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The Information Content of Aggregate Insider Trading*

This study investigates the information content of aggregate insider trading by analyzing approximately 60,000 open market sales and purchases by insiders from January 1975 to October 1981. The paper first examines the relation between market movements and aggregate insider trading. The evidence suggests that insiders cannot always distinguish between the effects of firm-specific and economywide factors. The paper also investigates whether publicly available information about aggregate insider trading activity can help predict future stock market returns and provide market analysts with market timing ability.

I. Introduction

This study investigates the information content of aggregate trading by corporate insiders in their own firms.[1] It is hypothesized that information-related trading by corporate insiders is in response to all factors that affect security returns (i.e., firm-specific, industrywide, or economywide factors); therefore, analysis of insider trading can potentially uncover the effects of economywide factors not currently reflected in security prices. Previous insider trading studies by Lorie and Niederhoffer (1968), Jaffe (1974), Finnerty (1976), and Seyhun (1986), among others, show that corporate insiders can identify the mispricings in their own firms and that they trade on the basis of their special information. If the mispricing observed by insiders in their own firms is strictly due to firm-specific information, then no relation between insider trading and

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1. The Securities and Exchange Act of 1934 defines insiders as officers, directors, and shareholders of 10% or more of any equity class of securities.

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changes in economywide activity would be expected. However, if part of the mispricing observed by insiders in their own firms is caused by changes in economywide activity that are not yet fully reflected in security prices, then a positive relation between aggregate insider trading activity and subsequent market returns would be expected.

This study uses the information content of aggregate insider trading data to address the possibility of predicting future stock market returns. Some market analysts claim that publicly available information about aggregate insider trading activity can signal subsequent changes in the stock market. An unusual increase in stock purchases by insiders in the aggregate is presumed to signal an increase in the stock market, while an unusual increase in stock sales by insiders in the aggregate is presumed to signal a decline in the stock market.[2] However, the ability to time market movements profitably using publicly available information would contradict the efficient markets hypothesis.

The paper is organized as follows. The testable implications of the relation between aggregate insider trading, changes in economywide activity, and stock market returns are discussed in Section II. Section III contains the data sources and sample characteristics of the data. The empirical results of the study are in Section IV, while the conclusions and implications are contained in Section V.

II. Aggregate Insider Trading and Economywide Factors

To illustrate the relation between aggregate insider trading and economywide factors, an example is useful. Suppose that an insider in a given firm expects the future cash flows to his firm to improve owing to increased sale orders and purchases his firm's stock. Also suppose that the reason for the increased sales orders is a general increase in economywide activity. Subsequently, when the increase in economywide activity is recognized by the market, the prices of most securities will rise. Since the insider has purchased stock prior to the increase to the stock market, his stock purchase will have "forecasted" the positive return to the stock market. Consequently, there will be a positive relation between the insider's transaction and the market return. If the reason for the increased sales orders had been a strictly firm-specific improvement, then no relation between insiders' transactions and market returns would be expected.

The potential relation between insiders' transactions and stock mar-

2. Some market analysts maintain that an aggregate insider purchase-to-sale ratio greater than one-half is a positive signal for the market, while a ratio less than one-half is a negative signal for the market. For references to this view in the financial press, see "The Insider Track on Stocks," *Money* (December 1983); and "Heard on the Street," *Wall Street Journal* (November 27, 1981). Aggregate insider trading information is provided on a weekly basis in *Insiders' Chronicle*.

ket returns does not require that insiders know whether the increase in sales orders is due to firm-specific, industrywide, or economywide factors. All that is necessary is that insiders observe an unanticipated change in the cash flows to their firms and trade on the basis of their observations. It is most likely that multiple factors affect the prospects of the firm simultaneously; insiders will not be able to distinguish and separate the effects of each of these factors.

A further insight into insiders' transactions can be obtained by considering the market risk of the firm. If part of the mispricing observed by insiders in their own firms is due to economywide factors, then the market risk of the firm would affect insider trading. Specifically, in firms characterized by greater market risk, insiders would be more likely to observe and trade on the basis of mispricing caused by economywide factors. In firms characterized by less market risk, insiders would be less likely to observe and to trade on the basis of economywide factors. As a result, the strength of the relation between stock market movements and aggregate insider trading is predicted to be positively related to the market risk of the firm.

The signal identification problem facing the corporate executive is similar to the one analyzed by Lucas (1973, 1975) in a different context (also see Sargent and Wallace 1975; Barro 1976; Sargent 1976; and Lucas 1977). Lucas shows that a positive trade-off between inflation and output arises if agents cannot fully distinguish general price movements from relative price movements. In Lucas's model, in the short run, suppliers of goods and services confuse a general increase in the price level for an increase in the relative price of their own goods or services and increase their supply. In the long run, economic agents become informed about the changes in the general price level. Since the agents base their decisions on the relative price changes, they reduce their supply of goods and services as they realize that relative prices have not changed. Hence, no trade-off occurs between inflation and output in the long run. Furthermore, the short-run trade-off between inflation and output diminishes as the variance of the general price changes dominates the variance of the relative price changes.

In the present context, separating the effects of firm-specific factors from economywide factors is also problematic. First, international events, economywide factors, and industrywide factors, as well as local, regional, and firm-specific factors affect the performance of a firm. Second, the sensitivity of a firm's stock price to economywide factors changes with changes in the firm's operations, as well as with changes in the firm's financial leverage. Consequently, even in the long run, it is difficult to attribute the reasons for unexpected changes in the cash flows of a firm to firm-specific and economywide factors.

Inferences about a Lucas-type confusion among corporate insiders must be qualified. The extent to which insiders will care about separat-

ing different types of signals will depend on the costs and benefits of exploiting economywide signals using their own firms' stock. If insiders find it very costly to exploit economywide information by trading in other stocks, then they may trade in their own firms' stock even when the stock price changes are due to the economywide factors. However, if insider trading regulations increase the cost of trading in their own firms' stock, then insiders would prefer to exploit economywide information by trading in other firms or mutual funds. Consequently, insiders would tend to trade in their firms' stock based on economywide factors when they are more likely to be confused about the source of mispricing.

The potential relation between aggregate insider trading and economywide factors raises the possibility of predicting future market returns using aggregate insider trading data. Studies by Treynor and Mazuy (1966), Henricksson and Merton (1981), Kon (1983), and Henricksson (1984), among others, investigate the ability of mutual fund managers to time (i.e., to predict) stock market movements (also see Fama 1972). If mutual fund managers can successfully predict stock market movements, then they would increase their relative investments in stocks prior to an increase in the stock market and decrease their relative investments in stocks prior to a decrease in the stock market. The findings of previous market timing studies generally show that mutual fund managers as a group cannot profitably time stock market movements.

Other studies provide growing evidence on the time-varying and predictable nature of expected returns to the market (see Bodie 1976; Nelson 1976; Fama and Schwert 1977; Fama 1984; Keim and Stambaugh 1986; and Fama and French 1986*a*, 1986*b*, 1987).[3] Fama and French (1986*a*) present evidence that shows that 25%–40% of the future variation in stock returns can be explained by long horizon past returns. Predictability of expected returns to the market does not necessarily contradict the informational efficiency of the capital markets, but it must be taken into account in properly evaluating market efficiency.

This study examines whether publicly available information about aggregate insider trading activity can help predict future expected market returns. If insiders can observe in their firms the effects of economywide factors not fully reflected in their security prices and trade on the basis of their observations, then aggregate insider trading can also help predict the future expected market returns. For this information to be useful to analysts, it is also necessary that security prices in the aggregate do not reflect the implications of the changes in econo-

3. For time varying nature of the required return to securities, also see Gibbons and Ferson (1985); Ferson (1986); and Ferson, Kandel, and Stambaugh (1986).

mywide activity until after the insider trading information becomes publicly available. Otherwise, by the time market analysts obtain aggregate insider trading information, security prices will have fully adjusted and there would be no market-timing ability.

This paper also examines whether the predictability of market returns violates the concept of market efficiency. To evaluate market efficiency, the expected risk premium on the market portfolio is assumed to be positive. Specifically, given an adverse signal from aggregate insider trading data, a significantly negative excess return on the market portfolio is considered inconsistent with market efficiency. However, ability to identify the time periods when the expected positive risk premium on the market portfolio is higher than at other times is considered consistent with market efficiency.

III. Data and Sample Characteristics

A. Data

Insider trading data for this study come from a computer tape compiled by the Securities and Exchange Commission (SEC). The tape contains more than 1.5 million transactions by insiders in all publicly held firms from January 1975 to October 1981, for a total of 82 calendar months. This study analyzes a sample of insider transactions in 790 firms on the daily returns file of the Center for Research in Security Prices (CRSP).[4] Of the 790 firms, 21 did not report any insider trading between 1975 and 1981. Hence, the actual number of firms analyzed is 769.

Only open market sales and purchases by insiders from 1975 to 1981 are analyzed in this study. All other types of insiders' transactions, such as private sales and purchases, exercises of options, shares acquired through a plan, and so forth, are excluded, since it is expected that insiders' open market sales and purchases are more likely to represent actions taken as a result of special insider information.[5] The distributions of insiders' open market sales and purchases by firm size are shown in table 1. Firm group 1 consists of firms with a market value of equity less than $25 million; group 2, between $25 million and $50 million; group 3, between $50 million and $250 million; group 4, between $250 million and $1 billion; and group 5, greater than $1 billion. This classification ensures that each size group contains more than

4. All 190 firms listed on option exchanges on January 1, 1977, are included in the sample. The remaining 600 firms were selected using stratified random sampling based on the value of equity on January 1, 1977. This accounts for the heavier representation of the larger firms in the sample. The sample of firms analyzed in this study is identical to that in Seyhun (1986), which contains further characterizations of the sample.

5. Numerous consistency checks on dates, prices, and shares were performed to eliminate approximately 1,000 transactions containing apparent data errors out of about 60,000 transactions.

TABLE 1 **Distribution of the Number of Open Market Sales and Purchases, the Total Dollar Value of Sales and Purchases (in $ Million), and the Number of Firms Grouped by the Average Month-End Market Value of Firms' Stock between January 1975 and October 1981**

	The Average Market Value of Stock					
	Less than $25 Million (Group 1)	Between $25 and $50 Million (Group 2)	Between $50 and $250 Million (Group 3)	Between $250 Million and $1 Billion (Group 4)	More than $1 Billion (Group 5)	All Firms
No. firms	104	68	173	267	157	769
No. sales	1,339	1,325	5,891	14,811	11,411	34,777
No. purchases	2,802	1,685	4,661	8,456	6,767	24,371
Value of sales ($)	51.3	56.2	550.0	1431.7	2235.7	4324.7
Value of purchases ($)	100.3	126.2	736.5	1558.0	4254.3	6775.3
Total no. of trades	4,141	3,010	10,552	23,267	18,178	59,148

3,000 insider transactions while maintaining a large diversity of firm sizes from less than $25 million to more than $1 billion. The total sample contains 59,148 open market sales and purchases with a total dollar value of $11.1 billion. Of these, 24,371 are open market purchase transactions with a total dollar value of $6.8 billion, and 34,777 are open market sale transactions with a total dollar value of $4.3 billion.

B. Statistical Properties of Aggregate Trading by Insiders

To determine the relation between insider trading and stock market returns, a measure of standardized aggregate insider trading is constructed. To the extent that some insider trading takes place either for reasons other than profiting from information or for firm-specific reasons only, aggregation cancels out the idiosyncratic components of insiders' transactions and reinforces the common response to economywide factors, thereby increasing the predictive power of the tests. Let

$$\mathrm{NE}_{i,t} = \sum_{j=1}^{J_{it}} H_{t,j}, \tag{1}$$

$t = 1,82$, from January 1975 to October 1981, where J_{it} denotes the total number of transactions in firm i and month t, and H equals one if purchase or minus one if sale. The net number of transactions by executives in firm i and month t, denoted as $\mathrm{NE}_{i,t}$, is the difference between the number of purchases minus the number of sales in each calendar month.[6] Define

$$\mathrm{SANE}_{k,t} = \sum_{i=1}^{I_k} (\mathrm{NE}_{i,t} - \overline{\mathrm{NE}_i})/s(\mathrm{NE}_i), \tag{2}$$

$k = 1,5$, and all firms, where I_k equals the total number of firms in group k and $\mathrm{SANE}_{k,t}$ refers to the standardized aggregate net number of transactions by executives in firm-size group k and in month t. Also,

$$\overline{\mathrm{NE}_i} = \left[\sum_{t=1}^{82} \mathrm{NE}_{i,t}/82\right], \tag{3}$$

and

$$s(\mathrm{NE}_i) = \left[\sum_{t=1}^{82} (\mathrm{NE}_{i,t} - \overline{\mathrm{NE}_i})^2/81\right]^{1/2}. \tag{4}$$

6. Large shareholders' transactions are separated, since Seyhun (1986) shows that large shareholders' transactions contain less special information than executives' transactions.

Hence, $SANE_{k,t}$ is computed by subtracting the mean and dividing by the sample standard deviation of net number of transactions over the 82 calendar months between January 1975 and October 1981, then summing across firms for each firm-size group. Standardization ensures that each firm gets approximately the same weight in the aggregate insider trading measure, thereby guarding against the possibility that a few firms receive undue weight in the results. While only the results for the net number of transactions for executives are reported, the tests have also been replicated using the net dollar volume of trading and the net proportion of the firm traded, computed similarly as the net number of transactions.

The statistical properties of the standardized aggregate net number of transactions by executives (SANE) are shown in table 2. The differences in standard deviations across firm-size groups largely reflect the different number of firms in each group. The cross-sectional correlation coefficients of the standardized aggregate net number of transactions are generally significantly positive, which indicates that executives in different firms tend to buy or sell the stock of their firms at the same time. This is consistent with the interpretation that the executives in different firms react to the same economywide factors at the same time or that a similar seasonal pattern of trading occurs among insiders of different firms.

Table 2 also indicates that the cross-sectional correlations of executives' transactions among firms of similar size are generally higher. Hence, it appears that insiders in similar-size firms are more likely to buy or sell stock at the same time, as compared with insiders in different-size firms. This finding suggests that firm size is a significant factor in determining the timing of insider trading activity. Consequently, separate examination of executives' transactions in different-size firms is expected to uncover additional information about aggregate insider trading activity.

Table 2 also shows the time-series properties of the standardized aggregate net number of transactions by executives. All six series have significantly positive first-order serial correlation coefficients, while the higher-order serial correlation coefficients are insignificant. Hence, the standardized aggregate net number of transactions by executives appears as a first-order moving-average process that is taken into account in the empirical tests presented in the next section.

IV. Empirical Results

A. Aggregate Insider Trading and Stock Market Returns

The evidence presented in this section uses regression analysis to examine the relation between aggregate insider trading and returns to the

TABLE 2 **Statistical Properties of the Standardized, Aggregate Net Number of Transactions by Executives from January 1975 to October 1981**

Variable	Standard Deviation	Cross-Sectional Correlation Coefficients					Serial Correlation Coefficients		
		$SANE_2$	$SANE_3$	$SANE_4$	$SANE_5$	SANE	r_1	r_2	r_3
$SANE_1$	11.9	.17	.34	.20	.02	.33	.18	.05	.00
		(1.5)	(3.2)	(1.8)	(.2)	(3.0)	(1.6)	(.0)	(.0)
$SANE_2$	9.0	...	.45	.37	.21	.47	.25	.23	.02
			(4.5)	(3.5)	(2.0)	(4.3)	(2.2)	(2.1)	(.2)
$SANE_3$	23.9	...	...	.76	.55	.86	.20	.06	.03
				(10.3)	(5.9)	(7.8)	(1.8)	(.5)	(.3)
$SANE_4$	42.5	...	...	...	.78	.95	.36	.07	.04
					(11.2)	(8.6)	(3.3)	(.6)	(.4)
$SANE_5$	27.6	...	...	...	...	.83	.36	.13	.14
						(7.5)	(3.3)	(1.2)	(1.3)
SANE	92.0	...	...	...	...	...	.35	.05	.03
							(3.2)	(.5)	(.3)

NOTE.—$SANE_1$–$SANE_5$ and SANE denote the standardized, aggregate net number of transactions by executives in firm-size groups 1–5 and all firms, respectively. See eqq. (1)–(4) for computation of SANE. The mean of SANE is zero by definition. Firms in group 1 have an average equity from 1975 to 1981 of less than $25 million; group 2, between $25 and $50 million; group 3, between $50 and $250 million; group 4, between $250 million and $1 billion; and group 5, more than $1 billion. The serial correlation coefficient of order 1–3 are denoted by r_1–r_3. Higher-order serial correlation coefficients are not statistically significant and therefore are not reported here. There are 82 monthly observations for each series. The t-statistics are shown in parentheses.

stock market. The dependent variable in the regressions is the difference between the monthly return to the market portfolio and the 1-month Treasury bill returns. This difference represents the excess return to the market portfolio. As proxies for the market portfolio, both the equally weighted and value-weighted portfolios of all New York Stock Exchange and American Stock Exchange stocks are used. The independent variables are the contemporaneous and lagged terms of the standardized aggregate net number of transactions by executives computed from equation (2).

If all insider trading occurs because of firm-specific reasons, then no relation between aggregate insider trading and the market's excess returns would be expected. If insiders recognize the effects of changes in economywide factors in their own firms at the same time other market participants do, and if they trade on the basis of their observations, then the relation between aggregate insider trading and excess market returns is expected to be positive and contemporaneous. Finally, if insiders recognize the effects of changes in economywide activity before other market participants, then a positive relation between current insider trading and future excess market returns is expected.

The results are shown in table 3. In models (1)–(3), the dependent variable is the excess return to the equally weighted market portfolio. In model (1), the independent variables are the two monthly lagged terms of the standardized, aggregate net number of executives' transactions (SANE). The estimated coefficient for $SANE_{t-1}$ is insignificant, while the estimated coefficient for $SANE_{t-2}$ is positive and significant at the 1% level. This regression suggests that an increase in current aggregate insiders' purchases is associated with an increase in future excess return to the market portfolio 2 months later. Given that sample standard deviation of $SANE_t$ equals 92.0 (from table 2), the coefficient estimate of 0.18 indicates that one standard deviation change in $SANE_t$ is associated with 1.7% change in future excess market returns. Model (2) includes the contemporaneous term, $SANE_t$ as well as the lagged terms, $SANE_{t-1}$ and $SANE_{t-2}$. In model (2), the estimated coefficient for $SANE_t$ is significantly negative, while both of the estimated coefficients for $SANE_{t-1}$ and $SANE_{t-2}$ are significantly positive. As table 1 shows, $SANE_t$ is serially positively correlated; hence, $SANE_t$ and $SANE_{t-1}$ tend to proxy for each other. Since the estimated coefficient of $SANE_t$ is negative while the estimated coefficient of $SANE_{t-1}$ is positive, omitting the contemporaneous term $SANE_t$ reduces the significance of the estimated coefficients of $SANE_{t-1}$. Model (3) includes the 1-month leading term $SANE_{t+1}$ as well. Model (3) shows that the estimated coefficients from model (2) are basically unchanged.

Models (4)–(6) of table 3 use as the dependent variable the excess

TABLE 3 **Regression of the Excess Monthly Return to the Equal and Value-Weighted Market Indices (RME and RMV) against the Leading, Contemporaneous, and Lagged Values of the Monthly Standardized Aggregate Net Number of Transactions by Executives (SANE) from January 1975 to October 1981**

Dependent Variable and Constant	$SANE_{t+1}$	$SANE_t$	$SANE_{t-1}$	$SANE_{t-2}$	r_1	r_2	r_3	r_{12}
RME_t:								
12.8 (2.2)	...	...	.001	.18	.08	−.05	−.06	.04
			(.02)	(2.64)‡				
13.1 (2.9)	...	−.39	.16	.15	−.21	.08	−.11	.03
		(−7.48)‡	(2.82)‡	(2.76)‡				
12.7 (2.5)	−.17	−.37	.16	.13	−.17	.18	−.06	.02
	(−3.53)‡	(−6.98)‡	(3.06)‡	(2.57)†				
RMV_t:								
5.0 (1.1)	...	...	.03	.10	.00	−.05	.00	−.01
			(.50)	(2.64)‡				
4.8 (1.9)	...	−.35	.16	.06	−.02	.05	−.02	.14
		(−7.91)‡	(3.26)‡	(1.49)				
4.6 (1.8)	−.12	−.27	.13	.07	−.03	.10	−.02	.11
	(−2.89)‡	(−5.68)‡	(2.85)‡	(1.74)*				

NOTE.—Excess market return is defined as the actual return to the market portfolio minus the return on the contemporaneous 1-month Treasury bill. The *t*-statistics of estimated coefficients are shown in parentheses. All estimated coefficients are multiplied by 1,000. Under the null hypothesis of no serial correlation, the standard error of the estimated serial correlation coefficients at lag k, r_k, is approximately .11. In models (1)–(3), the error model includes a significant moving average term at 12th lag. In models (4)–(6), the error model includes a significant moving average term at the first lag.

* Significant at the 10% level.

† Significant at the 5% level.

‡ Significant at the 1% level.

return to the value-weighted market portfolio. Comparison of models (4)–(6) with models (1)–(3) indicates that the results are not sensitive to the choice of market index. Both the estimated coefficients and their significance levels are similar.

Various tests have been conducted to examine the sensitivity of the results to the definition of aggregate insider trading activity. First, tests using the aggregate net number of insiders trading, the aggregate net dollar volume of trading, and the aggregate net proportion of the firm traded (standardized and unstandardized) produced results similar to those shown in table 3. Hence, the findings are not sensitive to a particular definition of insider trading activity. The tests also have been replicated using weekly measures of insider trading activity, providing results similar to those of the monthly tests. Specifically, the lagged weekly coefficients of $SANE_t$ are significantly positive, and the contemporaneous and leading weekly coefficients of $SANE_t$ are significantly negative. The relation between aggregate insider trading activity and subsequent market returns is examined separately by aggregating insiders' transactions by the size of firms' equity. Aggregate insider trading in a given firm size is positively correlated even more strongly with the subsequent return to the portfolio of firms included in each group.

Additional tests have been conducted to examine the sensitivity of the results to statistical methodology. First, using as the dependent variable the total return to the equally weighted market portfolio or the total return to the value-weighted market portfolio gives similar results. Second, table 3 reports the results of including moving average models for the residuals to account for the residual serial correlation. The omission of the moving average models for the residuals does not substantially change the magnitude or the significance levels of the estimated regression coefficients.[7] Third, the regressions have also been tested for the effects of outliers. Successively deleting the three observations with the highest Cook influence statistic does not alter the significance of the results.[8] Hence, the results in table 3 are not due to a few outliers. Finally, for all six models in table 3, the Kolmogorov statistics indicate that the residuals are approximately normally distributed.

Another potential explanation for the results in table 3 can be the seasonality of the stock returns. A recent study by Keim (1983) documents unexpectedly large, positive returns to small firms in the first week of January. Seyhun (1988) examines the seasonal patterns in insider trading and finds a significant increase in insider trading in

7. For identifying and estimating autoregressive moving average time-series models, see Box and Jenkins (1970).

8. For a discussion of the Cook influence statistic, see Cook and Weisberg (1980).

December. In small firms, insiders increase their net number of purchases in December. In large firms, insiders increase their net number of sales in December. An implication of this finding is that insiders' response to January stock returns can also produce similar types of relations as those observed in table 3.

To separate the effects of the end-of-year trading from the effects of economywide factors, the tests in table 3 have been repeated by introducing a dummy variable for the month of January. While not shown, these tests produce very similar results as those in table 3. As a second test, observations corresponding to the month of January are eliminated. Again similar results are obtained. Finally, the value-weighted market index reflects the returns to larger firms, and it is not as susceptible to January seasonality. As shown in models (4)–(6) in table 3, the value-weighted market index produces similar results to those of the equally weighted market index. Hence, the findings in table 3 cannot be attributed to a January seasonality in small firms.

Table 4 separates the net number of insiders' transactions into purchase and sale transactions. The significant coefficients for the lagged terms of a standardized aggregate number of purchases (SAPE) and sales (SASE) in table 4 show that advance insider purchases provide a positive signal about the stock market, and advance insider sales provide a negative signal for the stock market. This evidence is consistent with the results of table 3 and indicates that both insider purchases and insider sales contribute to the observed patterns shown in table 3. Also the significant leading and contemporaneous terms of SAPE and SASE variables indicate that insiders in the aggregate tend to decrease their stock purchases and increase their stock sales following an increase in the stock market. Statistical significance levels of the estimated coefficients in table 4 are smaller than those in table 3 because of the reduction in sample size.

The extent of the relation between the excess return to the market portfolio and the standardized aggregate net number of transactions by executives is examined in figure 1, which shows the cross correlations between the two variables for 24 monthly leads and lags. Figure 1 indicates that most of the significant correlations between the excess market returns and aggregate insider trading are confined to two monthly lead and lagged terms. Only one other cross correlation term out of the 49 estimated cross correlations is marginally significant.

The results in tables 3 and 4 and in figure 1 suggest that changes in aggregate insider trading activity occur approximately 2 months before the changes in excess returns to the market portfolio. A plausible interpretation of this evidence is that some insiders observe the effects of unanticipated changes in economywide activity in their firms' cash flows before other market participants recognize the changes in economywide activity. Consequently, insiders trade their firms' stock based

TABLE 4 **Regression of the Excess Monthly Return to the Equally Weighted Market Index RME against the Leading, Contemporaneous, and Lagged Values of the Monthly Standardized Aggregate Number of Purchases by Executives (SAPE) and Standardized Aggregate Number of Sales by Executives (SASE) from January 1975 to October 1981**

Constant (Dependent Variable = RME_t)	$SAPE_{t+1}$	$SAPE_t$	$SAPE_{t-1}$	$SAPE_{t-2}$	r_1	r_2	r_3	r_{12}
12.3 (2.1)	...	...	.51 (1.84)*	.45 (1.57)	.08	−.12	−.10	.02
11.9 (2.0)	...	−.38 (−1.32)	.53 (1.80)*	.46 (1.58)	.07	−.14	−.09	.00
11.8 (1.9)	−.32 (−1.11)	−.38 (−1.27)	.54 (1.81)*	.42 (1.41)	.05	−.15	−.07	.00
	$SASE_{t+1}$	$SASE_t$	$SASE_{t-1}$	$SASE_{t-2}$				
13.1 (2.2)	...	...	.03 (.49)	−.17 (−2.63)‡	.07	−.09	−.05	.03
14.4 (1.3)	...	.35 (6.13)‡	−.14 (−2.17)†	−.12 (−2.17)†	−.16	−.04	−.08	.02
13.0 (2.9)	.17 (3.61)‡	.28 (5.08)‡	−.09 (−1.49)	−.13 (−2.60)‡	−.14	.05	−.03	.02

NOTE.—Excess market return is defined as the actual return to the market portfolio minus the return on the contemporaneous 1-month Treasury bill. The t-statistics of estimated coefficients are shown in parentheses. All estimated coefficients are multiplied by 1,000. Under the null hypothesis of no serial correlation, the standard error of the estimated serial correlation coefficients at lag k, r_k, is approximately .11.

* Significant at the 10% level.

† Significant at the 5% level.

‡ Significant at the 1% level.

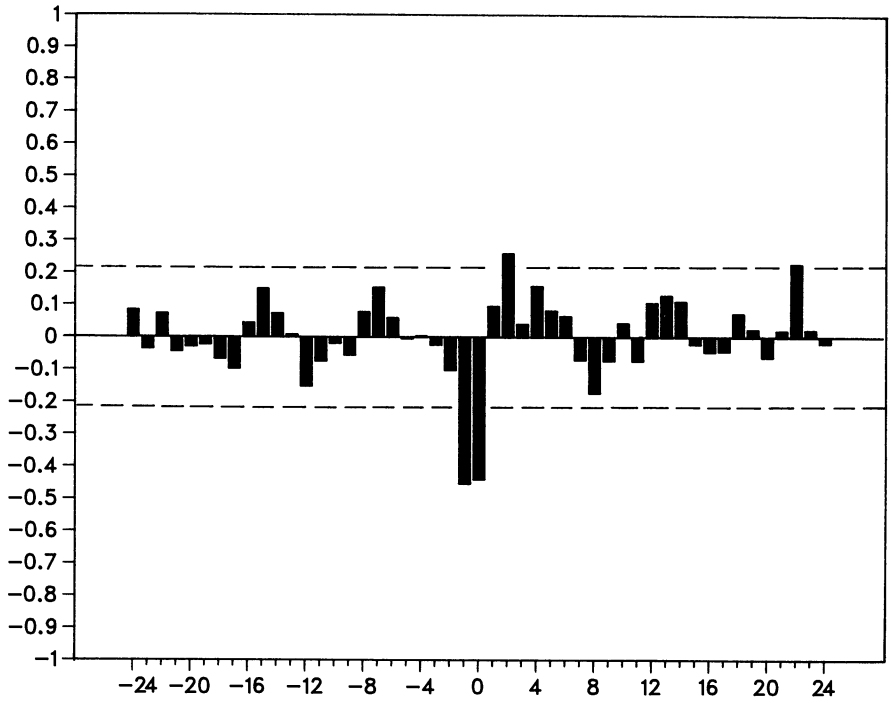

FIG. 1.—Cross correlations of the excess return to the equally weighted market index with the standardized aggregate net number of transactions by executives for −24 to +24 lags. The dashed lines indicate the 95% confidence band for the estimated cross correlations.

on their assessment of their own firms' future prospects. Within 2 months following insiders' transactions, the changes in economywide activity are recognized by most market participants, and security prices adjust. Since insiders' transactions precede the change in market return, insiders' transactions appear to forecast the market return during the next 2 months. In contrast, the significantly negative contemporaneous and leading coefficients of the standardized aggregate insider trading indicate that insiders reverse the direction of their transactions after the realization of the stock price movements. Insiders tend to sell stock following market increases, and they tend to purchase stock following market decreases.

B. Information Content of Aggregate Insider Trading and Market Risk

The previous discussion about the information content of aggregate insider trading suggests that, in firms characterized by higher market risk, insiders will be more likely to observe and therefore trade on the basis of the effects of economywide shocks. As a result, the strength of

the relation between stock market movements and aggregate insider trading is predicted to be positively related to the market risk of the firms. The evidence presented in this section tests this prediction.

First, the 769 firms in the study are classified into 100 groups based on the decile ranking of their estimated market risk and the average values of their equity from January 1975 to October 1981. One measure of market risk is the coefficient of determination, RS_{MM}, from the market model, which measures the proportion of the variance of the return to the firm explained by the market portfolio.[9] A second measure of risk is the slope coefficient, BETA, from the market model. The dependent variable is the coefficient of determination RS_{AT} obtained by regressing the monthly excess returns to the equally weighted market portfolio against the contemporaneous and lagged terms of SANE, similar to the regressions shown in table 3, for each of the 100 groups.

The results are shown in table 5. Model (1) of table 5 shows that the risk measure RS_{MM} is positively related to the coefficient of determination, RS_{AT}. As predicted, the strength of the relation between stock market returns and aggregate insider trading increases with the market risk of the firm. Model (2) indicates that the coefficient estimate on firm size is also significantly positive. However, when included together, only the coefficient of risk measure is significant in model (3), while the coefficient of firm size is no longer significant.[10] Models (4) and (5) in table 5 substitute the risk measure BETA, in place of RS_{MM}. The results using BETA are qualitatively similar to the results using RS_{MM}.[11] In firms characterized by higher market risk, insiders are more likely to observe and therefore trade on the basis of the effects of economywide factors.

Seyhun (1986) finds that insiders' predictive ability for their own firms' performance is stronger in smaller firms. Hence, it appears that insiders in small firms who tend to be more successful predictors of their firms' performances also tend to trade mostly on firm-specific information. Table 5 indicates that insiders in larger firms, who are less successful predictors of their own firms' performance, are also more likely to observe and trade on the basis of economywide factors that

9. The market model refers to the regression of the return to the security against the return to the value-weighted market portfolio. RS_{MM} equals the coefficient of determination from the market model, while BETA equals the estimated slope coefficient. For a discussion of the market model, see Fama (1976), ch. 4. To avoid a rank-order bias, the risk measures used in ranking are estimated from nonoverlapping data from those used in regressions.

10. Estimation errors in RS_{MM} and BETA will tend to bias the regression coefficient estimates toward zero in simple regressions, making it less likely that any significant relations will be detected.

11. As a further test, a weighted measure of aggregate insider trading activity has been constructed using as weights the average market risk of each firm. The relation between market returns and the weighted aggregate insider trading activity (not shown) is similar to the relations shown in table 3.

TABLE 5 **Ordinary Least-Squares Regression of the Coefficient of Determination from the Insider Trading Regressions (RS_{AT}) against the Coefficient of Determination from the Market-Model Regressions (RS_{MM}) Estimate of the Firms' Average Market Risk (BETA) and the Logarithm of the Firms' Average Market Value of Equity (LV)**

Model No.	Dependent Variable		Intercept		Independent Variables: Market Risk		LV	No. Portfolios	*F*-Statistic
(1)	RS_{AT}	=	.036	+	.266 RS_{MM}			100	8.72†
			(2.04)		(2.95)†				
(2)	RS_{AT}	=	−.038			+	.010 LV	100	4.43*
			(−.66)				(2.10)*		
(3)	RS_{AT}	=	.075	+	.333 RS_{MM}	−	.004 LV	100	4.46*
			(.96)		(2.08)*		(−.51)		
(4)	RS_{AT}	=	.019	+	.075 BETA			100	11.05†
			(.94)		(3.32)†				
(5)	RS_{AT}	=	−.005	+	.069 BETA	+	.002 LV	100	5.58†
			(−.08)		(2.55)*		(.45)		

NOTE.—The *t*-statistics for the estimated coefficients are shown in parentheses. The 769 firms included in the study are first classified into 100 groups based on the decile ranking of their estimated market risk, the beta, or the coefficient of determination, and the average values of equity of the firms between January 1975 and October 1981. RS_{MM} is the coefficient of determination, while BETA is the estimate of the slope coefficient from the market model regressions. LV is computed by taking the natural logarithm of the average of the market value of firms' equity for each of the 100 groups. The dependent variable is the coefficient of determination, RS_{AT}, obtained from regressions of the monthly excess returns to the equally weighted market portfolio against the contemporaneous and lagged terms of the standardized aggregate net number of transactions by executives (SANE) for each of the 100 groups. Risk measures used in ranking are estimated from nonoverlapping data from those used in the regressions. The *F*-statistics in models (1), (2), and (4) have 1 and 98 degrees of freedom (df) and, in models (3) and (5), 2 and 97 df.

* Significant at the 5% level.

† Significant at the 1% level.

affect their firms. Since larger firms tend to be more diversified than smaller firms, economywide factors play a greater role in producing observable mispricing in the stock price of larger firms. Hence, the differences in insiders' responses in different size firms to the economywide factors appear to be subsumed by the differences in the market risk of the firms.

C. *Market Efficiency*

The evidence provided in this section attempts to determine if the relation between insiders' transactions and the subsequent excess return to the market portfolio can be used to construct profitable trading rules. In each calendar month, only the insider transactions reported to the SEC or those published in the *Official Summary* are used to construct an aggregate insider trading variable. The date insiders' reports are received by the SEC represents the earliest date an outsider can obtain information about insiders' transactions. However, insiders' transactions are published in other publications prior to the *Official Summary*. Consequently, the publication date of the *Official Summary* is intended as the widest dissemination date of insider trading information.[12]

Table 6 shows the relation between the returns to the equally weighted market index and the standardized aggregate net number of executives' transactions computed from insiders' reports filed with the SEC (SANER). Models (1)–(3) indicate that the estimated coefficient of SANER_{t-1} is significantly positive at the 1% level, while the coefficient of SANER_{t-3} is marginally significant. The coefficients of both SANER_t and SANER_{t-2} are insignificant and have negative signs. Overall, the evidence shown in models (1)–(3) suggests that reported aggregate insider trading activity also contains some information about the return to the market portfolio 1–3 months later.

The relation between the returns to the equally weighted market index and the standardized aggregate insider transactions computed from *published* reports (SANEP) are shown in models (4)–(6) of table 6. The regression coefficients of SANEP_{t-2} variables are positive and marginally significant, while the coefficients of SANEP_t, SANEP_{t-1}, and SANEP_{t-3} are insignificant.[13] Hence, by the time insiders' transac-

12. Since the actual publication dates of the *Official Summary* are unavailable, the date the *Official Summary* is received by the Rush-Rhees Library of the University of Rochester is used. The latter dates are likely to overstate the publication dates by 1 week to 10 days, owing to delays in postal delivery. In addition to the *Official Summary (of Security Transactions and Holdings)*, private newsletters such as *Insiders, Insider Report, Insider Indicator, Consensus of Insiders,* and *Insiders' Chronicle* publish insider trading information.

13. The tests shown in table 6 are repeated using as the dependent variable the excess returns to the value-weighted market index. The results are similar.

TABLE 6 **Regression of the Excess Monthly Return to the Equally Weighted Market Index (RME), against the Contemporaneous and the Lagged Values of the Monthly Standardized Aggregate Net Number of Transactions by Executives, Reported Each Month (SANER) and Published Each Month (SANEP) from January 1975 to October 1981**

Constant (Dependent Variable = RME_t)	$SANER_t$	$SANER_{t-1}$	$SANER_{t-2}$	$SANER_{t-3}$	r_1	r_2	r_3	r_{12}
12.3 (2.1)	...	.24 (2.86)‡	−.04 (−.51)	...	.04	−.05	−.10	.02
11.9 (2.0)	−.01 (−.78)	.28 (2.87)‡	−.06 (−.65)	...	.05	−.04	−.08	.02
12.7 (2.2)	−.07 (−.84)	.31 (3.18)‡	−.17 (−1.73)*	.18 (2.17)†	.04	−.06	−.15	.03
	$SANEP_t$	$SANEP_{t-1}$	$SANEP_{t-2}$	$SANEP_{t-3}$				
12.6 (2.1)	...	.01 (.20)	.14 (2.02)†	...	.04	−.12	−.10	.02
12.6 (2.1)	.07 (1.05)	−.01 (−.10)	.13 (1.86)*	...	.04	−.19	−.14	.04
12.0 (2.0)	.07 (.94)	−.01 (−.06)	.12 (1.72)*	.03 (.40)	.04	−.19	−.16	.03

NOTE.—Excess market return is defined as the actual return to the market portfolio minus the return on the contemporaneous 1-month Treasury bill. The t-statistics of estimated coefficients are shown in parentheses. All estimated coefficients are multiplied by 1,000. Under the null hypothesis of no serial correlation coefficients at lag k, r_k is approximately .11.

* Significant at the 10% level.

† Significant at the 5% level.

‡ Significant at the 1% level.

TABLE 7 Average Monthly Excess Returns to Strategies that Exploit the Reported or Published Aggregate Insider Trading Information

Model No.	Strategy	Timing	N	Forecasting Horizon: 1 Month Ahead	2 Months Ahead	3 Months Ahead	4 Months Ahead
(1)	$R_F - R_M$(DOWN)	Reporting	37	.003	−.002	−.003	−.009
				(.26)	(−.24)	(−.39)	(−1.07)
(2)	$R_F - R_M$(DOWN)	Publication	39	−.006	−.001	−.008	−.003
				(−.74)	(−.07)	(−.84)	(−.39)
(3)	R_M(UP) − R_M(DOWN)	Reporting	37	.028	.018	.014	.003
				(2.43)†	(1.51)	(1.19)	(.23)
(4)	R_M(UP) − R_M(DOWN)	Publication	39	.013	.022	.005	.016
				(1.11)	(1.84)*	(.45)	(1.31)

NOTE.—Strategies (1) and (2) test to see whether the return on the equally weighted market portfolio falls below the risk-free rate when the aggregate insider trading provides a down signal. Strategies (3) and (4) examine the differences in returns to the equally weighted market index when the aggregate insider trading provides up or down signals. The variable N denotes the number of down predictions. The study covers a period of 82 calendar months in total. The variable R_F denotes the return on 1-month Treasury bills, and R_M denotes the return on the equally weighted market index. The t-statistics are shown in parentheses.

* Significant at the 5% level.

† Significant at the 10% level.

tions are published in the *Official Summary*, the predictive information content of aggregate insider trading activity is substantially reduced but not completely eliminated.

To measure the economic significance of the strength of predictive ability that can be extracted from publicly available insiders' transactions, the excess returns to some simple strategies are examined in table 7. First, each month the standardized aggregate net number of transactions from all reported and published transactions is computed. A down signal is obtained when the standardized aggregate net number of transactions is negative. Otherwise, an up signal is obtained. The first strategy tests to see whether the return to the equally weighted market index falls below the risk-free rate when a down signal is obtained. Model (1) in table 7 shows that, using reported transactions, the return to the equally weighted market index does not fall reliably below the risk-free rate for any of the four forecasting intervals. In fact, the market return generally exceeds the risk-free rate, but the difference is not statistically significant. Model (2) in table 7 shows similar results using the published aggregate insider trading data. Given a down prediction, the market return on average is not significantly below the risk-free rate. This finding suggests that, given a down signal, market analysts could not find it profitable to short sell a market index and to buy Treasury bills.

The second strategy examines the differences of the average monthly return to the equally weighted market index during up- and down-predicted months. Model (3) in table 7 uses reported aggregate insider trading to forecast the stock market. For a 1-month-ahead forecasting interval, the average return to the equally weighted market index during up-predicted months exceeds that of the down-predicted months by 2.8%. This value is significant at the 5% level. For other forecasting intervals, the differences are smaller. Model (4) of table 7 uses published insider trading data to forecast the stock market. For a 2-month-ahead forecasting interval, the average return to the equally weighted market index during up-predicted months exceeds that of down-predicted months by 2.2%. This value is significant at the 10% level. For other forecasting intervals, the differences are smaller and statistically insignificant.[14]

The evidence in table 7 suggests that the future market returns remain predictable to some extent even after the publication of the aggregate insider trading information. However, predictability of market returns cannot be used to obtain a profitable switching strategy between the Treasury bills and the stock market. Hence, expected market returns are never reliably negative. This evidence is consistent with

14. The tests in table 7 are also replicated using the return to the value-weighted market index. The results (not shown) are somewhat less significant.

the recently growing evidence on the predictability of expected market returns (Fama 1984; Keim and Stambaugh 1986; Fama and French 1986*a*, 1986*b*, 1987).

V. Conclusions and Implications

The evidence presented in this study shows that net aggregate insider trading activity in a given month is significantly positively correlated with the return to the market portfolio during the subsequent 2 months. In the aggregate, insiders increase their stock purchases prior to increases in the stock market and decrease their stock purchases following increases in the stock market. Also, insiders increase their aggregate stock sales prior to declines in the stock market and decrease their aggregate stock sales following increases in the stock market. A plausible interpretation of this evidence is that part of the mispricing observed by insiders in their own firms' securities is caused by unanticipated changes in economywide activity. For instance, insiders purchase their own firms' stock based on their assessment of favorable prospects for their firm that are partially caused by an unanticipated increase in economywide activity. Subsequently, when the increase in economywide activity is generally recognized, stock prices rise. Since insiders have purchased their firms' stock prior to the rise in the return to the market portfolio, insiders' purchases appear to forecast the rise in the stock market.

The evidence presented in this paper is consistent with a Lucas effect. Insiders respond to the effects of some economywide factors as though they were firm-specific factors by trading in the stock of their own firms. The strength of the relation between market returns and aggregate insider trading is positively related to the market risk of the firm. This finding suggests that insiders in higher market risk firms are more likely to observe and trade on the basis of mispricing caused by economywide factors. Also, insiders in small firms who tend to be more successful predictors of their firms' performance tend to trade mostly on firm-specific information. Insiders in larger firms who are less successful predictors of their firms' performance are more likely to observe and trade on the basis of economywide factors rather than firm-specific factors.

The evidence presented in the paper suggests that future market returns remain predictable to some extent even after the publication of the insider trading information. However, the predictability of market returns cannot be used to obtain a profitable switching strategy between the Treasury bills and the stock market, even ignoring any transactions costs.

Extrapolating from the findings of this study, net aggregate insider trading activity can be a useful component of the leading indicators of

future economic activity. If it is to be useful, aggregate insider trading information must be gathered soon after insiders report their transactions to the SEC. Early gathering of insider trading information is necessary since the information content of aggregate insider trading activity gradually degenerates over time.

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