

RESEARCH NOTES AND COMMENTARIES

INSIDER TRADING AS A VEHICLE TO APPROPRIATE RENT FROM R&D

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While most insider trading is routine and legal, investors still treat it as new information about the firm's prospects—they assume that trades reflect managers' attempts to profit from their private information. This article explores insider trading as a mechanism to appropriate rent from R&D advances. We analyze stock price reactions to over 134,000 insider-trading events and find that insider purchases generate larger positive stock price reactions for R&D-intensive firms. Investors seem to assume that managers use insider trading to appropriate rent from R&D breakthroughs. We discuss how shareholders may prefer this rent appropriation mechanism over other forms of compensation that directly reduce the firm's income. Copyright © 2002 John Wiley & Sons, Ltd.

Some analysts are shaking their heads over the apparently legal ways the company's executives were able to walk away with personal fortunes . . . Gary Winnick who founded Global Crossing sold shares worth \$734 million before the company collapsed. (Geraldine Fabrikant and Simon Romero, *New York Times*, February 2002)

Most insider trading is routine, legal, and far removed from headlines. Thompson Financial Corporation's insider trading database documents more than 588,000 legal insider transactions between 1991 and 1999. Nevertheless, as the above quote suggests, investors draw important implications from 'routine' trading activity. These trades have

important signal value because investors believe that managers seek to profit from their private information. Insider trading is of interest to strategy scholars because managers may exploit strategic knowledge. Given the regulatory focus on explicit knowledge of near-term events (e.g., earnings announcements), managers may profit from knowledge ascribed the greatest significance in the strategy literature (e.g., tacit and/or knowledge with long-term effects).¹ Accordingly, insider trading may be a mechanism through which managers exploit information asymmetries to appropriate rent arising from strategic capabilities. Rent appropriation is an under-researched area at the

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¹ Securities and Exchange Commission (SEC) focuses on trading linked to specific information (e.g., earnings or M&As). Trading on tacit or long-term knowledge is too costly to examine (DeMarzo, Fishman, and Hagerty, 1998).

core of the resource-based view and the strategy literature (Barney, 2001; Coff, 1999).

This article empirically examines R&D as a strategic asset and insider trading as a vehicle for rent appropriation. We test the relationship between R&D intensity and investor responses to announcements of insider trades. We conclude with implications for future research.

R&D, ASYMMETRIC INFORMATION, AND RENT APPROPRIATION

Research on the resource-based view focuses on knowledge asymmetries as a source of sustainable competitive advantage; rivals cannot imitate or gain access to rent-generating knowledge assets (Barney, 1991). In addition to asymmetries between rivals, information about a firm's future prospects may be hard to convey to shareholders (Myers, 1984). For example, R&D projects are typically complex and tacit in the early stages—even if they can be codified later in patent applications. Indeed, while the value of known codified outputs such as patents should be fully incorporated in the firm's stock price, the future value may depend greatly on early-stage R&D efforts. Moreover, such knowledge is often closely held to keep breakthroughs secret until patent protection can be achieved (Bhattacharya and Ritter, 1983).

Ironically, since managers cannot fully inform shareholders about R&D progress without also informing rivals, shareholder interests may actually be served by keeping them in the dark. However, at the same time, this lack of communication may prevent investors from fully understanding management's long-term goals and from monitoring their actions effectively.

Management trading as a form of rent appropriation

One response to such information asymmetries is insider trading (Damodaran and Liu, 1993)—the buying and selling by corporate executives of their own firm's stock. Indeed, studies confirm that corporate insiders are able to identify mispricing in their own firms, and hence, can profit from their nonpublic information (Jaffe, 1974; Seyhun, 1986). Insider transactions have been documented prior to equity issuances (Karpoff and

Lee, 1991) and dividend announcements (John and Lang, 1991), among other events. In fact, Seyhun (1992) shows that insider trading can predict up to 60 percent of the variation in 1-year-ahead stock returns.

If managers have knowledge about the sustainability of a competitive advantage, they may try to appropriate rent through insider trading. Managers normally notify the SEC of stock transactions about 10 days after a trade has been executed. Trades are scrutinized to see if they were motivated by 'significant, confidential corporate developments' (Securities and Exchange Commission, 2002), such as a tender offer. In practice, enforcement focuses on trading that is driven by knowledge of specific short-term corporate events and managers are not barred from general or long-term trading in their firm's stock. Since the stock price adjustment does not take place until information about the trade is made public (e.g., reported to the SEC), managers can purchase shares at the unperturbed price, thereby reaping the gains.

Predicting investor reactions to insider trading

Positive knowledge of the firm

Managers may exploit asymmetric information by purchasing shares with knowledge that the stock price will increase once the private information is fully disclosed. Investors may view these purchases as a vote of confidence in the firm and a signal that they should increase their holdings. This leads to an upward adjustment in the firm's share price even if management's information remains undisclosed. Additional upward movement may occur when that information becomes public (e.g., confidence in an upcoming product launch). This signal may be especially powerful since managers often have much of their wealth tied to the firm in the form of incentives—their willingness to commit further might be viewed as particularly telling.

While the broad signal of an insider purchase should represent good news, the contextual setting affects how such news is received (Bagnoli and Khanna, 1992). Since information asymmetries play a greater role in R&D firms, we suggest that insider purchases have greater signal value to investors in these settings. Managers may have private information about an R&D breakthrough even in its early stages. As such, the signal value of an

insider stock purchase should be much greater in this setting. Thus,

Hypothesis 1: Positive abnormal returns from insider stock purchases rise as the firm's R&D intensity increases.

Negative knowledge of the firm

Managers may believe that an R&D project is destined for commercial failure or that a new product will have a hard time passing safety standards. In these cases they may sell shares that they own and would benefit from their private information by selling shares before the stock's true value is known. Investors watch for such signals and may consider managers dumping their stock as a signal that they too should reduce their holdings, causing a correction in the firm's stock price. Since the correction generally occurs after management's transaction has been completed, however, managers benefit personally from their private information.

This type of signal may also be much more powerful when it involves insider stock sales in R&D-intensive firms where information asymmetries play an even greater role. Management may have private information about reduced R&D productivity or the failure of new technologies that has profound negative implications for the firm's future performance. As such, the signal value of a management sell-off should be much greater in this setting.

Hypothesis 2: Negative abnormal returns from insider stock sales rise as the firm's R&D intensity increases.

One qualification of the above hypothesis is the fact that managers are often paid in stock and it is not unusual for them to sell shares to obtain cash and to diversify their holdings. This is especially true in R&D-intensive firms where incentives may substitute for costly monitoring (Rediker and Seth, 1995). Thus, sales by managers may represent little new information about the firm since they may primarily reflect other personal motivations (Ofek and Yermack, 1997).

DATA AND METHODOLOGY

Sample and data

Following Seyhun (1990), we focus on open-market sale and purchase transactions by insiders. Other transactions, such as exercise of options and shares acquired from compensation plans, are excluded, since these transactions carry little new information about the firm's value. Insider trading data come from Thompson Financial Corporation. This database covers all insider trading activity reported to the SEC—more than 588,000 insider trades in over 9000 firms between 1990 and 1999. Information about these trades is released in bundles as they are reported to the SEC. That is, an event may include several trades from a given manager along with trades from other managers. The database includes the date the transactions occur and the date that information is reported to the SEC. We use the latter date since this is when information about the trade is released. Collapsing insider transactions into unique announcement dates reduced the sample to 206,941 events. Of these, 134,819 were matched to both stock market returns and control variables.

Stock returns

Data on stock returns come from the Center for Research in Securities Prices (CRSP) of the University of Chicago. Stock returns were available for 149,641 events. The remaining events reflect very small firms traded on the NASDAQ over-the-counter market for which there were no contiguous return series available on CRSP.

R&D intensity

R&D intensity, our primary independent variable, is the firm's R&D expenditures divided by total sales (Baysinger and Hoskisson, 1989; Ettlie, 1998). Using COMPUSTAT, we were able to match R&D intensity for 59,510 of the events.

Control variables

To account for other explanations for investor reactions to insider trades, we include five control variables (see Seyhun, 1986, 1992). First, we control for the number of days that have passed between when the trade was executed and when it was made

public (*DaysSinceTrade*). Second, we control for the net number of shares being traded in all the transactions for that announcement date, scaled by shares outstanding. In general, a large trade should have greater signal value than a small trade. Third, the weighted average price of the trades (*Trade-Price*) is included to account for discreteness in price movements and to reflect information about the price at which the trade took place. Finally, we control for the number of managers buying shares (*#MgrsBuy*) and the number selling shares (*#MgrsSell*). This is important since events that are net purchases of stock may still have some managers selling shares and events that represent net sales of stock may have some managers purchasing shares.

Firm-level controls include volatility, profitability, firm size, and insider ownership. *Volatility* is measured as the standard deviation of the return. Since highly volatile stocks may be hard to value, any management signal is likely to be more informative. *EBITDA*, or the change in earnings before interest, taxes, depreciation and amortization reflects trends in profitability. If the trade represents known earnings trends (e.g., a downturn and a sale or an upturn and a purchase), the stock transaction may have less signal value. We controlled for firm size (log of market value) since there is often more information available about large firms, reducing signal value. On the other hand, large firms are often complex and insider trades may serve as critical signals. Whether the first or the second effect dominates is an empirical issue. Finally, we controlled for *insider ownership* since it may affect how insider trading is perceived. If insiders have significant holdings, agency problems should be reduced. Also, decisions to augment already strong holdings (in lieu of diversifying their wealth) signal even greater confidence while decisions to sell a small part of a very large holding may be insignificant.

Event study methodology

We used standard event study methodology (Fama *et al.*, 1969) to measure abnormal returns. This use of stock price reactions is common in financial economics and strategic management (e.g., Bromiley and Marcus, 1989; Lee, 1997, 2001). The premise is that price changes reflect investor expectations of changes in a firm's future performance based on new information. In this context, the new information is the revelation of insider trading.

Defining the event window is important to our analysis. A short window captures the significance of an event if there is no information leakage (McWilliams and Siegel, 1997), and reduces contamination from confounding events. However, there is lag between the time the insider trade takes place and the release of information about the trading. Thus, we use a longer window (−15, +5) to capture the information conveyed by the trades.²

Independence of observations

Since trading is a fairly common event, there are multiple observations of trades from the same firm, implying that some events may not be fully independent. We addressed this problem in two ways. First, we estimated a fixed-effects time series model to account for firm effects and time-dependent covariates. However, this algorithm assumed that the time periods were equally spaced. Second, we averaged the results by firm and year so that there were no observations of the same firm with the same financial controls (since these are observed annually).³ This reduced the sample from 59,510 to 18,462 and thereby reduced the power of statistical tests, but does not introduce any biases into the results (Prabhala, 1997). As such, this offers a conservative test of hypotheses. Due to space limitations, we present only this second approach.

RESULTS

Table 1 shows descriptive statistics for the sample. The top right half of the table (italics) depicts correlations for stock sales while the bottom left refers to purchases. Many of the correlations differ since purchases and sales are very different in nature. For example, R&D intensity has a positive coefficient (0.03) for purchases and a negative coefficient for sales (−0.03). This mirrors the hypothesized effects and is to be expected. In examining the impact of control variables for purchases, the

² A 3-day window yielded similar results but is less appropriate due to the anticipated information leakage. Given our large sample, we assume that any contamination from confounding events is randomly distributed and would tend to reduce the explanatory power of our model rather than bias the results in any specific direction.

³ We are grateful to an anonymous reviewer for recommending this methodology.

Table 1. Descriptive statistics and correlation matrices for stock purchases and sales^a

	Mean/S.D.	1	2	3	4	5	6	7	8	9	10	11
1. Abnormal returns	0.00 (0.13)		-0.03**	-0.02**	0.05***	-0.02**	-0.07***	0.00	-0.04***	-0.01	0.06***	-0.01
2. R&D intensity	1.88 (35.36)	0.03**		0.00	0.03**	0.01	0.01	-0.03***	0.00	0.00	-0.03**	0.02 [†]
3. Log(% shares traded)	-2.20 (7.28)	0.12***	0.03**		0.00	0.00	0.00	-0.01	0.01	0.00	-0.01	0.00
4. # mgrs buying shares	-4.63 (4.61)	0.05***	0.03**	0.18***		0.00	0.08***	0.02*	0.00	0.00	0.04***	0.05***
5. # mgrs selling shares	0.89 (1.04)	-0.01	0.00	0.06***	0.07***		0.08***	0.32***	-0.02 [†]	0.01	0.33***	0.14***
6. Log (Days since trade)	25.29 (12.24)	0.06***	-0.01	0.07***	0.05***	0.08***		-0.09***	0.01	0.00	-0.11***	0.10***
7. Log (Price of trade)	19.45 (19.16)	-0.12***	-0.03**	-0.67***	-0.05***	0.05***	-0.08***		-0.02**	0.01	0.80***	-0.24***
8. Log (Volatility)	0.09 (1.15)	0.14***	0.03**	0.48***	0.07***	-0.01	0.06***	-0.51***		0.00	-0.03***	0.03**
9. Log (EBITDA change)	13.03 (0.16)	-0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00		0.01	-0.01
10. Log (Market value)	5.25 (2.10)	-0.09***	-0.02*	-0.73***	0.00	0.06***	-0.08***	0.77***	-0.50***	0.01		-0.30***
11. Log (Insider holdings)	7.44 (3.02)	0.10***	0.03***	0.79***	0.20***	0.07***	0.10***	-0.56***	0.42***	-0.01	-0.61***	

^a Since stock purchases and sales are analyzed as separate events and are hypothesized to have relationships in opposing directions, the samples are shown separately here. The correlation matrix for stock sales ($N = 10,390$) is shown in the upper right (italics) while the matrix for stock purchases ($N = 8,072$) is at the bottom left.
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; [†] $p < 0.1$

price at which the trade was executed, the stock's volatility, and the portion of the firm's outstanding shares traded have the strongest effects. In the case of sales, the days elapsed since the trade, market value, and number of managers buying have relatively strong effects. These are indicators of the type of signal to which investors are responding.

Some control variables are strongly correlated—particularly market value. Predictably, large firms tend to have a smaller portion of their shares owned by insiders, less volatile stock prices, and higher share prices. However, none of the controls are strongly correlated with R&D intensity, the independent variable of interest here. Furthermore, since the variance inflation factors for regression models are less than 2, multicollinearity should not be a cause for concern.

Abnormal returns

Table 2 presents results of our regression analysis, with cumulative abnormal returns (−15, +5) as the dependent variable and R&D intensity as the primary independent variable. Both models are statistically significant even though the R^2 values are low. This is consistent with other studies predicting abnormal returns (Bromiley and Marcus, 1989; Lee, 1997, 2001).

Most of the control variables are significant in anticipated directions. The number of managers buying is a positive signal while the number of managers selling is a negative signal. For example, even an event representing a net sale of stock may involve some managers making stock purchases (since trades are reported to the SEC in bundles). As such, a net stock sale would be less meaningful if some managers were making purchases—the negative signal is less clear.

In many cases, control variables have opposite signs for stock purchases and stock sales. In general, these variables indicate that a management trade should be taken particularly seriously. For example, if the trade represents a relatively large portion of outstanding shares or the stock is highly volatile, the effects of a stock purchase or sale are amplified. R&D intensity also appears to amplify the signal of a management trade. Consistent with Hypothesis 1, R&D intensity is positively (and significantly) related to abnormal returns for stock purchases. Similarly, as suggested in Hypothesis 2, R&D intensity is negatively related to cumulative abnormal returns for stock sales. We also

Table 2. Impact of R&D intensity on cumulative abnormal returns^a

Variables	Stock purchases	Stock sales
R&D intensity	0.044*** (0.014)	−0.013*** (0.004)
<i>Controls</i>		
Log (% of shares traded)	0.452*** (0.127)	−0.012* (0.005)
# mgrs buying shares	0.009 [†] (0.005)	0.026*** (0.005)
# mgrs selling shares	−0.008 (0.009)	−0.009** (0.003)
Log (Days since trade)	0.051*** (0.011)	−0.080*** (0.010)
Log (Price of trade)	−0.061*** (0.014)	−0.067*** (0.009)
Log (Volatility)	0.018*** (0.002)	−0.004** (0.001)
Log (EBITDA change)	−0.010 (0.009)	−0.054 (0.129)
Log (Market value)	0.005*** (0.001)	0.009*** (0.001)
Log (Insider holdings)	−0.033 (0.088)	0.079* (0.039)
<i>N</i>	8 072	10 390
<i>F</i>	25.65***	21.92***
<i>R</i> ²	0.03	0.02

^a Standard errors are shown in parentheses.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; [†] $p < 0.1$

performed a number of checks to ensure the robustness of our results; all tests confirm our results.⁴

DISCUSSION AND IMPLICATIONS

This study melds the strategic importance of knowledge-based assets for generating rent with analysis

⁴ First, we tested the model's robustness by adding controls including: (1) percentage of insider holdings bought or sold in the transaction, (2) insiders' position, (3) number of inside directors, (4) year, (5) the firm's industry (SIC), (6) the firm's exchange (NYSE, etc.), (7) total assets, (8) number of annual events for each firm, and (9) industry R&D intensity. Since these variables did not improve the fit or alter conclusions, they were dropped to facilitate presentation. Second, we tested whether the sample reduction altered results by using industry-level R&D intensity to substitute for missing data. Finally, we modeled the relationship using a cross-sectional time series analysis to adjust for the lack of independence among observations. All of these tests confirm our results.

of how that rent might be appropriated. It extends the resource-based view of the firm by linking the rent-producing assets (R&D) to rent appropriation. While the inputs for R&D are particularly promising as sources of competitive advantage, they are also associated with information asymmetries for both rivals (to hinder imitation) and investors. Investors view managerial trading as a signal about the quality of the firm's resources. This signal value is borne from an assumption that managers exploit their private knowledge to appropriate rent.

Rent appropriation from whom?

Is insider trading a preferred mechanism for rent appropriation? Interestingly, it may allow employees to appropriate rent without directly harming shareholders (as opposed to pay which reduces cash flows). To illustrate, suppose that managers purchase shares at a price of P_0 based on knowledge of a pending R&D breakthrough. The public announcement and commercialization may be years away, but managers perceive significant progress. Let us assume that once this information becomes publicly known, the firm's share price will increase to P_2 .

Upon announcement of managers' trades, other investors purchase shares and some existing shareholders increase their stakes—driving up the price to P_1 since the trading represents a positive signal but not all of the information (i.e., $P_0 < P_1 < P_2$). Eventually, the full disclosure will push the price from P_1 to P_2 . Here, managerial trading releases some of the information earlier than otherwise would have been the case (e.g., moving directly from P_0 to P_2 at a later date).

Investors who had a stake before management traded benefit since their shares increase in value sooner. For those who buy shares after management has traded, their gains are lower because they do not realize the gains when the stock price moves from P_0 to P_1 . If they would have bought even without the signal, this represents a loss to them. On the other hand, if the investors were attracted by management's signal of confidence, they would not have received any gains at all (e.g., they receive $P_2 - P_1$ by following management's signal). In this way, many shareholders may benefit from the signals provided through managerial trading. Some shareholders reap gains sooner, while others follow management's lead and reap gains

that they would not have had otherwise. In any event, it should be clear that the firm's existing shareholders have little incentive to curtail insider trading.

This argument becomes even stronger when we consider the cost associated with other possible mechanisms for appropriating rent. If managers perceive that they deserve more of the rent and insider trading is prohibited, they may demand the rent in the form of higher compensation (Manne, 1966). This suggests that insider trading may be an efficient way to align employee and shareholder interests when allocating rent from a resource-based advantage. In other words, insider trading may substitute for other forms of rent appropriation that are quite costly to shareholders since they directly lower net income.⁵

Conclusion and future directions

This study raises questions that should be explored in future research. Rent appropriation is an under-researched aspect in the strategic management literature, and specifically, in the context of the resource-based view (Barney, 2001; Coff, 1999). This study scratches the surface of that question by identifying one way in which employees may appropriate rent associated with a resource-based advantage. Additional research should explore this further, and identify other means of rent appropriation.

Finally, this study has only focused on insider trading and, therefore, rent appropriation of top managers. Indeed, scientists and technicians may be the beneficiaries of even more asymmetric information and they are generally subject to less regulatory monitoring. Is this form of rent appropriation more or less prevalent at lower levels?

The strategy literature has focused extensively on rent generation with relatively little exploration of who reaps the gains from a competitive advantage. Ultimately, one cannot predict firm performance adequately if the theory of competitive advantage only addresses rent generation.

⁵ Some argue that insider trading adversely affects market efficiency and imposes costs on investors (Fishman and Hagerty, 1992). However, this is an externality in that it reflects costs of all insider trading to society. If one firm unilaterally stopped such trading, it would not generally lower the cost for investors.

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