and ρ, the autocorrelation of the order flow. The proportion of information asymmetry was calculated as the cross-sectional average of θ /(θ + Φ) and the standard error as the cross-sectional average of $\left[\frac{\theta+\phi-1}{(\theta+\phi)^2}, \frac{-\theta}{(\theta+\phi)^2}\right] V_{\hat{\theta},\hat{\phi}} \left[\frac{\theta+\phi-1}{(\theta+\phi)^2}, \frac{-\theta}{(\theta+\phi)^2}\right]'$ where $V_{\hat{\theta},\hat{\phi}}$ is the estimated covariance matrix of the GMM estimators.

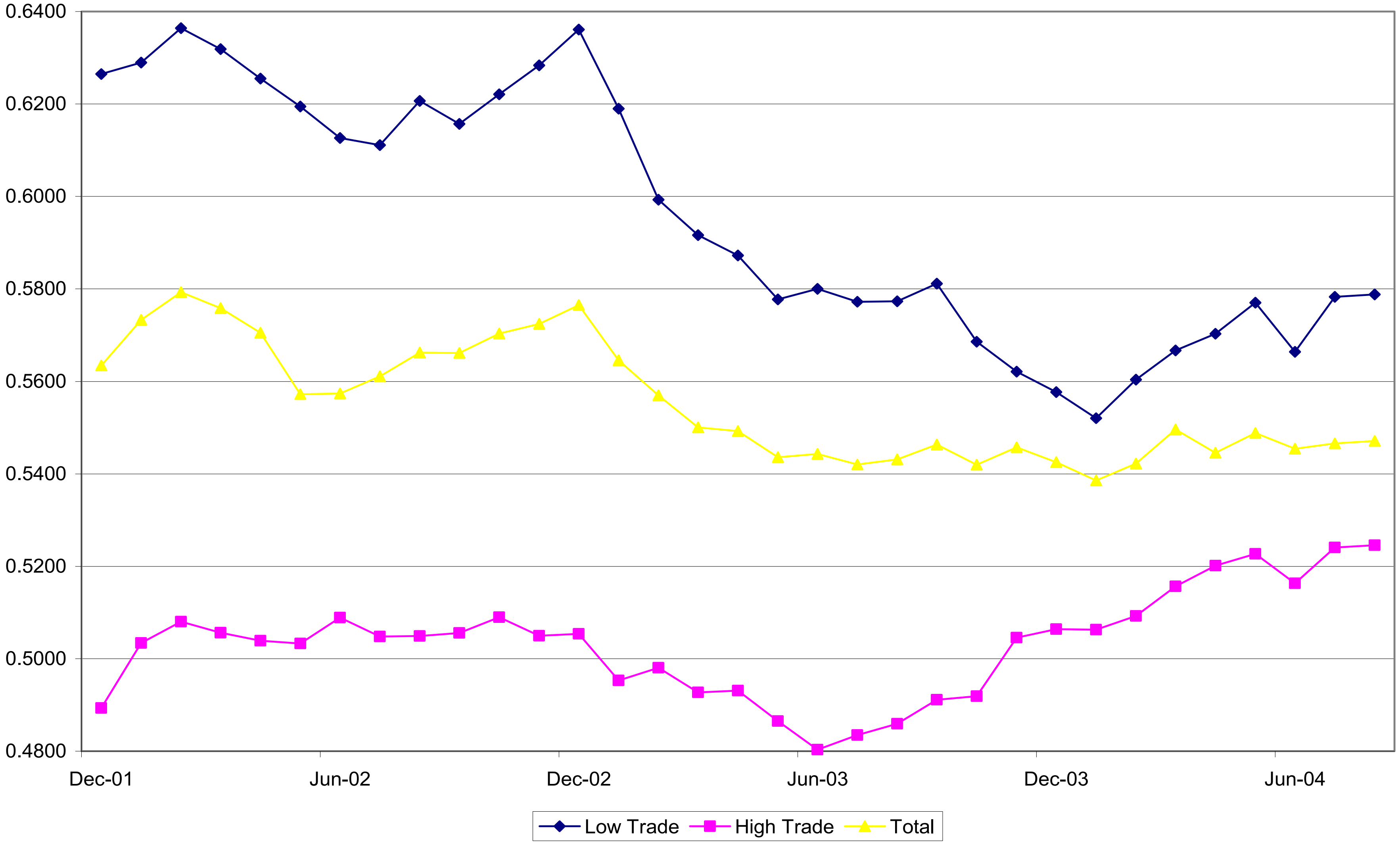
Panel B presents the number of companies that observed either a statistically significant improvement or decline in the parameter estimates. The difference was calculated between the pre-change period from June 2001 to November 2002 and the post-change period from March 2003 to August 2004. The standard errors were adjusted using the NeweyWest (1987) corrections for heteroskedasticity as detailed in Hamilton (1994). Prices were scaled in the estimation procedure by 100. Low and High Trades contain the estimates of the lowest and highest 30 companies when sorted by number of trades. Low Asymmetry and High Asymmetry contain the lowest and highest 30 companies when sorted by pre-change proportion of information asymmetry. *** indicates significant at 1%, ** indicates significant at 5%, * indicates significant at 1% using the matched pairs t-test for the difference between pre and post-change.

Table 3: Glosten and Harris Model Parameter Estimates

Panel A: Average GH Parameter Estimates				
	Full Sample	Pre-Change	Post Change	
θ_0				
Mean	0.4216	0.4823	0.4619	
Std Dev	0.0188	0.0481	0.0368	
Median	0.2904	0.3088	0.3183	
θ_1				
Mean	-0.0027	-0.0129	-0.0004	**
Std Dev	0.0079	0.0226	0.0207	
Median	-0.0013	-0.0015	-0.0007	*
ϕ_0				
Mean	0.1390	0.1692	0.1515	*
Std Dev	0.0169	0.0329	0.0227	
Median	0.1167	0.1105	0.1247	
ϕ_1				
Mean	0.0056	0.0061	0.0019	*
Std Dev	0.0106	0.0154	0.0127	
Median	0.0007	0.0013	-0.0003	
Panel B: Spread Cost Components				
Asymmetric Information	0.2880	0.3699	0.3087	**
Order-Processing	0.8352	0.8988	0.9137	
Proportion	0.2817	0.2920	0.2776	**

Measures the parameters estimates for the 70 sample companies based on the Glosten and Harris model (1988) defined as $\Delta p_t = \phi_0 \Delta x_t + \phi_1 \Delta x_t V_t + \theta_0 x_t + \theta_1 x_t V_t + \eta_t$. Asymmetric information is measured as $2(\theta_0 + \theta_1 V_t)$ while order-processing is measured as $2(\phi_0 + \phi_1 V_t)$. Proportion is measured as $\frac{2(\theta_0 + \theta_1 V_t)}{2(\theta_0 + \theta_1 V_t) + 2(\phi_0 + \phi_1 V_t)}$. *** indicates significant at 1%, ** indicates significant at 5%, * indicates significant at 1% using the matched pairs t-test for the difference between pre and post-change.

Figure 1: 12 Month Rolling Average Proportion of Information Asymmetry



Presents 12 month rolling cross-sectional average proportions of information asymmetry for a sample of 70 NZX companies. Low (High) Trade represents the rolling estimates for the 30 lowest (highest) companies when sorted by number of trades.

Table 4: Components of Price Volatility

Panel A: Volatility Proportions and Component Estimates	Full Sample	Pre Change	Post Change		Panel B: Breakdown of Changes	
Public Information						
Proportion of Total Volatility	0.5403	0.5644	0.5101	*	Prop Decreased	35
Standard Deviation	0.2159	0.1898	0.1977		Prop Increased	26
Median	0.5554	0.5801	0.5419			
Price Discreteness						
Proportion of Market Friction	0.4796	0.4766	0.4667		Prop Decreased	33
Standard Deviation	0.1859	0.1965	0.1950		Prop Increased	28
Median	0.5219	0.5290	0.5020			
Information Asymmetry						
Proportion of Market Friction	0.2035	0.2030	0.1705	*	Prop Decreased	48
Standard Deviation	0.1890	0.1553	0.1383		Prop Increased	13
Median	0.1486	0.1771	0.1381	*		
Transaction Cost						
Proportion of Market Friction	0.1416	0.1392	0.1761	**	Prop Decreased	21
Standard Deviation	0.1646	0.1596	0.1890		Prop Increased	40
Median	0.0891	0.0814	0.0972			
Interaction						
Proportion of Market Friction	0.1753	0.1812	0.1867		Prop Decreased	29
Standard Deviation	0.0791	0.0872	0.0843		Prop Increased	32
Median	0.1806	0.1790	0.1917			
Total Volatility	0.0053	0.0057	0.0048			
Proportion Market Friction	0.4597	0.4356	0.4899			

Panel C: Parameter Estimates Sorted by Number of Trades	Low Trades			High Trades	
	Pre-Change	Post-Change		Pre-Change	Post-Change
Information Asymmetry					
Proportion of Volatility	0.2315	0.1999	*	0.1762	0.1487
Standard Deviation	0.1382	0.1376		0.1763	0.1381
Median	0.2142	0.1595	*	0.1247	0.1156

Panel D: Parameter Estimates Sorted by Pre-Change Proportion of Information Asymmetry	Low Asymmetry		High Asymmetry		
	Pre-Change	Post-Change	Pre-Change	Post-Change	
Information Asymmetry					
Proportion of Volatility	0.0867	0.0888	0.3117	0.2480	**
Standard Deviation	0.0532	0.0686	0.1571	0.1515	
Median	0.0787	0.0721	0.2796	0.1985	*

Presents the five components of the price volatility, news shocks (σ_ε^2), price discreteness ($2\sigma_\xi^2$), information asymmetry, ($(1-\lambda)(1-\rho^2)\theta^2$), trading costs, ($2(1-\lambda)(1-\rho)\phi^2$), and the interaction term, ($2\phi\theta(1-\lambda)(1-\rho^2)$), for the sample of 70 companies. The proportion of volatility is cross-sectional average of the component value divided by the total volatility. Low and High Trades contain the estimates of the lowest and highest 30 companies when sorted by number of trades. Low Asymmetry and High Asymmetry contain the lowest and highest 30 companies when sorted by pre-change proportion of information asymmetry.

FOOTNOTES

[1] Details on the structure of the previous regime and the exact nature of the changes can be found in Gilbert, Tourani-Rad and Wisniewski (2005).
[2] Glosten and Harris (1988) differ in this respect, because they consider all information in the arrival of a trade as a surprise.

[3] As the results for both pre-change periods and both the 18 and 12 month samples were virtually identical we report only the results of the 18 month sample and the pre-change period that ran from June 2001 to November 2002.

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