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# The Relationship between Insider Trading and Volume-Induced Return Autocorrelation

## Abstract

As was established in Llorente et al. (2001) the dynamic relationship between return and volume is a function of information asymmetry. This study extends their analysis by linking the volume-induced return autocorrelation coefficients with the level of disclosed insider trading. Using New Zealand data, we document a strong link between the sustainability of trade-generated price changes and the extent of insider trading. This relationship is robust to alternative econometric specifications and remains significant even after controlling for conventional measures of information asymmetry such as bid-ask spreads, size and analyst following. This suggests that volume-induced autocorrelation may be a suitable criterion on which to rank firms on the level of private information trading.

JEL Classification: C22, G14

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## I. Introduction

Llorente, Michaely, Saar, and Wang (2001, henceforth LMSW) develop a theoretical model with heterogeneously informed agents to show that the return-volume dynamic of individual stocks is governed by the degree of informational asymmetry. In particular, the stocks with a high proportion of private information trading volume exhibit return continuations, whereas stocks in which investors trade predominantly for portfolio rebalancing reasons have a negative volume-induced return autocorrelation. The rationale behind this result is that whenever an insider exploits nonpublic information by trading in securities, prices will partially reflect the information before it is announced, i.e. the price impact of an insider trade will be permanent. Conversely, dealings driven by allocational motives tend to generate return reversals. The stock price will initially move in the direction of the hedging transaction in order to encourage other market participants to take the other side. However, since the trade does not reflect any superior knowledge of future payoffs the stock price is likely to rebound in the next period. By conditioning on volume, the LMSW model isolates the aforementioned impact of trading on serial correlations of returns.

LMSW perform a cross-sectional regression analysis of the trade-generated first-order autocorrelation coefficient and provide persuasive evidence that its magnitude can be successfully explained by the standard informational asymmetry proxies such as capitalization, bid-ask spreads and analyst following. In a related paper, Grishchenko, Litov and Mei (2002) examined market index constituents from

18 emerging markets and concluded that stocks in countries that enforce insider trading laws and provide better investor protection exhibit less return continuation following high volume days. It has to be noted, however, that the dichotomous variable for a successful prosecution on insider trading charges used in their study is a rather indirect measure of the degree of speculative trading based on private information. The authors were unable to develop a more explicit proxy due to a lack of data. It is our intention to empirically expand on the model of LMSW by explicitly including insider transactions into the model. Specifically, the analysis focuses on the corporate insider trading reports filed with the New Zealand Stock Exchange (NZSE)<sup>1</sup> and investigates the relationship between the degree of insider trading and volume-induced autocorrelations.

The remainder of the paper is organized as follows. The following section describes the sample and variable construction. Section 3 outlines the methodology and provides empirical results. Section 4 concludes the paper.

## 2. Data

The sample employed in this study was drawn from companies listed on the NZSE between January 1995 and December 2003 for which insider trades could be collected. This resulted in a sample of 83 companies, 577 firm-years and 3031 insider trades. Information on insider transactions came from the NZSE and company annual reports. Data on company prices, volume, bid-ask spreads and market capitalization were collected from Thompson Financial Datastream while analyst following data came from Datex. The analyst following data, however, was

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<sup>1</sup> Insiders, defined as directors, substantial shareholders and executives, are required to disclose changes in their shareholdings under the Securities Market Act 1988 and Securities Market Amendment Act 2002. For more information on the institutional setting of insider trading in New Zealand we would refer the reader to Eterbari, Tourani-Rad and Gilbert (2004).

only available from 1997 necessitating a smaller sample be used in some specifications.

The insider trading variable is defined as the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company year (as consistent with the reasoning of John and Lang (1991), Lustgarten and Mande (1995) and Roulstone (2003)). Scaling by the total volume follows directly from the LMSW model which predicts that the relation between the volume-induced return autocorrelation and the significance of speculative trades relative to hedging trades is monotonic.

[Table 1 about here]

The market value of equity for our sample is distributed with an arithmetic mean of NZ\$520 million and a median of only NZ\$82 million, indicating that the sample comprises both the smallest and largest firms listed on the NZSE. The Bid-Ask spread has a mean of 4.31% and a median of 2.44%. The relatively high magnitude of spread is likely attributable to the poor liquidity of the New Zealand market. To reduce the excess skewness in these two variables a log transformation of the data was used. There was at least one analyst following a company in 51% of the firm-years and in total 60% of the firms were followed in at least one year. The disclosed trades of insiders make up 4.4% of the total volume traded and 2.9% of the volume traded each year appear to be informed trading by insiders. The summary statistics for the variables employed in our study are shown in Table 1.

The cross-sectional correlations between variables are also presented. While neither size nor analysts following is significantly related to insider trading, its association with bid-ask spread is positive and statistically significant. This conforms with the well-established finding that market makers increase spread in

response to active insider trading in order to avoid considerable losses (Glosten and Milgrom (1985), Kyle (1985) and Copeland and Galai (1988)). Furthermore, the information asymmetry proxies are strongly interrelated in the expected directions. Larger companies and companies with smaller bid-ask spreads for instance are covered by more analysts while size and bid-ask spreads are inversely related.

### 3. Methodology and Empirical Findings

To calculate the value of trade generated return autocorrelation we apply two LMSW empirical specifications the second of which removes the impact of market-wide variations from the analysis:

$$R_{i,t+1} = C_0 + C_1 R_{i,t} + C_2 R_{i,t} V_{i,t} + e_{i,t+1} \quad [1]$$

$$R_{i,t+1} = C_0 + C_1 R_{i,t} + C_2 R_{i,t} V_{i,t} + C_3 R_{m,t+1} + e_{i,t+1} \quad [2]$$

where  $R_{i,t}$  and  $R_{m,t}$  denote the continuously compounded return on security  $i$  and the NZSE ALL index on day  $t$ , respectively.  $V_{i,t}$  is the log, detrended turnover at date  $t$ , such that

$$V_{i,t} = \ln((Vol_{i,t} / N_{i,t}) + c) - (1/200) \sum_{j=1}^{200} \ln((Vol_{i,t-j} / N_{i,t-j}) + c)$$

where  $Vol_{i,t}$  and  $N_{i,t}$  are the number of shares traded and the total number of shares outstanding on day  $t$  for company  $i$ , respectively. Following LMSW we add a small constant  $c = 0.0000025$  to the turnover ratio in order to avoid the problem of zero trading volume days. The detrending procedure accounts for the fact that daily turnovers series tend to be nonstationary.

The parameter of interest,  $C_2$ , has been deemed to indicate whether the trading is dominated by portfolio rebalancing or private information trades. To verify this assertion we estimate the  $C_2$  coefficient for each of the firm-years available in

sample and regress it on the insider trading variable and information asymmetry proxies. The findings are reported below.

[Table 2 about here]

The results in Table 2 Panel A examine the relationship between insider trading and volume-induced return autocorrelation measured by the  $C_2$  coefficient from equation [1]. The results show a significant relationship between the insider trading variable and the regressant indicating that the  $C_2$  coefficients increase monotonically with the degree of speculative trading on nonpublic information. This supports the prediction of Lorente et al (2001) that positive  $C_2$  coefficients are symptomatic of prevalent private information trading. The robustness of the results to inclusion of other information asymmetry variables is verified in specifications (2), (3) and (4). Since all the informational asymmetry measures are highly cross-correlated they are not bundled together into one regression due to potential multicollinearity problems. Insider trading retains its predictive power in all of the models considered, however, inclusion of bid-ask spread or analyst following reduces its significance level. This could be due to the fact that bid-ask spreads partially reflect the degree of informed trading and analysts condition their investment decisions on the subset of information available to insiders.

Panel B in Table 2 presents the determinants of the  $C_2$  coefficient from a model incorporating the overall movement of the market. This specification takes into account a possible cross-equation correlation of errors arising from sensitivity to common factors. The magnitude and statistical significance of the coefficients is directly comparable with the findings reported in Panel A. Moreover, the sensitivity of results to the exclusion of outliers has been examined by eliminating observations for which the absolute value of the fitted residual exceeded three times the estimated

residual standard deviation. The results were not materially altered. Lastly, we retest the model using an alternative definition of volume, where volume is defined as  $(\ln(1 + \text{number of shares traded}))^2$ . This specification reduces the discrepancy between the theoretical and empirical representation of the LMSW model. The use of alternative volume definition, however, does not affect the conclusions drawn.

#### IV. Conclusions

This study investigated the connection between volume-induced return autocorrelation and the relative significance of private information trading versus trading for portfolio rebalancing reasons. Insider transactions disclosed to the NZSE have been used to construct a measure of informed trading prevalence. The findings validate the theoretical predictions of the LMSW model in that the return continuations following high volume days appear to be more likely for stocks with high degree of insider dealing. Consequently, the volume-induced autocorrelation coefficient could be helpful in identifying periods in which ordinary shareholders are at a great disadvantage, especially in markets in which insiders are not required to report their transactions.



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Table 1  
Summary Statistics

Variable	Mean	Median	Standard Deviation	CrossSectionalCorrelations		
				Size	Analysts	BAS
INS	0.0292	0.0016	0.0876	0.0055 (0.8951)	-0.0159 (0.7327)	0.1265 (0.0023)
Size	11.3934	11.3097	1.8252	–	0.6729 (0.0000)	-0.8073 (0.0000)
Analysts	2.7909	1.0000	3.2982	–	–	-0.6380 (0.0000)
BAS	-3.6499	-3.7146	0.9475	–	–	–

Note - The p-values are shown in parentheses. INS is the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company year. Size is the natural logarithm of the average market value of equity during a given firm-year. Analysts is the number of analyst forecasts available for a company at the end of a calendar year. BAS is the natural logarithm of the average bid-ask spread during a given firm-year.

Table 2  
Empirical determinants of the C<sub>2</sub> coefficient

Panel A: Regressions on the Volume-Induced Return Autocorrelation Coefficient					
Variable	Predicted Sign	(1)	(2)	(3)	(4)
Intercept		-0.0012 (0.0035)	0.0960 <sup>***</sup> (0.0278)	0.0162 <sup>**</sup> (0.0046)	0.0510 <sup>**</sup> (0.0156)
INS	+	0.0745 <sup>**</sup> (0.0343)	0.0755 <sup>*</sup> (0.0314)	0.0602 <sup>‡</sup> (0.0316)	0.0551 <sup>‡</sup> (0.0304)
Size	-	-	-0.0085 <sup>***</sup> (0.0025)	-	-
Analysts	-	-	-	-0.0069 <sup>***</sup> (0.0014)	-
BAS	+	-	-	-	0.0142 <sup>**</sup> (0.0044)
Adj. R-squared		0.68%	4.23%	7.19%	3.17%
No. of obs.		577	577	577	464
Panel B: Regressions on the Market- Adjusted Volume-Induced Return Autocorrelation Coefficient					
Variable	Predicted Sign	(1)	(2)	(3)	(4)
Intercept		-0.0016 (0.0036)	0.0927 <sup>***</sup> (0.0285)	0.0145 <sup>***</sup> (0.0046)	0.0482 <sup>**</sup> (0.0158)
INS	+	0.0727 <sup>**</sup> (0.0341)	0.0737 <sup>**</sup> (0.0313)	0.0588 <sup>‡</sup> (0.0317)	0.0542 <sup>‡</sup> (0.0304)
Size	-	-	-0.0083 <sup>***</sup> (0.0026)	-	-
Analysts	-	-	-	-0.0064 <sup>***</sup> (0.0014)	-
BAS	+	-	-	-	0.0135 <sup>***</sup> (0.0045)
Adj. R-squared		0.46%	3.89%	6.08%	3.17%
No. of obs.		577	577	577	464

Note- <sup>\*\*\*</sup>, <sup>\*\*</sup>, <sup>\*</sup> indicates significance at the 1%, 5%, and 10% level, respectively.

The White (1980) heteroscedasticity consistent standard errors are shown in parentheses. INS is the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company-year. Size is the natural logarithm of the average market value of equity during a given firm-year. Analysts is the number of analyst forecasts available for a company at the end of a calendar year. BAS is the natural logarithm of the average bid-ask spread during a given firm-year.

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