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MARKET EFFECIENCY AND EXPECTED VALUE, COST AND QUALITY OF INFORMATION

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Abstract: Recent studies in information economics literature predict that when the costs of obtaining and exploiting information are significant, security price reaction to information depend on the expected value of information, costs of acquiring and exploiting information, and the quality of information. This paper tests the predictions of the information economics models by analyzing stock price reactions for approximately 60,000 insider transactions in 769 firms from January 1975 to October 1981. The security price reaction following insiders' transactions is well suited for this task since insider trading is a real-world analog of information economics models where the informed insiders are expected to take into account the expected value and quality of their information, and the costs of trading before they trade on the basis of their special information. The security price reaction following insider trading suggests that traders who invest resources in information processing are compensated for the costs they incur and the risks they bear.

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I- Introduction

In the empirical market efficiency literature numerous studies report that security prices do not fully and immediately reflect all publicly available information. For example, Ball (1978) reviews 20 studies that report gradual security price adjustment to earnings announcements. Schwert (1981) finds a measurable security price adjustment at the time of the announcement of the Consumer Price Index even though the information about consumer prices is already publicly available. Jaffe (1974) and Seyhun (1986) among others, report that security price reaction to corporate insiders' transactions in their own firms is not immediately completed.[1]

Regarding the anomalous evidence on market efficiency, Fama (1976) points out that tests of market efficiency are joint tests: Failure to meet the test can be due to the information inefficiency of the capital markets or a misspecification of the model of expected returns. Recent theoretical studies in information economics by Green (1973), Grossman and Stiglitz (1980), Verrecchia (1980), and Diamond and Verrecchia (1981), among others, further suggest that security price reaction to information is not expected to be instantaneously completed, when the costs of obtaining and exploiting information are significant. Security price adjustment to information must allow traders who invest resources in processing information to earn a normal rate of return on their investment. For instance, initial security price

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[1] Section 16(a) of the Securities and Exchange Act of 1934 defines insiders as officers, directors, and owners of 10% or more of any equity class of securities. In Seyhun (1986), abnormal stock price adjustment following the reporting of insiders' transactions is less than the transactions costs. For other insider trading studies, see Lorie and Niederhoffer (1968), Pratt and DeVere (1970), and Finnerty (1976). For some additional anomalous evidence on market efficiency, see the special issue of the Journal of Financial Economics entitled, Symposium on Some Anomalous Evidence Regarding Market Efficiency, June/September 1978, Volume 6, no 2/3.

reaction to information that is more costly to acquire and exploit is predicted to be less complete. Consequently, greater subsequent security price adjustment is expected to enable the traders to recover their investment in information processing. Information economics models also predict that the initial security price reaction to lower quality information to be less complete.[2] Consequently, greater subsequent security price adjustment is expected to provide greater compensation to risk averse traders who exploit the lower quality information.

The objective of the study is to test the proposition that traders who invest resources in processing information are compensated for the costs they incur. In addition, the paper tests the more specific predictions of the information economics models: The initial security price reaction to information that is more costly to acquire and exploit and lower quality information is expected to be less complete. Hence, the subsequent return to processing information that is more costly to acquire and exploit is predicted to be greater. Similarly, the subsequent return to processing lower quality information is also predicted to be greater. The propositions about the determinants of the security price reaction to information are tested by examining the security price adjustments around corporate insiders' transactions in their own firms.

The corporate insiders' decisions to engage in open market sales and purchase transactions based on their special information is a real-world analog of the information economics models. It is expected that an information related insider transaction occurs when the insider finds it beneficial to trade after considering the expected value of the information,

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[2] Grossman and Stiglitz (1980), p. 399, defines the quality of information as the ratio of variance of information to variance of noise. Quality of information as used in this paper is defined later in a similar way.

the costs of trading, and the quality of the information. Outsiders can also attempt to imitate insiders' transactions by obtaining and analyzing the insider trading information. Hence, if the security price adjustment following insiders' transactions provides outsiders with an incentive to analyze insider trading information, then it is predicted that the return earned by outsiders must also increase with the costs of acquiring and exploiting the information and decrease with the quality of the information.

The paper is organized as follows: Section 2 of the paper discusses the testable implications of the relation between stock price adjustment, cost of information processing, and the variance of information. Section 3 describes the data sources and sample characteristics. Empirical methodology is in Section 4. Results of the paper are in Section 5, and the conclusion and implications are in Section 6.

II-Stock Price Reaction and the Cost and Variance of Information

The proposition that the costs of acquiring information affect the security price reaction to information is an accepted part of the efficient markets literature. As stated by Fama (1970), for instance, costs of acquiring and exploiting weak form and semi-strong form information are assumed to be negligible as compared to the potential profits that can be obtained from such information.[3] Hence security prices are expected to fully reflect all weak form and semi-strong form information. In contrast, costs of acquiring and exploiting strong form information is assumed to be substantial. Consequently, security prices are not expected to fully and immediately

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[3] Weak form information refers to the information in the past history of security prices, while the semi-strong form information refers to all publicly available information. Strong form information refers to all information, public and private. See Fama (1970) for a review of the theory and early evidence on the efficient markets literature.

reflect strong-form information.

There is a greater divergence of opinion about the effects of the trading costs on market efficiency. Fama (1970) suggests that trading costs are not likely to affect the security price reaction to information, since a significant number of investors have low cost access to trading. For instance, the commission fee is not a marginal cost for those investors who have already decided to trade for other reasons such as investing idle funds or changes in consumption requirements. Moreover, the marginal cost of trading are much smaller for the members of the organized stock exchanges.[4] Jensen (1978) on the other hand, points out the all trading costs must be taken into account in assessing market efficiency.

Currently, the efficient markets literature in financial economics does not ascribe a significant role for the quality or the variance of information. While risk averse individual traders would require greater compensation to exploit more variable information, risk neutral traders such as institutional traders would not be deterred from exploiting profitable, yet high variance information. Implicitly, it is assumed that the risk neutral traders would be able to trade in sufficient quantities to eliminate all profit opportunities, regardless of the variance of the information. Consequently, the security prices are expected to reflect all information equally well, regardless of the differences in the variance of the information.

To derive testable relations between cost of acquiring information and the return to processing information, consider the three time periods immediately following the insider trading day during which insider trading

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[4] Schwert (1977) analyzes the price of membership for the New York and American Stock Exchanges and concludes that the price of membership efficiently reflects members' cost advantage over nonmembers.

information becomes publicly available. Immediately following the insider trading day, few non-insiders can acquire information about insider trading. Some exceptions may be the insiders' brokerage firm and some favored customers of the brokerage firm. During this period, the cost of acquiring information about insiders' transactions for most non-insiders is expected to be high.

By law, insiders are required to report their transactions to the Securities and Exchange Commission (SEC) and the exchange where the transaction takes place within the first ten days of the month, following the month of the transaction. During this second period, non-insiders can obtain the insider trading information from the SEC's public library at some cost. The reporting of insiders' transaction is expected to significantly reduce the cost of acquiring insider trading information for non-insiders.

Starting within two weeks of the reporting of insiders' transactions, some private newsletters publish selected insider transactions. Finally, after about two months following the reporting of insider trading information, SEC publishes the Official Summary (of Security Transactions and Holdings) which includes all reported transactions by insiders. It is expected that the cost of acquiring the insider trading information following the publication of the Official Summary is negligible.

Consider a strategy of obtaining insider trading information during the trade to report, report to publication, or the post-publication period, imitating insiders' transactions, and closing out the position in the post-publication period. Given the differential costs of acquiring insider trading information, the return from initiating the transaction in the trade to report period should be highest, followed by the return from initiating the transaction in the report to publish period. The return from initiating and closing out a transaction in the post-publication period ought to be the

smallest. This proposition is a testable implication that arises out of differential information acquisition costs.

To obtain a testable relation between the cost of exploiting information and the return to processing information, a measure of trading costs is needed. Trading costs depend among others, on the size of firm, size of the transaction, and the urgency of the transaction. The two major components of trading costs are the commission fee and the bid-ask spread. The commission fee provides the market-maker with compensation for brokerage services. The commission fee depends on the volume of trade: With increasing dollar volume of trade, the commission fee falls as a percent of the dollar volume of trade.[5] The bid-ask spread is the difference between the selling and purchasing prices quoted by the market-maker and it helps compensate the market-maker for expected losses to the informed traders. The bid-ask spread is highest in smallest size firms and falls with increasing firm size. Stoll and Whaley (1983) report that the bid-ask spread falls from 2.9% for firms with average size of equity of $15 million, to about 0.7% for firms of average size of equity greater than $3 billion.

The costly information models predict a greater return before costs to processing information in smaller firms, since the costs of trading are higher in smaller firms due to the higher bid-ask spreads. Rational investors would require that the return to processing information must at least cover the cost of trading on information. On the other hand, if the marginal cost of trading cost is negligibly small for the informed traders, then no relation is expected between return to processing information and firm size.

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[5] In 1985, the commission fee charged by discount brokers on a $2500 trade is about 2.0% for a one-way transaction. On a $25,000 trade, the commission fee falls to about 0.5%.

The costly information models also predict a negative relation between the quality of information and the return to processing information. Following Grossman and Stiglitz (1980), define the quality of information as the ratio of variance of information to variance of noise. Empirically, the variance of information is not observed, while the variance of noise can be computed as the variance of abnormal returns to the security, conditional on an insider transaction. Hence, quality of information can be taken as proportional to the inverse of the variance of abnormal returns, conditional on an insider transaction. A negative relation between quality of information and return to information processing therefore implies a positive relation between variance of abnormal returns and return to information processing.

As an alternative way of reasoning, as the variance of returns increases, expected utility of exploiting information falls for risk averse insiders. Given a sufficient marginal increase in the variance, risk-averse insiders would prefer not to exploit information. Hence, insiders are expected to require additional compensation in the form of higher average returns to take on greater variance, which is expected to lead to a positive relation between the expected value and the variance of abnormal returns.

The other market participants' response to the quality of insiders' information is also examined. If other market participants are also risk averse, then they would be expected to respond to a marginal increase in the quality of insiders' information by trading a greater volume of shares. The greater trading response is expected to result in more complete immediate security price reaction to information. Therefore, even if additional information is disclosed to the market at a later date, less of the security price reaction for higher quality information is expected to occur subsequently, following the complete dissemination of the insider trading information.

III. Data and Sample Characteristics

The insider trading data used in this study come from a computer tape compiled by the Securities and Exchange Commission (SEC). The tape summarizes more than 1.5 million insider transactions in all publicly held firms from 1975 to 1981. This study analyzes a sample of transactions in 790 firms on the daily returns file of the Center for Research in Security Prices (CRSP). The 190 firms listed on option exchanges on January 1, 1977 are included in the sample. The option exchange listing dates are obtained by corresponding with the option exchanges. The remaining 600 firms are chosen by stratified random sampling based on the size of firms' equity. Out of 790 firms, 21 did not report any open market sales or purchases between 1975 and 1981. Consequently, the actual number of firms with insider trading data is 769.

Table 1 shows the sample characteristics of the insider trading data analyzed in this study. The sample contains a total of 59,148 open market sales and purchase transactions by insiders in 15,083 firm-months.[6] All other insider transactions such as exercises of options, shares acquired from a compensation plan, private transactions etc., are excluded, since open market sales and purchases occur more frequently due to information reasons.[7] The net dollar volume of trade is computed by netting out the dollar value of insiders' sales against their purchases in each month. The net dollar volume

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[6] The sample analyzed in this study is identical to Seyhun (1986) where the reader is referred to for additional characterization of the sample. Numerous consistency checks on dates, prices, and shares were performed to eliminate approximately 1000 transactions containing apparent data errors out of about 60,000 transactions.

[7] This proposition is tested by comparing the abnormal returns following insiders' open market transactions with the abnormal returns following other transactions. Other insider transactions do not appear to be information motivated since the abnormal returns following other insider transactions are statistically insignificant.

Table 1

Distribution of firm-months, number of firms, net dollar value of insiders' transactions, and the average number of days between trading day, reporting day, and the publication day of the Official Summary grouped by the quintile of the average size of equity of the firm. Sample period is from January 1975 to October 1981.[a]

	Quintiles of average size of firms' equity from 1975 to 1981					
	I	II	III	IV	V	
	Less than or equal to $111.1 million	Between $112.9 & $382 million	Between $384.6 & $754.5 million	Between $754.8 & 1298.0 million	More than 1298.0 million	All Firms
Number of firm-months ..	3020	3004	3018	3023	3018	15,083
Number of Firms	253	154	129	123	110	769
Net dollar trade per firm-month (in $1000).....	$130	$413	$385	$540	$1,701	$634
Trade to report lag	38	38	34	32	32	33
Report to publish lag ...	40	41	39	39	38	39

[a] The trade to report lag shows the average number of trading days between the day insiders trade and the day their reports are received at the Securities and Exchange Commission (SEC). The report to publish lag shows the average number of trading days between the days insiders' reports are received at the SEC and the day The Official Summary is received at the Rush-Rhees Library of the University of Rochester. Due to postal delivery delay, the latter date is expected to overstate the publication date of the Official Summary by about a week to ten calendar days.

of trade increases with firm size from an average of $130,000 in small firms to $1.7 million in large firms.[8] Hence, on average, the net dollar value of insider trading in large firms is more than 10 times greater than the net dollar value of insider trading in small firms. This is expected since there are greater number of insiders in larger firms.

Table 1 also shows the average number of days between the insider trading day, the day insiders report their transactions to the SEC, and the publication day of the Official Summary.[9] The average number of trading days between the trade day and the report day is 33 days, or about 47 calendar days, while the average report to publication lag is 39 trading days, or about 55 calendar days. Hence, there are substantial delays between the insider trading day, reporting day, and the publication day. The empirical tests presented in the next section explicitly account for the delays in reporting and the publication of insider trading information. Table 1 also shows that trade to report lag is somewhat greater in smaller firms than in larger firms. This is suggestive that insiders in smaller firms feel less constrained by the regulations of insider trading and thus report their transactions to the SEC with greater delays. The report to publication lag is about the same in all firms.

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[8] While not shown, for a given firm, only about 7% of the dollar volume of insiders' transactions in a given month are in opposite directions. The relatively small magnitude of the disagreements among insiders suggests that insiders trade in response to the same signals, possibly nonpublic information.

[9] Since it was not possible to obtain the actual publication dates of the Official Summary, the dates the issues of Official Summary are received by the Rush-Rhees Library of the University of Rochester are used instead. Due to postal delays, the latter dates are likely to overstate the actual publication dates by a week to ten days.

IV-Empirical Methodology

This study uses the market-model to measure the expected returns to securities. The market-model is a statistical model based on the joint normality of the distribution of security returns. Given parameter stationarity, the market-model prediction errors have an expected value of zero for firms of any size, thereby avoiding a firm size bias introduced by the CAPM.[10] The prediction error $PE_{i,t}$ for security i on day t, from 199 days before to 300 days after each event day is calculated as follows:[11]

$$(1) \quad PE_{i,t} = (r_{i,t} - (\alpha_i + \beta_i r_{m,t})) W \quad \text{for } t = -199,300$$

where $r_{i,t}$ is the with-dividend return to security i on day t and $r_{m,t}$ is the with-dividend return to value-weighted portfolio of all New York Stock Exchange and American Stock Exchange stocks on day t. To account for potential changes in market parameters, the parameters α_i and β_i are estimated using ordinary least squares regression of $r_{i,t}$ on $r_{m,t}$ with 250 post-event daily return data, always excluding the period from the insider trading day to 300 days thereafter. The post-event estimates are used to calculate the prediction errors between days 0 and 300. The last insider trading day in

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[10] Jaffe (1974) measures the abnormal returns in 200 large firms following insiders' transactions, using Fama-MacBeth (1973) estimates of the two-parameter CAPM, which are computed against an equally-weighted market index. Keim (1983) documents that the CAPM residuals are mostly negative for large firms using an equally weighted market index. The use of CAPM can lead to upward biased estimates of abnormal profits in insider trading studies, as Seyhun (1986) points out. Since the majority of insider transactions in large firms happen to be open market sales, even if insider trading conveys no special information, the negative CAPM residuals will be associated with insiders' sales. A similar consideration holds for CAPM benchmark and small firms. See Seyhun (1986) for specifics.

[11] See Fama (1976), Chapter 4 for a discussion of the market-model, and Brown and Warner (1980,1985) for an investigation of the empirical event study methodologies. The mean returns adjusted model, and the Scholes and Williams (1977) estimates of the market model also give similar estimates of the prediction errors to securities.

in each month is taken as the event day. The parameter W is equal to one if the number of buyers exceed the number of sellers in that month, or minus one if the number of sellers exceed the number of buyers. If the number of buyers equals the number of sellers, that month is excluded. An insider is considered a buyer if he buys more shares than he sells or a seller if he sells more shares than he buys. Insiders who buy as many shares as they sell are ignored.

The average portfolio prediction error for event day t, APE_t, is calculated by averaging all prediction errors for that event day,

$$(2) \qquad APE_t = \frac{1}{K_t} \sum_{i=1}^{K_t} PE_{i,t} \qquad t = -199,300$$

where K_t = number of prediction errors on event day t.

The gross abnormal profit from exploiting insider trading information is measured by the cumulative daily average prediction error from event day t_1 to t_2, $GAP(t_1,t_2)$, which is calculated by summing the daily average prediction errors,

$$(3) \qquad GAP\ (t_1,t_2) = \sum_{t=t_1}^{t_2} APE_t$$

To obtain as much information is possible, all open market transactions by insiders for the firms represented in the sample are included for study. To classify a given time period as a purchase or sale period, determine the dollar volume of insider trading and the identity of traders, insiders' transactions are aggregated for each nonoverlapping two-month periods. For convenience, the two month aggregation period is referred to as the insider trading month.

The cost of including all open market transactions of insiders is that estimates of insiders gross abnormal profits from two successive months share

the same return data. For example, estimates of insiders' gross abnormal profit from 1 day to 120 days after the insider trading day for two successive trading months share approximately 78 days of return data.[12] Overlapping return data leads to positive serial correlation of gross abnormal profits if both trading months are either purchase or sale months, and to negative serial correlation if one of the months is a purchase month while the other is a sale month. The empirical tests presented in the next section explicitly take into account the serial correlation of the gross abnormal profits in a given firm by using the known structure of the covariance matrix of the gross abnormal profits and performing generalized least squares regressions. In comparison, the correlation of the gross abnormal profits across firms at a given calendar date after multiplying the abnormal returns for sale transactions by minus one, is not expected to be as significant. The empirical methodology used in this paper assumes that the gross abnormal profits are uncorrelated across firms. The next section of the paper presents the empirical results of the study.

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[12] Assuming an average of 21 trading days per calendar month, the return data for the subsequent trading month (which corresponds of two calendar months) are shifted by 42 trading days, which leaves 78 days of overlapping return data. If both months are purchase months, the correlation coefficient between the gross abnormal profits equals 0.65 (78 divided by 120)

V.-Empirical Results

5.1 Costs of acquiring information and returns to information

Table 2 shows the average gross abnormal profit from initiating a transaction (a purchase transaction if insiders purchase, or a sale transaction if insiders sell) following the insider trading day and closing out the position at a later date. Abnormal returns for four holding periods are examined. First is the overall period from 1 day after the insider trading day to 120 days thereafter. Second is the period from 1 day after the insider trading day to 33 days thereafter. This period corresponds to the average trade to report lag shown in table 1. Also shown are the periods from 34 days after the insider trading day to 72 days after the insider trading day, and the period from 73 days after insider trading to 120 days after the insider trading day. These periods correspond to the average report to publication lag shown in table 1 and the post-publication period.

Table 2 shows that the average gross abnormal profits are 2.5% for the overall period, and 1.4%, 0.6%, and 0.5% during the three subperiods, respectively.[13] All three values are statistically significant given the large sample size. The magnitude of the average abnormal profit following insiders' transactions is small, which suggests that a significant portion of insiders' transactions are due to non-information reasons. The small average gross abnormal profit reflects the averaging effect of including non-information insider transactions such as transactions due to closing out earlier positions, tax-strategies or portfolio adjustment reasons along with the information related insider transactions. Table 2 indicates that the

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[13] Seyhun (1986) disaggregates insiders' transactions into sales and purchases shows that security prices rise abnormally following insiders' purchases and decline abnormally following insiders' sales.

Table 2

Percentage average gross abnormal profit, GAP and proportion of positive gross abnormal returns following insider purchases, and negative gross abnormal returns following insider sales, PGAP, for the overall period from 1 day to 120 days after the insider trading day, as well as the average trade-to-report, report-to-publish, and post publication periods. There are a total of 15,083 firm months in 769 firms. The t-statistics are shown in parentheses. The period of analysis is from January 1975 to October 1981.[a]

Period relative to Insider trading day	GAP	PGAP
Day 1 through 120 ...	2.5% (10.1)[b]	54.7% (10.1)[b]
Day 1 through 33 ...	1.4% (12.1)[b]	55.1% (11.9)[b]
Day 34 through 72 ...	0.6% (5.1)[b]	52.0% (5.1)[b]
Day 73 through 120 ...	0.5% (4.3)[b]	51.5% (3.7)[b]

[a] Both the gross abnormal profits and the proportion of positive gross abnormal returns are first averaged for each of the 769 firms. The coefficient estimates and the t-statistics are computed by running weighted least squares across the 769 firms, where the weights are inversely proportional to the variance of each observation. Variances of observations are computed by taking account of the serial correlation of the gross abnormal profits over successive calendar months in a given firm. The t-statistics for PGAP are for the hypothesis that PGAP equals 50%.

[b] Significant at the 1% level.

gross abnormal return to exploiting insider trading information during the trade to report period is 1.4% higher than the report to publish period, which in turn is 0.6% higher than the post-publication period. The gross abnormal profit during the post-publication period equals 0.5%. The evidence presented in Table 2 is consistent with the effects of information acquisition costs. The return to acquiring and exploiting insider trading information is highest during trade to report period, which is also characterized by highest information acquisition costs. The returns to acquiring and processing insider trading information fall during the subsequent periods as the costs of acquiring insider trading information fall.

Table 2 also shows the proportion of gross abnormal profits that are positive following purchases and negative following sales. These fractions can be interpreted as the fraction of the insider transactions that give an accurate signal about the future abnormal stock price performance. For the overall period the fraction of accurate signals equals 54.7%. This value is significantly different from 50%, which is what would be expected if insiders' transactions contain no special information. The fraction of accurate signals for the three subperiods declines from 55.1% to 52.0% and to 51.5% during the trade-to-report period, report-to-publish period, and post-publication period, respectively. The t-statistics for the fraction of positive gross abnormal profits indicate that the fraction of insider transactions that give accurate signals about the abnormal future stock price movements also significantly exceed 50% in each subperiod. This evidence corroborates the results using the average gross abnormal profits, that the return to processing insider trading information fall over time.

To further focus on the effects of dissemination of insider trading information on subsequent security price reaction, table 3 separates insiders'

transactions by the reporting and publication lags. Column 1 of Panel A shows the gross abnormal profit when all insider transactions are published within 120 days of the insider trading day. Column 2 shows the gross abnormal profit when some or all insider transactions are published with more than 120 day delay following the insider trading day. Column 3 shows the difference in the gross abnormal profits for the first two columns. The evidence in table 3 shows that disclosure of the insider trading information has a significant effect on security price reaction. Promptly published insider transactions are associated with greater security price reaction. The difference in gross abnormal profits between promptly published and late published transactions equals 1.51%, which is significant at the 5% level.

Further examination of table 3 shows that the difference in gross abnormal profits for promptly published and late published transactions during the 33 days following the insider trading day is small and statistically insignificant. This evidence is not surprising since only few of the promptly published transactions are actually published within 33 days of the insider trading day. Hence, most of the security price reaction during this period comes from the disclosure of the underlying information that has led to insider trading or trading by other informed traders.

Further examination of Panel A in table 3 shows that no additional security price reaction to late published insider transactions occurs during the period from 33 through 120 days after the insider trading day. In contrast, during the same time period, significant security price adjustment occurs for the promptly published transactions. This evidence strengthens the inference that the difference in gross abnormal profits between promptly published and late published insider transactions arises due to the information provided by the public dissemination of the insider trading information.

Table 3

Comparison of the gross abnormal profits for prompt and late reported and published transactions for selected periods following the insider trading day for 15,083 firm-months in 769 firms traded by insiders from January 1975 to October 1981.[a]

Panel A: Late publication and average gross abnormal profits

Time period relative to insider trading day	All transactions published within 120 trading days (prompt)	Some transactions published after 120 trading days (late)	Difference (prompt minus late)
Day 1 through 120	2.79% (8.0)	1.21% (1.8)	1.51% (2.1)
Day 1 through 33	1.45% (10.6)	1.12% (3.6)	0.33% (1.0)
Day 34 through 72	0.66% (4.8)	0.14% (0.5)	0.52% (1.5)
Day 73 through 120	0.66% (5.9)	-0.12% (-0.4)	0.78% (2.5)
Sample size	12863	2220	15083

Panel B: Early reporting and average gross abnormal profits

Time period relative to insider trading day	All transactions reported within 33 trading days (prompt)	Some transactions reported after 33 trading days (late)	Difference (prompt minus late)
Day 1 through 120	2.91% (8.0)	1.72% (3.2)	1.19% (2.1)
Day 1 through 33	1.55% (11.3)	1.01% (4.4)	0.54% (2.0)
Day 34 through 72	0.69% (4.7)	0.31% (1.5)	0.38% (1.5)
Day 73 through 120	0.64% (5.2)	0.31% (1.5)	0.33% (1.4)
Sample size	10822	4261	15083

[a] All estimates are computed using generalized least squares. Since the computer does not like inverting a 15,083 by 15,083 covariance matrix, data are first grouped into 100 groups using firm size, proportion of firm traded, and reporting and publication lags.

Panel B of table 3 examines if early reporting of the insider trading information is sufficient to bring about complete security price reaction. Column 1 of Panel B shows the gross abnormal profits following those months when all insiders' transactions are reported to the SEC within 33 days of the insider trading day. Column 2 shows the gross abnormal profits when some or all of the transactions are reported with more than 33 day delay following the insider trading day. Column 3 shows the difference in gross abnormal profits in the first two columns.

Panel B indicates that early reporting of insiders' transactions is associated with significantly greater abnormal security price adjustment. The difference in gross abnormal profits between the promptly reported and late reported transactions from 1 day through 120 days following the insider trading day equals 1.19%, which is significant at the 5% level. Examining the gross abnormal profits during the 33 days following the insider trading day also shows that early reporting is associated with greater gross abnormal returns. The difference in gross abnormal profits between the promptly reported and late reported transactions during the 33 days following the insider trading day equals 0.54%, which is also significant at the 5% level. This evidence agrees with the previous finding that disclosure of insider trading information affects the security price adjustment.

Further examination of Panel B provides evidence which is inconsistent with the view that complete dissemination of insider trading information is sufficient to bring about complete security price adjustment. Panel B shows that even when all insider trading information is reported to the SEC within 33 days of the insider trading day, significant additional security price reaction continues after day 33. In fact, the security price reaction for promptly reported transactions exceeds the security price adjustment for late

reported transactions after day 33. This evidence suggests that security price reaction to promptly reported insider transactions continues to take place over a period of six months.[14]

In summary, the evidence presented in tables 2 and 3 shows that security price reaction to insiders' transactions is not fully completed immediately following the reporting or the publication of insider trading information. Furthermore, the evidence suggests that the return to processing insider trading information is significant and it falls over time as the cost of acquiring the insider trading information falls. This finding suggests that information acquisition cost is a significant component of the costs of exploiting information, although it is not the only factor that determines security price reaction to information.

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[14] Additional evidence not shown in table 3 also supports the view that complete dissemination of insider trading information is not sufficient to bring about complete security price adjustment to insider trading information. For instance, significant security price reaction continues after 73 days following the insider trading day, even for those months when all insider transactions are published by day 73. The abnormal security price adjustment from day 73 through day 120 for those transactions published before day 73, is 0.58% with a t-statistic of 3.8. This value is significant at the 1% level. Hence, delayed security price reaction to insider trading information is not entirely due to late reporting or late publication of insiders' transactions.

5.2 Costs of trading and returns to information processing

The costly information models predict that the returns to processing information ought to be higher in firms with higher costs of trading to compensate the potential informed traders for higher costs of exploiting information. Trading costs have two major components. First component is the commission fee which provides compensation for brokerage services. The second component is the bid-ask spread which helps protect the market-maker from the adverse selection associated with informed investors' transactions.[15] The bid-ask spread falls with increasing firm size. Hence, a predicted positive relation between trading costs and before cost return to processing information implies a negative relation between firm size and before cost return to processing information.

The effect of the bid-ask spread on the return to processing information is examined by classifying insiders' transactions on the basis of firm size. Table 4 shows the relation between the gross abnormal profits following insiders' transactions and firm size during the trade to report period, the report to publish period, and the post-publication period. Model (1) in table 4 shows that the gross abnormal return during the trade to report period declines significantly with firm size. The relation between gross abnormal profits and firm size is significant at the 1% level, and explains 5.6% of the variation in gross abnormal profits across firms. To control for the differences in reporting lags among different size firms, model (2) restricts the sample to those months when all insider transactions are reported within

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[15] Studies by Demsetz (1968), Tinic and West (1972), Benston and Hagerman (1974), Stoll (1978), and Amihud and Mendelson (1980) among others, analyze the effects of competition facing the market-maker or the costs of maintaining inventories on the bid-ask spreads.

Table 4

Generalized least squares regression of gross abnormal profits, GAP on firm size during the trade to report, report to publish, and post-publication periods following 15,083 firm months for 769 firms traded by insiders during January 1975 to October 1981.[a]

Model No	Model	Sample size	Adj. R^2	F-Stats
Panel A: Day 1 through 33 after insider trading day				
(1)	GAP = 0.074 - 0.0046 LV (8.3) (-6.8)	15,083	0.056	46.1[b]
(2)	GAP = 0.073 - 0.0044 LV (6.9) (-5.5)	10,822	0.037	30.2[b]
Panel B: Day 34 through 72 after insider trading day				
(3)	GAP = 0.045 - 0.0030 LV (5.0) (-4.4)	15,083	0.024	19.1[b]
(4)	GAP = 0.055 - 0.0031 LV (4.4) (-3.7)	9,769	0.017	13.9[b]
Panel C: Day 73 through 120 after insider trading day				
(5)	GAP = 0.030 - 0.0019 LV (3.1) (-2.5)	15,083	0.007	6.5[b]
(6)	GAP = 0.033 - 0.0020 LV (3.1) (-2.5)	12,863	0.007	6.3[b]

[a] The gross abnormal profit denoted as GAP is computed from equation (3). LV is the log of the average size of equity of the firm from 1975 to 1981. Models (1), (3), and (5) use all 15,083 firm-months. Model (2) restricts the sample to those months when all insider transactions are reported within 33 trading days. Model (4) restricts the sample to those months when all transactions are reported within 33 days and published within 72 days. Model (6) restricts the sample to those months when all transactions are published within 120 days of the insider trading day. The gross abnormal profits for 15,083 firm months are averaged for each of the 769 firms, and the covariance matrix of the gross abnormal profits is computed. Each relation is transformed into ordinary least squares relation by premultiplying with the root of the inverse of the covariance matrix. The F-statistic is computed using the squared sum of errors from the constrained version of the transformed relation. The R-square values are implied from the F-statistic.

[b] Significant at the 1 % level.

33 trading days of the insider trading day. Model (2) shows that the differences in abnormal security price adjustment during the trade to report period cannot be attributed to differences in reporting lags in different size firms, since the differences in security price adjustment for different size firms remain even after controlling for differences in reporting lags. Models (3) and (5) show that the significant negative relation between the gross abnormal profits and firm size persists after the reporting and publication of insiders' transactions. Models (4) and (6) show that the negative relation between gross abnormal profits and firm size following the reporting and publication of insiders' transactions cannot be attributed to differences in reporting and publication lags among different size firms. While the significance levels are reduced following the dissemination of the insider trading information, the relations between gross abnormal profits and firm size are nevertheless significant at the 1% level.

In summary, the evidence in table 4 suggests that insiders take the costs of trading into account before trading.[16] It is expected that insiders do not engage in a transaction unless the expected value of their information exceeds the cost of trading. Otherwise, they would be better off not trading. Since the cost of trading is higher in small firms, insiders in small firms are expected to exploit relatively more important information, which at least covers the higher costs of trading. Hence, consideration about the costs of

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[16] The direction of the causal relation between the expected value of information and costs of trading is not strictly from higher trading costs to higher expected value of information. Seyhun (1986) argues that trading by informed traders can be the cause of significant trading costs, leading to increased bid-ask spreads in small firms. Hence, in equilibrium, trading costs (as represented by the bid-ask spread) and the expected value of informed traders' information would be expected to be jointly determined. Studies by Bagehot (1971), Treynor (1981), Copeland and Galai (1983), and Glosten and Milgrom (1985) hypothesize a positive relation between expected losses to informed traders and the bid-ask spread.

trading imply a negative relation between firm size and the value of insiders' information, given that a trade has occurred. The evidence in table 4 is consistent with this implication.

If the cost of trading does not affect the return to processing information, then following the public dissemination of insiders' transactions, security prices would be expected to fully adjust to the expected value of insiders' information. Consequently, no subsequent relation should be observed between firm size and security price reaction to insiders' transaction. However, the evidence in table 4 also shows that the negative relation between firm size and security price adjustment continues following the reporting and the publication of insiders' transactions. Models (3) and (4) in table 4 indicate that the negative relation between the average gross abnormal profits and firm size following the reporting of insiders' transactions is significant at the 1% level. Model (5) and (6) indicate that the negative relation between the average gross abnormal profits and firm size remains significant at the 1% level even after the publication of insiders' transactions. A plausible interpretation of this evidence is that other market participants' response to insider trading information is also affected by the cost of trading. Higher trading costs in smaller firms prevent other traders from fully and immediately incorporating the implications of insider trading information into the prices of securities.

5.3 Quality of information and returns to information processing

To analyze the relation between the quality of information and the return to information processing, first a measure of the expected value of insiders' information is required. The relation between the proportion of the firm traded, the size of insiders' firm, and the average gross abnormal return following insiders' transactions are shown in table 5. Table 5 separates the gross abnormal returns from 1 day to 120 days following the insider trading day for 15,083 firm months into 25 groups based on the quintiles of the firm size and the proportion of the firm traded. The gross abnormal returns increase from 0.9% to 4.4% as the proportion of the firm traded increases from the smallest quintile to the largest quintile. The gross abnormal returns decrease from 5.0% to 1.3% as firm size increases from the smallest quintile to the largest quintile. Table 5 indicates that both the proportion of the firm traded and the size of insiders' firm are good predictors' of the expected value of insiders' information.

To analyze insiders' response to the quality of their information, the variance of abnormal returns following insider trading is computed for each of the 15,083 firm months as the square of the difference between the actual gross abnormal return and the average gross abnormal returns. The average abnormal return from 1 day to 120 days following the insider trading day are taken from table 5 for each of the 25 groups. Within each of the 25 groups, variances are further grouped into quintiles and averaged. This procedure results in 125 groups, based on the quintiles of firm size, proportion of firm traded, and the variance of abnormal returns.

Table 6 shows the weighted least squares regression of the proportion of the firm traded by executives and shareholders against the expected value of insiders' information, the variance of abnormal returns, and the size of insiders' firm. The results are reported separately for executives (which

Table 5

The average gross abnormal profits from 1 day to 120 days following the insider trading day grouped by the quintiles of the firm size and the proportion of the firm traded by insiders. The number of observations in each group are shown in parentheses.[a]

Average gross abnormal profits

Quintiles of proportion firm traded	Quintiles of Firm Size I small firms	II	III	IV	V large firms	All firms
I small trades	0.4% (115)	2.5% (373)	1.0% (645)	1.2% (812)	0.2% (1071)	0.9% (3016)
II	1.4% (297)	2.6% (573)	2.8% (668)	1.4% (703)	1.8% (776)	2.0% (3017)
III	4.0% (540)	3.7% (719)	1.4% (635)	0.9% (605)	1.9% (518)	2.4% (3017)
IV	4.8% (899)	2.9% (709)	2.1% (575)	0.6% (472)	2.5% (362)	2.9% (3017)
V large trades	6.9% (1169)	5.0% (630)	1.0% (495)	2.5% (431)	1.6% (291)	4.4% (3016)
All Trades	5.0% (3020)	3.4% (3004)	1.7% (3018)	1.3% (3023)	1.3% (3018)	2.5% (15083)

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a The ranges of the values of equity in each firm size group are as follows: Quintile 1, less than $111.1 million, quintile 2, between $112.9 and $382.3 million, quintile 3, between $384.6 and $754.5 million, quintile 4, between $754.8 million and $1.298 billion, quintile 5 greater than or equal to $1.308 billion. The ranges of the proportion of the firm traded in each group are as follows: Quintile 1, less than 0.000015, quintile 2, between 0.000015 and 0.000061, quintile 3, between 0.000061 and 0.00021, quintile 4, between 0.00021 and 0.00082, and quintile 5, greater than 0.00082 of the firm traded.

includes officers, directors, officer-directors, and chairmen of the boards of directors) and large shareholders, since many of the large shareholders are other corporations which are not expected to be risk averse in exploiting information. To the extent insiders can discern differences in the quality of their information, the information economics models predict that insiders would trade smaller a volume of shares in response to a marginal increase in variance of abnormal returns.

Model (1) in table 6 shows that the weighted least squares regression of the proportion of the firm traded by executives[17] on the variance of abnormal returns. The relation between the proportion of the firm traded and variance is positive.[18] Model (2) in table 6 includes the expected value of insiders' information and the log of firm size as additional variables. Model (2) shows that a marginal increase in variance, holding expected value of insiders' information and firm size constant, reduces the proportion of the firm traded by executives. The negative relation between proportion of the firm traded and variance is significant at the 5% level. Furthermore, a marginal increase in the expected value of the information increases the proportion of the firm traded by insiders. This relation is significant at the 1% level. The evidence shown in table 6 suggests that insiders can discern the differences in the expected value and the quality of their information. As predicted, insiders respond to a marginal decrease in the quality of their information (greater variance) by trading a smaller number of shares, thereby exhibiting risk aversion. Insiders respond to a marginal increase in the expected value

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[17] The proportion of the firm traded is computed per trader per month. For each trader, the absolute value of the difference between the dollar value of all purchases and sales is divided by the value of the firm.

[18] The positive relation is conjectured to be a proxy effect of variance for the expected value of information since as shown later, the variance and expected value of information are positively related.

Table 6

Weighted least squares regression of the proportion of the firm traded by executives PE, and the proportion of the firm traded by shareholders, PS against the average gross abnormal profit following insiders' transactions, GAP, the variance of the gross abnormal profits, and the average size of the insiders' firm. The t-statistics for estimated coefficients are shown in parentheses.[a]

Model no.	Model	N	Adj. R^2	F-statistic
(1)	PE = 0.009 + 0.031 VAR (5.1) (1.8)	125	0.02	3.2
(2)	PE = 0.067 + 0.237 GAP - 0.005 LV - 0.03 VAR (5.2) (4.1) (-5.1) (-2.0)	125	0.40	28.1[b]
(3)	PS = 0.38 + 1.90 VAR (5.2) (2.8)	125	0.06	7.9[b]
(4)	PS = 2.90 + 6.34 GAP - 0.20 LV - 0.50 VAR (5.0) (2.4) (-4.9) (-0.7)	125	0.38	24.2[b]

[a] All estimated coefficients are multiplied by 100. The 15,083 firm-months are first grouped into 25 groups based on quintiles of firm size and proportion of firm traded. Variance is computed as the square of the difference between the actual gross abnormal profit and the average gross abnormal profit from 1 day to 120 days following insider trading day for each of the 25 groups. The average gross abnormal profits for the 25 groups are shown in Table 5. The computed variances are then ranked into quintiles for each of the 25 groups. This procedure results in 125 groups for the regression shown above. The weights in the regression are the number of firm months in each group. PE is the proportion of the firm traded per executive, PS is the proportion of the firm traded by large shareholders (per shareholder), VAR is the variance of the gross abnormal profits, LV is the log of the average firm size (in $1000), and GAP is the gross abnormal profit from 1 day through 120 days following the insider trading day.

[b] Significant at the 1% level.

of their information by trading a greater fraction of the firm.

Models (3) and (4) in table 6 shows the relation between the proportion of the firm traded by large shareholders (per large shareholder who trades), and the expected value of their information, variance and firm size. Model (3) shows a significantly positive relation between the proportion of the firm traded and variance of abnormal returns. Model (4) shows that the marginal effect of an increase in variance of abnormal returns, holding the expected value of information and firm size constant, is insignificant for large shareholders. The insignificant marginal relation between the proportion of the firm traded and variance is not surprising since many of the large shareholders are corporations and corporations are not expected to be risk-averse in exploiting information.

Risk aversion implies that insiders would require higher gross abnormal profit to take on sufficiently greater variance of abnormal returns, otherwise they would prefer not to trade. The relation between the expected value of insiders' information and variance is examined in table 7 by running generalized least squares regressions of the average gross abnormal profit on the variance of the abnormal returns following the insider trading day, as well as on the average firm size and the proportion of the firm traded. Model (1) in Table 7 indicates a positive relation between the average gross abnormal profits and the variance of abnormal returns. This relation is significant at the 1% level and explains 21% the variability in the average variance measure across the 125 groups. Model (1) indicates that more profitable insider transactions are associated with higher variability. The risk averse insiders are expected to exploit lower quality information (higher variance of abnormal returns), when they expect to be compensated by earning higher average returns. Hence, the result shown in model (1) is consistent with risk averse behavior on the part of insiders.

Mention that skewness cannot be responsible since GTP = -1(AR) for sales

Table 7

Generalized least squares regression of average gross abnormal profit following insiders' transactions, denoted as GAP, on the variance of the gross abnormal profits, the average size of the insiders' firm and the proportion of the firm traded. The t-statistics for estimated coefficients are shown in parentheses.[a]

Model no.	Model	N	Adj. R^2	F-statistic
(1)	GAP = 0.018 + 0.14 VAR (6.2) (5.9)	125	0.21	34.6[b]
(2)	GAP = 0.15 - 0.010 LV (7.6) (-6.4)	125	0.24	40.3[b]
(3)	GAP = 0.07 + 0.005 LP (7.4) (5.0)	125	0.15	25.3[b]
(4)	GAP = 0.16 - 0.008 LV + 0.003 LP (7.9) (-4.6) (2.9)	125	0.28	25.5[b]
(5)	GAP = 0.12 - 0.006 LV + 0.003 LP + 0.104 VAR (6.2) (-3.6) (3.0) (4.6)	125	0.39	27.0[b]

[a] The 15,083 firm-months are first grouped into 25 groups based on quintiles of firm size and proportion of firm traded. LV is the log of the average firm size (in $1000), and LP is the log of the average proportion of firm traded in each group. Variance of abnormal returns, VAR, is computed as the square of the difference between the actual gross abnormal profit and the average gross abnormal profit from 1 day to 120 days following insider trading day for each of the 25 groups, which are shown in Table 5. The computed variances are then ranked into quintiles for each of the 25 groups. This procedure results in 125 groups for the regression shown above. The covariance matrix of the gross abnormal profits is constructed by explicitly taking into account the serial correlation of the gross abnormal profits over successive months in a given firm. Each regression relation is then transformed into ordinary least squares relation by premultiplying with the root of the inverse of the covariance matrix. The F-statistic is computed by using the sum of squared errors of a constrained version of the transformed relation. The R-square is implied from the F-statistic.

[b] Significant at the 1% level.

The positive relation between variance and the magnitude of the gross abnormal returns is explored in more detail in models (2) through (4). Model (2) shows a negative relation significant at the 1% level, between the gross abnormal profits and the average size of insiders' firm. Model (3) shows a positive relation between the gross abnormal profits and the proportion of the firm traded. This relation is also significant at the 1% level. Model (4) includes both the firm size and the proportion of the firm traded. Model (4) shows that both the size of insiders' firm and the proportion of the firm traded are separately related to average gross abnormal profits.

Model (5) in table 7 includes as independent variables in the regression, the variance of abnormal returns as well as the size of insiders' firm and the proportion of the firm traded. All three variables remain highly significantly related to the average gross abnormal profits. Jointly, the variance of abnormal returns, the size of insiders' firm, and the proportion of the firm traded explain 39% of the variation in average gross abnormal profits across the 125 groups. This evidence suggests that the positive relation between insiders' abnormal profits and the variance of abnormal returns is not caused by a relation between variance and firm size, or between variance and the proportion of the firm traded.

The next set of tests examines the market's response to the quality of insiders' information. The evidence presented in the previous section suggests that risk-averse insiders respond to higher quality information (lower variance of abnormal returns) by trading greater volume of shares. If most other market participants also behave in a risk averse manner, then the initial security price reaction to higher quality information, for a given level of the expected value of the information, is expected to be more complete. Conversely, the initial security price reaction to lower quality

information is expected to less complete, since fewer traders are expected to act on lower quality information. Consequently, for lower quality information (higher variance of abnormal returns), when additional information is disclosed to the market at a later date, more security price reaction is expected to occur. To test this proposition, the relation between the variance of the gross abnormal profits and the security price reaction during trade to report period, report to publish period, and the post-publication period are examined. The empirical prediction is that if other market participants also care about the quality of the information, then holding the expected value of the information constant, a greater portion of the security price adjustment for lower quality information would take place following the dissemination of the insider trading information.

To abstract from the positive relation between gross abnormal profits and the variance of abnormal returns shown in table 7, a relative variance measure is used. The relative variance measure is the quintile ranks of the variance of the abnormal returns. The quintile ranks of variance of gross abnormal profits abstracts from the differences in absolute magnitude of the variance across the 125 groups. Hence, by construction, there is no relation between variance ranks and firm size and the proportion of the firm traded by insiders. The proposition tested is whether the security price reaction to information differs by variance while holding the expected value of information constant.

Table 8 shows the relations between variance ranks and the security price adjustments during trade to report period, report to publish period, and the post-publication period. The independent variables are dummy variables that correspond to the quintiles ranks of the variance of gross abnormal profits within each of the 25 groups, formed by the quintiles of firm size and the

proportion of firm traded. Hence, a given transaction is assigned to one of five cells depending on its relative variance within its group. Model (1) in table 8 shows that there is no relation between security price adjustment during the trade to report period and the variance ranks. Similarly, model (2) shows no relation between security price adjustment during report to publication period and variance ranks. Consequently, the use of relative variance measure has abstracted from the positive relation between the gross abnormal profits and the variance of gross abnormal profits shown in table 7. Model (3) shows the relation between the security price adjustment during the post-publication period and the variance ranks. While the relation is not monotonic, highest variance ranks are associated with significantly greater security price adjustment during the post publication period. The coefficient of the highest variance rank is significantly positive at the 5% level. This evidence is consistent with the proposition that greater portion of the security price adjustment for more variable information takes place during the post-publication period. A plausible interpretation of this evidence is that a smaller initial security price response to lower quality insider trading information (higher variance of abnormal returns) is accompanied by the disclosure of additional information during the post publication period.

Table 8

Generalized least squares regression of the gross abnormal returns to 769 firms traded by insiders from 1975 to 1981 during the trade to report period, report to publish period, and the post-publication period and the variance ranks of the gross abnormal returns. The t-statistics are shown in parentheses.[a]

Model no.	Model	Adj. R2	F-Stat
(1)	GAP_{TR} = 1.3 - 0.04 VR2 + 0.13 VR3 - 0.25 VR4 + 0.44 VR5 (5.6) (-0.1) (0.4) (-0.7) (1.3)	0.005	1.1
(2)	GAP_{RP} = 0.6 + 0.03 VR2 - 0.07 VR3 - 0.20 VR4 + 0.05 VR5 (5.1) (0.1) (-0.3) (-0.7) (0.0)	-0.026	0.2
(3)	GAP_{PP} = 0.5 + 0.13 VR2 - 0.19 VR3 - 0.33 VR4 + 0.78 VR5 (1.9) (0.4) (-0.6) (-1.0) (2.3)	0.065	3.2[b]

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[a] All estimated coefficients are multiplied by 100. VR2 = 1 if the variance of the gross abnormal profit is in second (from lowest) quintile in each of the 25 groups based on quintiles of firm size and proportion of firm traded, otherwise VR2=0. VR3 = 1 if the variance of the gross abnormal profit is in third quintile, otherwise VR3=0. VR4 = 1 if the variance of the gross abnormal profit is in fourth quintile, otherwise VR4=0. VR5 = 1 if the variance of the gross abnormal profit is in fifth (highest) quintile, otherwise VR5=0. GAP_{TR} is the gross abnormal profit during trade to report period. GAP_{RP} is the gross abnormal profit during report to publish period. GAP_{PP} is the gross abnormal profit during the post publication period. Each relation is first transformed into an ordinary least squares relation by premultiplying with the root of the inverse of the covariance matrix of the gross abnormal profits. The F-statistic is computed by using the sum of squared errors of the constrained version of the transformed relation. The R-square values are the implied values from the F-statistic.

[b] Significant at the 5% level.

VI- Conclusions and Implications

Evidence presented in this paper by analyzing approximately 60,000 insider transactions in 769 firms from January 1975 to October 1981 suggests that traders who invest resources in processing information are compensated for the costs they incur and the risks they bear. The return to processing information is positively related to the cost of acquiring information. Information that is more costly to acquire provides the informed trader with a higher before cost return. As the cost of acquiring the insider trading information falls due to the reporting and the publication of the insider trading information, the before cost return to processing information also falls.

Evidence also suggests that costs of trading affect both the informed investors' decision to trade as well as the security price reaction to information. Several findings support this conclusion. First, insiders' abnormal profit before costs is greatest in small firms which are also characterized by high costs of trading. One interpretation of this finding is that insiders in smaller firms choose to exploit information only when the expected value of their information exceeds the higher costs of trading. Consequently, conditional on trading, higher value information is associated with higher costs of trading. Evidence also shows greater security price reaction occurs following the public dissemination of insiders' transactions in small firms. This evidence suggests that higher costs of trading in small firms prevent outsiders from immediately incorporating the implications of the insider trading in security prices.

Evidence presented in this study shows that insiders can discern the differences in the expected value and the quality of their information. Executives respond to a marginal decrease in the quality of their information

(an increase in the variance of abnormal returns) by trading a smaller volume of shares, thereby exhibiting risk-averse behavior. Executives respond to a marginal increase in the expected value of their information by trading a greater volume of shares. On the other hand, large shareholders, many of whom are corporations, show less risk aversion. The large shareholders respond to marginal decrease in the quality of their information with an insignificant decline in the volume of shares traded, while they respond to a marginal increase in the expected value of their information with a significant increase in the volume of shares traded.

Analysis of the security price reaction following insiders' transactions shows that lower quality information is associated with greater subsequent security price adjustments, as suggested by the costly information models. This evidence suggests that risk aversion on the part of insiders induces them to require a higher average abnormal profit to take on lower quality information, otherwise they would prefer not to trade. A smaller trading response to lower quality information results in less complete initial stock price reaction and thus greater subsequent stock price reaction. Furthermore, other market participants also respond to lower quality information by trading a smaller volume of shares, which limits the initial security price reaction to insider trading information. Hence, greater security price reaction to more variable information occurs at a later date when additional information is disclosed to the market. This interpretation suggests that security price reaction to information is affected by risk averse behavior of market participants.

In conclusion, the evidence presented in this paper suggests that lack of instantaneous security price reaction to insider trading information is due to the costs of acquiring and exploiting information and risk aversion on the

part of traders. The magnitude of the stock price reaction following the dissemination of the insider trading information is not large, but rather on the same order of magnitude as the trading costs. Nevertheless, the evidence suggests that trading costs and risk aversion on the part of market participants are important determinants of the security price reaction to information. This finding suggests a positive prescription for security analysts: High quality information, that is less costly for others to obtain, analyze, and exploit are most likely to be already fully incorporated in security prices. Hence, to maximize their return to information processing, security analysts would best concentrate their analysis to firms characterized by higher variance of returns relative to the variance of the information, and to information that is also more costly for others to obtain, analyze, and exploit.

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