

INSIDER TRADING AND THE INFORMATION CONTENT OF EARNINGS  
ANNOUNCEMENTS

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## INSIDER TRADING AND THE INFORMATION CONTENT OF EARNINGS ANNOUNCEMENTS

This paper addresses whether the net effect of insider trading is to promote accurate pricing of stocks by conveying insiders' private information to market participants. I investigate this question by examining the relation between insider trading and the information content of earnings announcements. I document two main findings: first, decisions to trade are influenced by future earnings announcement returns. These relations are generally concave and are economically more significant for insider purchases than for insider sales. Second, insider purchases and sales executed *and disclosed* prior to an earnings announcement preempt news in the announcement and have a negative relation with market reactions to the announcement, consistent with insider trading informing the market. These relations hold after controlling for the endogenous relation between trading and market reactions. These findings are consistent with insiders trading on private information and their trading conveying information to the market, two necessary (but not sufficient) conditions for insider trading to have a net positive effect on securities pricing.

*J.E.L. Classification:* G14

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# INSIDER TRADING AND THE INFORMATION CONTENT OF EARNINGS ANNOUNCEMENTS

## 1. Introduction

This paper examines the informational role of insiders in securities markets by investigating the relation between insider trading and the information released at earnings announcements. An unresolved issue in financial economics is whether the net effect of insider trading is to increase the amount of information in prices. Critics of insider trading argue that restricting insider trading makes markets fairer, encourages greater liquidity, and promotes information acquisition by non-insiders. In response, some economists and legal scholars argue that allowing insiders to trade is the best method for introducing insiders' private information into the market (Manne, 1966a, 1966b; Carlton and Fischel, 1983). A number of theoretical papers have analyzed this issue (e.g., Fishman and Hagerty, 1992), and there is empirical evidence that insider trading provides information to the market (e.g., Damodoran and Liu, 1993).

Addressing this question requires answering three subsidiary questions: Do insiders possess and trade on price-relevant, private information? Do insider trades convey this information to the market? Do other communication mechanisms (e.g., security analysts, mandated and voluntary disclosure etc...) substitute for the information benefits (if any) of insider trading? This paper provides evidence on the *first two* questions by documenting that, even with strict regulation of insider trading, insiders trade on the information released at quarterly earnings announcements and these trades appear to reduce the market's surprise at these announcements.

I examine insider trading ahead of quarterly earnings announcements because these information releases are mandated and regular and are accompanied by observable market expectations such as prior earnings numbers and analyst forecasts. Thus, examining earnings releases avoids some of the endogeneity concerns raised when relating insider trades to voluntary disclosure activities such as management forecasts.<sup>1</sup>

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<sup>1</sup> Insider purchases have been linked to management forecasts (Noe, 1999; Cheng and Lo, 2006). Section 4.2.7 reports robustness tests controlling for the presence of management forecasts.

I document two main results. First, an insider's decision to trade before an earnings announcement is associated with the earnings surprise and stock return at the announcement: decisions to buy (sell) shares are more likely ahead of positive (negative) announcement returns and earnings surprises. The relations with future information are generally concave and extend up to two announcements (6-8 months) in the future. These relations persist when controlling for endogeneity between insider trading and earnings announcement returns. While both insider purchases and sales are associated with earnings announcement news, the economic significance of these relations is far higher for insider purchases than for insider sales. Finally, I find evidence these relations have weakened as insider trading laws have strengthened.

Second, insider-trading volume conveys information to the market. Reaction to earnings announcements (measured by return volatility and abnormal trading volume) decreases in the insider-trading volume preceding the announcement. Trades prior to the earnings announcement are associated with increased "information leakage" where cumulative returns are positive (negative) before good (bad) news announcements. Interestingly, only trades disclosed to the SEC prior to the announcement have this effect; trades whose disclosure occurs after the announcement are unrelated to market reactions and information leakage. This fact is especially significant given the Sarbanes-Oxley Act requirement that insiders disclose their trading activity more quickly than in the past. From these results I conclude that insiders do trade on their knowledge of private information released at earnings announcements and these trades provide information to the market.

Despite the advantages offered by my focus on quarterly earnings announcements my results are subject to several caveats. First, private information influences insiders' trades and, when it is partially revealed at the earnings announcement, drives the market reaction to the announcement. Thus, my inferences are conditional on how well I control for endogeneity in these relations. Second, as indicated earlier, addressing the underlying research question of whether insider trading positively impacts price efficiency requires research on the ability of other communication mechanisms to substitute for insider trading. For example, Bushman, Piotroski and Smith (2005) find, in an international setting, that analyst activity increases following the enforcement of laws restricting insider trading. However, Piotroski and Roulstone (2004) show that analyst activity contributes a mix of industry-level and firm-specific information into prices,

while insider trades contribute firm-specific information. Thus, analysts may be an imperfect substitute for insiders' ability to provide information about a firm. Further research is necessary to indicate whether it is optimal to limit or allow insider trading in an attempt to improve the informational efficiency of stock prices.

This paper contributes to the literature by documenting insiders' use of earnings announcement information in their trading decisions. While prior research has found an association between insider trades and subsequent returns, I show that earnings announcement returns have an association with insider trades incremental to long-term returns and incremental to a contrarian reaction to past news. Beyond just statistical significance, I show that this association is economically significant for insider purchases. While few existing studies investigate whether the market learns from insider trades, I show that insider trades are associated with market reactions both prior to, and at the time of, the earnings announcement. Importantly, these associations are strongest for insider trades disclosed prior to the earnings announcement implying the market learns from insider trades when trades are disclosed and not when they are executed and supporting recent regulatory changes to increase the speed with which insiders report their trades. Overall, these results support, but do not conclusively document, the idea that insider trading can increase the information content of stock prices.

The paper is organized as follows: Section 2 reviews the prior literature and develops the main hypotheses; Section 3 discusses data and research design issues; Section 4 presents empirical results; and Section 5 concludes.

## **2. Prior Literature and Hypothesis Development**

### *2.1. Insider Trading and Earnings Announcement News*

Beginning with Ball and Brown (1968) and Beaver (1968), a number of papers have investigated the information content of earnings by examining the price and volume reactions to earnings announcements.<sup>2</sup> Ball and Brown (1968) showed that prices anticipate earnings surprises. Trades by corporate insiders are an example of an information signal that anticipates future disclosures and could contribute to prices leading earnings. For example, Meulbroek (1992)

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<sup>2</sup> Cross-sectional determinants of these reactions are examined in Atiase (1985), Bamber (1986), and El-Gazzar (1998) among others, while Landsman and Maydew (2002) investigate whether the information content of earnings has changed over time.

reports that almost half the price run-up before takeovers occurs on days when insiders trade on knowledge of the takeover, suggesting that “the stock market detects informed trading and impounds a large proportion of the information into the stock price before it becomes public.” Damodoran and Liu (1993) find that insider trades preempt the market response to the public disclosure of reappraisals of the value of real estate investment trusts.

Prior research has also examined whether insiders trade on earnings news. For example, Elliot, Morse and Richardson (1984) find an increase (decrease) in insider purchases (sales) prior to extreme earnings increases. Piotroski and Roulstone (2005) relate annual earnings changes to insider trades and Ke, Huddart, and Petroni (2003) show that insider sales anticipate breaks in consecutive earnings increases. Finally, Lustgarten and Mande (1995) report trading patterns consistent with insiders trading on their knowledge of future earnings announcements. However, Givoly and Palmon (1985) examine a sample of insider trades and find little relation between the existence of the trade and subsequent information events, including earnings announcements. Similarly, Sivakumar and Waymire (1994) conclude that “[their] evidence is also consistent with prior studies which suggest that insider trading profitability is not linked to foreknowledge of specific corporate news events such as earnings announcements” (p. 32). Thus, there is conflicting evidence that insiders trade on earnings news, particularly short-term earnings news.

Extant research on the relation between insider trading and earnings news typically attempts to relate the size of observed trades with a measure of earnings surprise. Such a methodology restricts the variation in the insider trading variable to the size of trades, ignoring insiders who choose not to trade at all. Thus, considering the *decision* to trade along with the *size* of the trade offers a more powerful methodology for examining the determinants of insider trading. In addition, the prior literature has focused on earnings news, while insider trades should be based on any price-relevant news known to the insider. For example, new contracts, order backlog, components of earnings etc... released at or around an earnings announcement should explain trades made before the announcement. Such news will affect the announcement return even if it is separate from the news in the earnings surprise.<sup>3</sup>

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<sup>3</sup> Brandt et al., (2006) show that the earnings announcement return is a better measure of the news in the announcement than the earnings surprise.

Finally, the relation between insider trading and private information should be influenced by a firm's sensitivity to legal sanctions on informed trading.<sup>4</sup> Garfinkel (1997) shows that securities laws regarding insider trading have affected the relation between insider trading and earnings news. One implication of legal liability is that insiders will balance the rewards to trading on private information with the penalties associated with breaking insider trading laws. As the importance of private information grows, insiders will trade on it until the information becomes extreme enough to attract regulatory attention. This implies that the relation between insider trading and announcement news is non-linear with trades decreasing as information becomes too extreme (Piotroski and Roulstone, 2008).

A second implication of legal liability is that insider sales before bad news should be less common than insider purchases ahead of good news. Bad news disclosures are more likely than good news disclosures to trigger investor lawsuits and regulatory attention. Investor lawsuits use insider selling ahead of the disclosure to indicate management's foreknowledge of the bad news. Thus, insider selling ahead of bad news disclosures carries greater legal risk than insider purchasing ahead of good news disclosures. This observation is consistent with prior studies finding an asymmetry in the relation between insider trading and private information (e.g., Jeng et al. (2003) and Lakonishok and Lee (2003), both of which find a greater relation between insider purchasing and subsequent returns than between insider selling and subsequent returns).<sup>5</sup>

In this paper, I re-examine the relation between insider trading and the news at earnings announcements. I use Tobit estimation to relate both the existence of trading and the size of the trade to private information proxied by the price change at the announcement. If the rewards to trading on private information are great enough, insiders aware of upcoming, positive (negative)

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<sup>4</sup> Ke, Huddart, and Petroni (2003) presents a good summary of the legal ramifications of insiders trading on short-term earnings news. Seyhun (1992) and Jagolinzer and Roulstone (2008) examine the effects of laws targeting insider trading.

<sup>5</sup> Legal liability will not necessarily eliminate informed trading on earnings news as the SEC rarely prosecutes traders for using foreknowledge of earnings. Meulbroek (1992) finds that only 8% (15/183) of illegal insider-trading cases pertain to knowledge of a firm's earnings. Even insider selling may escape close scrutiny; for example, an investigative series by the Chicago Tribune in 2003 found 718 instances in which insiders traded (mostly selling) within three months before an earnings pre-announcement. Seventy two executives were identified as selling within two weeks ahead of a disclosure that earnings would miss expectations. At the end of 2003, "authorities [had] not filed insider-trading charges in any of these cases" (Countryman, 2003). SEC resources are limited and investigations naturally focus on prominent and egregious cases; trading related to earnings is unlikely to be as prominent as trading based on takeovers.

news will initiate purchases (sales) before the announcement that would not have been made without the knowledge of this news. These relations will be non-linear as insiders avoid trading on extreme news events and will be more economically significant for insider purchases than insider sales. Formally:

**Hypothesis 1:** *Prior to an earnings announcement, the decision to trade and the size of the trade are related to the news (earnings announcement return) in the announcement.*

The null hypothesis is that the decision to trade and the size of trades are unrelated to the news in the announcement. This will occur if insiders do not have foreknowledge of the news to be released at the announcement (unlikely for the short horizon I examine) or if legal concerns restrict insiders from trading on their private information no matter what its materiality.<sup>6</sup>

## *2.2. Insider Trading and Market Reactions to Earnings Announcements*

In Kyle (1985) type models, trading by informed parties partially reveals their information to other market participants. Kabir and Vermaelen (1996) empirically test this idea by investigating the effect of an Amsterdam Stock Exchange ban on insiders trading in the two months before earnings announcements. They find weak evidence that after this ban took effect, stock prices responded to positive earnings news more slowly than before the ban. Udpa (1996) also considers the effect of insider trading on the market's reaction to earnings announcements. He finds firms with insider trading prior to earnings announcements have smaller earnings response coefficients and lower return volatility at the earnings announcement than firms with no trading before the announcement. These results are consistent with insider trading conveying information to the market, supporting the arguments in Manne (1966a, 1966b) and Carlton and Fischel (1983).

I extend the insider signaling story in Udpa (1996) with one additional feature. An insider's information advantage regarding earnings announcement news is correlated with the market's

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<sup>6</sup> In particular, the existence of the short-swing profits rule (which requires insiders to hold their positions for at least six months) implies insiders will trade on information that is profitable for several months, e.g., earnings surprises one to two quarters ahead. The relation between trading and future earnings announcements is examined in Section 4.2.1. Another complication in testing Hypothesis 1 is that insider trading may preempt the announcement news; sections 4.2.2 and 4.2.3 investigate this possibility.

reaction to that news: the more the insider knows relative to the market the greater the benefits to trading *and* the more the market will need to revise its beliefs at the announcement. This implies a *positive* relation between the existence and size of insiders' trades before an earnings announcement and the market's reaction to that announcement. Combined with the market learning from the trades, this implies the relation between insider trading and the market's reaction to the earnings announcement is endogenous.

In this paper I use an empirical specification of the relation between insider trading and market reactions that examines the endogenous relation between trading decisions and market reactions. The formal hypothesis is as follows:

**Hypothesis 2:** *Insider trading before an earnings announcement is endogenously related to the market's reaction to that announcement: insider-trading volume increases in the market's reaction to the announcement and the market's reaction to the announcement decreases in insider-trading volume.*

The null hypothesis is that insider trading before an earnings announcement is not related to the market's reaction to the announcement. This will be true if the market's reaction is a poor proxy for the insider's information advantage or if insider trading fails to convey information to the market. In addition, the incidence and size of insider trades will not increase (and may decrease) in the market's reaction if legal concerns induce insiders to trade smaller amounts as their private information (and hence, the market surprise) increases.

### **3. Data Sources and Variables**

#### *3.1. Data Sources*

Data for this study comes from the Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial Insider Trading Data Feed and National Archives Insider Trading Summaries databases. From Compustat, I collect data on all firms with quarterly earnings announcement dates from 1980-2002. From CRSP I collect data on returns, trading volume and market value. From I/B/E/S I gather the mean of the last consensus forecast prior to the earnings announcement along with the number of analysts contributing to the forecast. From CDA/Spectrum I gather data on institutional ownership. From the Insider Trading Data Feed and National Archives

Insider Trading Summaries, I gather all open-market purchases and sales of at least 100 shares, made by corporate insiders (top officers and directors) from 1980-2002.

### 3.2. *Insider Trading Variables*

Insider buying (*Buys*) and selling (*Sales*) in the months between earnings announcements is measured as the dollar value of shares purchased or sold, scaled by market value ten days before the announcement.<sup>7</sup> I measure insider trading over a time period starting one day after the prior quarter's earnings announcement and ending one day before the upcoming quarter's earnings announcements. If a firm-quarter has no insider trading in this time period *Buys* and *Sales* are set to zero. To avoid data errors, I eliminate 16 firm-quarters where *Buys* or *Sales* is equal to or greater than 1. Due to missing data or delays in reporting earnings I require the number of calendar days between earnings announcements to be less than or equal to 120. Results are similar if I divide the approximately 90-day period between earnings announcements into two equal sections and treat the 45-day period prior to the announcement as the pre-announcement trading period. Results are also similar if I focus only on trading occurring in the two months prior to the upcoming earnings announcements (eliminating trading that occurs just after the prior earnings announcement).<sup>8</sup>

The majority of observations have no insider buying or selling. If we are only interested in the size of non-zero trades and we suspect the sample suffers from incidental truncation (i.e., the outcome of a variable other than *Buys* or *Sales* determines whether we observe a non-zero value for *Buys* or *Sales*) then we need to test for sample-selection bias. Alternatively, if purchase and sales data are zero because the insiders' demand for a trade becomes non-positive, then Tobit estimation using all available observations is appropriate. An example of possible selection bias is firms' use of trading windows whereby insiders are prohibited from trading during certain time periods. In the extreme, firms may prohibit their insiders from trading at all times. To deal with possible sample-selection issues I make two methodological choices: first, I eliminate observations from firms that never show insider trading by top executives and directors; these firms appear to have eliminated such activity regardless of the information released at the future

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<sup>7</sup> Scaling shares purchased and sold by quarterly trading volume or shares outstanding produces similar results. I also report, but do not tabulate, results using the number of insider buys or sales as the measure of insider trading.

<sup>8</sup> Most of my tests are carried out on the full sample of insider trades; tests of the effect of trades on market reactions also distinguish between trades disclosed prior to the announcement versus trades disclosed after the announcement.

earnings announcement. Second, I use the Heckman (1979) estimator to model the choice to trade and test for sample-selection bias. Results with the sample in this paper fail to reject the null of no selection bias. Thus, I carry out my main tests using Tobit estimations that jointly examine the presence of trading and the size of the trades; I also report OLS estimations for comparison.

The final sample has 249,585 firm-quarters from 1980-2002 with complete data. Of these firm-quarters 62,056 (79,235) have insider buying (selling) in the (roughly) three months between quarterly earnings announcement  $q-1$  and quarterly earnings announcement  $q$ . Trading within a firm-quarter is quite homogeneous: of the firm-quarters with any trading, only 22,814 of them have both insider buying *and* insider selling.

### *3.3. Earnings Announcement News and Information Content Variables*

I measure the news in the earnings announcement as the earnings announcement return (*CAR*) and the earnings surprise (*UE*). *CAR* is the daily, market-adjusted return cumulated over days -1, 0, and +1 relative to the earnings announcement date. *UE* is unexpected earnings scaled by stock price ten days before the announcement, where unexpected earnings is either I/B/E/S-reported actual earnings less the mean analyst forecast of earnings, or, if there is no analyst forecast, actual earnings less actual earnings four quarters previously.<sup>9</sup>

I measure the market's reaction to the earnings announcement using return volatility and abnormal trading volume at the earnings announcement. Return volatility (*Volatility*) is the daily, squared market-adjusted return, summed over the days of the announcement period (three days centered on the announcement date) and scaled by the variance of market-adjusted returns during the estimation period (180 trading days from day -100 to +100 relative to the announcement day excluding the 21 trading days surrounding the announcement day). A "normal" value of *Volatility* is 3, i.e., the sum of three days with return volatility equal to 1. Abnormal trading volume (*Abvol*) is the difference between daily share turnover (shares traded scaled by shares outstanding) during the announcement period and mean daily share turnover during the estimation period, scaled by the standard deviation of estimation period share

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<sup>9</sup> Results are similar if I require firms to be followed by at least one analyst. Results are also similar when I substitute within-quarter ranks of *CAR* and *UE* for their raw values.

turnover. As with *Volatility* I sum the daily measures of abnormal trading volume from days -1, 0, and +1 relative to the earnings announcement date to create *Abvol*. A “normal” level of *Abvol* is 0.<sup>10</sup> While all tests are carried out using both variables separately, for ease of exposition I report results using a combination of the two measures (*Reaction*). To create this variable, I rank the two measures within industry-years (industries defined by two-digit SIC code) and create percentage ranks for each variable that range between zero and one. *Reaction* is defined as the sum of the percentage ranks for *Volatility* and *Abvol*, and ranges between zero and two.

### 3.4. Control Variables

Insider trading and the market’s reaction to earnings announcements are affected by a number of firm factors. Larger firms are more likely than small firms to use stock-based compensation, resulting in insiders at larger firms making fewer purchases relative to sales. I proxy for size with the market value of equity 10 days prior to the earnings announcement (*Size*). Along with *Size*, the number of analysts and the percentage of institutional ownership (*Instown*) are associated with the information content of earnings (Atiase, 1985; Lobo and Mahmoud, 1989; El-Gazzar, 1998; Hotchkiss and Strickland, 2003). The number of analysts (*Number*) is the number of forecasts in the last I/B/E/S consensus forecast prior to the announcement and is equal to zero if there are no forecasts available.

Rozeff and Zaman (1998) document that past returns and book-to-market are associated with the direction of insider trading activity: insiders sell glamour firms with high past returns. To control for these effects I include *PreRet6* (the market-adjusted buy and hold return from six months prior to the announcement to two days prior to the announcement) and *B/M* (the book value of equity scaled by the market value of equity, measured at the end of the prior quarter) in my tests. I also include *PostRet6* (the market-adjusted buy and hold return from two days after the announcement to six months after to the announcement) to control for future, non-earnings announcement news that drives insider trading. Firm-level restrictions on the timing of insider trades are increasing through time (Bettis, Coles and Lemmon, 2000); to control for this, I include a variable, *Trend* that takes on the values zero to 22 for the years 1980-2002. In addition, Landsman and Maydew (2002) document a time trend in reactions to earnings announcements: return volatility and abnormal volume at earnings announcements have

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<sup>10</sup> Landsman and Maydew (2002) use similar measures of information content.

increased through time. The *Trend* variable also controls for this effect. Models of informed trade (e.g., Kyle, 1985) predict that insiders will be more active when liquidity trading provides “cover” for their trades. Thus, for the time period between the prior announcement and the upcoming announcement I calculate total trading volume scaled by shares outstanding (*Turnover*) and the standard deviation of daily share turnover (*StdVolume*). When estimating determinants of market reaction, I control for the fact that good news announcements are accompanied by larger reactions than bad news announcements; I include a variable (*Plus*) that equals one if the earnings announcement return is positive; zero otherwise. I include the absolute value of the earnings surprise as a control for the amount of earnings news released and include *Turnover* to control for market activity prior to the announcement.

## 4. Empirical Results

### 4.1. Univariate Statistics

Table 1A presents descriptive statistics for the key variables along with the median values for all firms in the Compustat universe with data availability other than insider trading. The mean (median) value of *Volatility* is 5.69 (2.65) indicating that the average earnings announcement day conveys more information to the market than the average non-event day. Mean (median) *Abvol* is 0.47 (-0.08) further indicating that the average earnings announcement conveys information to the market.<sup>11</sup> The mean firm is followed by 1.45 analysts, has 29% of its shares held by institutions, has a mean (median) abnormal announcement return of 0.40% (0.08%), and has an absolute earnings surprise equal to 5.0% of stock price. Firm size is quite skewed with a mean (median) value of \$1.5 billion (\$147 million). Comparison to the Compustat universe shows that sample firms are larger, have greater institutional ownership, higher announcement returns, a larger absolute earnings surprise, slightly more insider buying and selling, and slightly higher reactions to earnings announcements than the median Compustat firm. Across all firm-quarters mean insider buying (selling) represents 0.04% (0.14%) of market value. Across all firm-quarters the dollar value of purchases (sales) is roughly \$60,000 (just over \$900,000).

Table 1B presents statistics on trading for several sub-samples of the data based on the timing of insider trades and insider identity. These statistics are calculated across firm-quarters with non-

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<sup>11</sup> Landsman and Maydew (2002) report mean values of 5.33 and 0.94 for their return and volume reaction measures respectively.

zero trading only. Panel A shows that insiders tend to buy in the one-month period following an earnings announcement: the dollar value of buys and sales occurring in this window is far greater than 50% of the dollar value of buys and sells occurring in the two month period before an earnings announcement. This effect is more pronounced for insider sales: the dollar value of insider sales in the one month after an earnings announcement is greater than the dollar value of insider sales made at other times.<sup>12</sup> Panel B shows that chief officers sell (buy) more (less) than directors, consistent with the use of stock compensation for chief officers. Finally, Panel C shows that while insider buying has been flat over time, insider selling has increased from 1990 on. Again, this is probably due to increased use of stock compensation along with stock-ownership plans for executives and directors.

If insider trades are based on private information they should earn abnormal returns. Table 1C presents statistics on the profitability of insider trades in my sample.<sup>13</sup> I measure the profitability of insider trading using calendar-time portfolio regressions as in Jeng et al. (2003). For each calendar-month in my sample, I form a portfolio of all firms experiencing an insider trade in the past six months. The excess returns of these monthly portfolios are then regressed on the Fama-French factors (the market factor, *MKTRF*; the size factor, *SMB*; and the book-to-market factor, *HML*) and a momentum factor (*UMD*). Table 1C presents the intercepts for these regressions for trades by all insiders, trades by CEOs, trades by all chief officers (CEO, COO etc...), and for trades by outside directors.

The overall results in Panel A are similar to those in Jeng et al. (2003): Insider purchases are followed by abnormal returns of 54 basis points per month over a six-month period (Jeng et al. (2003) found abnormal returns of 52 basis points per month over this period). Insider sales are followed by returns of -15 basis points per month (Jeng et al. (2003) found post-sale abnormal returns to be a statistically insignificant -5 basis points per month). Examining sub-sets of insiders, I find purchases made by chief officers and CEOs to be more profitable and more volatile than overall purchases (higher intercepts but also higher standard errors). Trades by outside directors are similar to the overall results.

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<sup>12</sup> Examining all trades made between consecutive earnings announcements shows that 56.8% of sales and 49.5% of buys occur within one month following the prior announcement. An additional 29.4% of sales and 29.5% of buys occur during the second month following the prior earnings announcement.

<sup>13</sup> I thank the referee for suggesting this analysis.

The small return following sales is probably due to the prevalence of liquidity trades, i.e., trades made for compensation or diversification reasons rather than solely as a result of private information. Insider purchases are unlikely to be made for liquidity reasons, thus, if insiders are buying and selling during the same period, the sales are more likely to be liquidity trades than if insiders are only selling during the period. Consistent with this idea, Panel B shows sales in my sample are followed by lower abnormal returns (roughly -28 basis points per month) when I exclude firms from the monthly portfolio if the firm had an insider purchase in the prior six months. These informed sales appear to be driven by outside directors and non-top officers as the homogeneous sales for chief officers and CEOs continue to be followed by insignificant abnormal returns.

Panel C examines the effect of trade timing on post-trade abnormal returns. For insider buys, abnormal returns are slightly higher when made following an earnings announcement relative to buys before an announcement. Sales made after earnings announcements earn an insignificant 9 basis points per month, while sales made ahead of earnings announcements earn a significant 15 basis points per month. Thus, for sales, there is weak evidence that sales made before earnings announcements are more closely associated with private information than sales made after earnings announcements.

From my overall results, I conclude that insiders are trading in a way that makes use of private information with this usage being strongest for insider purchases. Thus, my sample offers a relevant setting for investigating whether insiders trade on private information regarding earnings announcement information.

Table 2 presents the correlation structure for the main variables. The two information content components (*Volatility* and *Abvol*) are highly correlated with each other, with a correlation coefficient of 0.299. Correlations among the independent variables are generally low with the exception of *Number* and *Size*, which have a correlation of 0.193, and *Number* and *Instown* which have a correlation of 0.305.

## 4.2. Multivariate Tests

### 4.2.1. Hypothesis 1

Hypothesis 1 states that insider trading before the announcement is related to the news in the announcement. I investigate this by estimating the following regression using Tobit and OLS estimation:<sup>14</sup>

$$\begin{aligned} Buys_q/Sales_q = & \alpha_0 + \alpha_1 CAR_q + \alpha_2 CAR_q * CAR_q + \alpha_3 CAR_{q-1} + \alpha_4 UE_q + \alpha_5 UE_q * UE_q + \\ & \alpha_6 UE_{q-1} + \alpha_7 LN(Size_q) + \alpha_8 PreRet6_q + \alpha_9 PostRet6_q + \alpha_{10} B/M_{q-1} + \\ & \alpha_{11} LN(Number_q) + \alpha_{12} Instown_t + \alpha_{13} Trend_t + \alpha_{14} StdVolume_q + \\ & \alpha_{15} LN(Turnover_q) + \varepsilon \end{aligned} \quad (1)$$

I use the natural log of firm size, share turnover, analyst following plus one, and the standard deviation of daily trading volume because these variables are highly skewed. With a large set of panel data, standard errors may be biased due to cross-sectional and time-series correlation. Thus, I report t-statistics based on Rogers (1993) standard errors that are robust to heteroscedasticity and correlation across observations from the same industry (as defined by two-digit SIC). This effectively reduces the degrees of freedom for determining statistical significance to 70 (the approximate number of industry clusters in my data). There is no fixed-effects estimator for Tobit so I manually add fixed-effects for industry (based on one-digit SIC). OLS estimations include fixed-effects for each firm (OLS results are similar without the inclusion of firm fixed-effects).<sup>15</sup> All models also include an indicator variable for fourth-quarter observations.

A positive coefficient on *CAR* in equation (1) indicates that the higher the announcement return, the more likely insiders are to trade prior to the announcement and the larger are their trades. Similarly, a positive coefficient on *UE*, the unexpected component of announced earnings, indicates that insiders are trading shares prior to the release of earnings that beat market expectations. I expect a positive coefficient on *CAR* and *UE* in explaining insider purchases and

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<sup>14</sup> I omit firm subscripts in all equations. Time subscripts are defined as follows: subscripting with a *q* indicates a value measured quarterly; subscripting with a *t* indicates a variable measured yearly. Maximum-Likelihood  $R^2$  (Adjusted  $R^2$ ) values are reported for the Tobit (OLS) results.

<sup>15</sup> STATA does have a procedure for random-effects Tobit. Use of random-effects Tobit produces results similar to those in Table 3A for insider purchases; however, maximum-likelihood estimation of random-effects Tobit for insider sales fails to converge.

negative coefficients when explaining insider sales. Lagged values of *CAR* and *UE* control for insiders purchasing (selling) after the release of bad (good) news. I expect negative (positive) coefficients on these lagged variables in explaining purchases (sales). I also include terms for the square of *CAR* and *UE* to control for any non-linear relation between trading and earnings and returns (see Piotroski and Roulstone, 2007). I expect negative coefficients on these terms for both purchases and sales. I estimate equation (1) with 249,585 firm-quarters of data.

Tables 3A (for insider purchases) and 3B (for insider sales) report results from Tobit and OLS estimations of equation (1). The first (second) column of Table 3A reports on Tobit (OLS) marginal effects for insider purchases. Consistent with insiders being contrarians, the coefficients on future and past *CAR*, *PreRet6*, and *PostRet6* indicate insiders buy after stock price declines and before stock price increases. Consistent with insiders trading on earnings news, the coefficient on future (past) *UE* is positive (negative). Consistent with insiders curtailing buying as news becomes more extreme, the coefficients on the square of *CAR* and the square of *UE* are negative; however, only the square of *CAR* is statistically significant. The incidence of insider purchases is lower at large firms and firms with high institutional ownership. The coefficient on *Trend* is negative. Finally, high trading volume volatility is positively associated with buying. OLS results are generally consistent in sign with the Tobit results although the magnitude and statistical significance of the OLS marginal effects are lower than the magnitude and statistical significance of the Tobit marginal effects.

The economic significance of these results can be seen by adjusting the reported marginal effects for scaling. The Tobit marginal effect of announcement return on insider buying is 0.001, i.e., an increase in announcement return of 1 (100%) increases insider buying by 0.1% of market value. The average market value in the sample is \$1,459,459,000: this implies a one-standard deviation increase in announcement return (approximately 8.6%) increases insider buying by roughly \$120,000. The mean value of insider buying in the sample is \$60,000. Thus, a one-standard deviation increase in announcement return triples insider buying in the three months prior to the announcement. These results are robust to examining the number of insider purchases: the number of insider purchases increases in the future earnings announcement return and earnings surprise and decreases in the squared and lagged measures of announcement return and earnings surprise (results not tabulated).

Tests of Hypothesis 1 assume that decisions to trade are influenced only by the upcoming earnings announcement. However, trading decisions should be influenced by future announcements. Because of the “short-swing” trading rule in federal securities law, insiders cannot profit from buys and sales made less than six months apart. Thus, insiders will benefit from trading well in advance of information in order to reduce legal scrutiny of the trade and to ensure the gain from the transaction will not have unwound before the insider can close out his/her position.

To test these ideas I add the next two quarterly announcements’ values of *CAR* and *UE* to equation (1). Thus, I am now testing whether insider trades relate to three earnings announcements separated by as much as nine months (up to three months prior to quarter *q*’s announcement, plus six months to quarter *q+2*’s announcement) from the transaction. Results for insider purchases [untabulated] indicate that future announcement returns do influence current purchases: insider purchase decisions are related to the announcement return in quarters *q*, *q+1*, and *q+2* although the marginal effects drop greatly for the one and two-quarter ahead returns.

Table 3B investigates whether insider sales are associated with the news released at the announcement. The first column reports that, similar to purchase decisions, sales decisions are related to the past and future earnings announcement return and earnings surprise. Consistent with the presence of liquidity sales and litigation risk, the effect of announcement returns on insider selling is weaker than its effect on insider buys: *ceteris paribus*, a one standard-deviation increase in *CAR* decreases insider selling by \$113,000. This is only 12% of the mean insider selling in the sample of roughly \$925,000. Sales are more likely at large firms covered by analysts and held by institutions. Sales decisions are negatively (positively) correlated with the book-to-market ratio and future returns (past returns); consistent with Rozeff and Zaman (1998), insiders at glamour firms experiencing high returns are sellers. As with insider purchases, these inferences hold when measuring insider selling by the number of sales occurring between earnings announcements [results untabulated], and the OLS estimates are generally smaller than the Tobit estimates.

For insider selling, the addition of future returns has little effect; however, the decision to sell is associated with the earnings surprise in quarters  $q+1$  and  $q+2$  [results untabulated]. Thus, there is some evidence that insider selling uses more long-term earnings information relative to insider purchases.

The results in Tables 3A and 3B are consistent with insiders considering upcoming earnings and non-earnings information in making trading decisions. Purchase decisions are related to future earnings surprises and announcement returns with the return relation extending up to two quarters ahead. Insider sales are also related to future returns and to future earnings surprises beyond the upcoming earnings announcement. While both insider purchases and sales are related to earnings announcement news, the economic significance of these relations is higher for purchases than for sales.

#### *4.2.2. Hypothesis 1 and Causality*

As noted earlier, Givoly and Palmon (1985) concluded that the returns to insider trades were not due to the release (subsequent to the trade) of value-relevant information. They posited that insider trades create their own returns: "...a major part of the observed abnormal performance of insiders is likely to be due to price changes arising from the information revealed through the trades themselves" (Givoly and Palmon, 1985, abstract). This effect could also explain the observed relation between decisions to trade and subsequent announcement returns in my sample: insiders trade and the market reacts to the trade with positive (negative) announcement returns following buys (sales). (Note, however, that this effect is unlikely to explain any relation between trades and earnings surprises.)

To further investigate causality between trades and announcement returns, I estimate the simultaneous relation between insider trading volume and earnings announcement returns. Given the short time periods involved, I assume that earnings news is exogenous with respect to trading decisions made in the three months prior to the release of the earnings news.

To examine the endogeneity between trading and future announcement returns, I estimate the following equations using instrumental variables Tobit (equation (2a)) and Two Stage Least Squares (equation (2b)):

$$\begin{aligned}
Buys_q/Sales_q = & \alpha_0 + \alpha_1 CAR_q + \alpha_2 CAR_{q-1} + \alpha_3 UE_{q-1} + \alpha_4 LN(Size_q) + \alpha_5 PreRet6_q + \\
& \alpha_6 B/M_q + \alpha_7 LN(Turnover_q) + \alpha_8 LN(Number_q) + \alpha_9 Instown_t + \alpha_{10} Trend_t \\
& + \alpha_{11} LN(StdVolume_q) + \varepsilon
\end{aligned} \tag{2a}$$

$$\begin{aligned}
CAR_q = & \alpha_0 + \alpha_1 Buys_q/Sales_q + \alpha_2 CAR_{q-1} + \alpha_3 UE_q + \alpha_4 UE_q * UE_q + \alpha_5 LN(Size_q) + \\
& \alpha_6 B/M_q + Firm-Fixed-Effects + \varepsilon
\end{aligned} \tag{2b}$$

Note that equation (2a) omits forward-looking variables (*PostRet6*, *CAR\*CAR*, *UE*, and *UE\*UE*) so all instruments for the insider-trading variables in (2b) are realized before *CAR<sub>q</sub>* is measured. I report Anderson and Cragg-Donald (1993) statistics for tests of identification and the presence of weak instruments. Equation (2b) includes firm fixed effects (results are similar without including firm fixed effects). Results are presented in Table 4.<sup>16</sup>

Column 1 shows that, consistent with Table 3A, the decision to purchase shares is positively associated with the upcoming announcement return after accounting for endogeneity. Similarly, insider sales (Column 2) are negatively associated with the upcoming announcement return, consistent with Table 3B. Finally, Column 3 reports insider buying (selling) leads to lower (higher) announcement returns. The coefficient magnitudes indicate that a one standard-deviation increase in *Buys* (*Sales*) lowers (raises) the announcement period return by approximately 9% (1%). This is consistent with insider trades pre-empting announcement news: announcement returns are lower (higher) when preceded by insider purchases (sales) than they would be without the insider trades.<sup>17</sup> The Anderson and Cragg-Donald statistics reject the nulls of under-identification and weak instruments. These results are robust to measuring insider trading with the number of trades: the number of purchases (sales) increases (decreases) in the announcement return and the announcement return is lower when preceded by more insider buys and higher when preceded by more insider sells (results not tabulated).

<sup>16</sup> IVTobit can be estimated using maximum likelihood or a two-step procedure. Equation (2a) is estimated with the two-step procedure as the maximum-likelihood estimates fail to converge. One consequence of this is that Stata does not report marginal effects and robust t-statistics with the two-step procedure. Thus, coefficients and non-robust t-statistics are reported in Table 4, columns 1 and 2. T-statistics in column 3 (2SLS estimation of the determinants of the announcement return) are robust to heteroscedasticity and industry-level clustering.

<sup>17</sup> Section 4.2.3 provides additional information that insider trades prior to the announcement pre-empt information in the announcement; specifically trades lead to positive (negative) cumulative abnormal returns ahead of good (bad) news releases.

I have assumed earnings are exogenous over a time period of less than three months; however, as discussed earlier, the decision to sell is related to earnings surprises up to six months in the future. Over this time frame, managers could be selling and then managing earnings down, i.e., causality between insider trades and earnings surprises could run the opposite way from what I have assumed. I do not investigate this possibility because I consider it unlikely insiders would find it beneficial to reduce earnings after they sell stock; in particular, such activity would increase the risk of litigation if the lowered earnings caused stock prices to fall.

#### *4.2.3. Insider Trading and Information Leakage*

One explanation for the effect of insider trading on upcoming announcement returns is the possibility insider trading moves prices in the correct direction *before* the announcement and thus reduces the need for a price change at the announcement. In other words, does insider trading aid in information “leakage” prior to the announcement?

Support for this idea is found by examining cumulative abnormal returns prior to earnings announcements. Announcements of good news preceded by insider buying should show larger cumulative abnormal returns prior to the announcement than announcements of good news with no pre-announcement buying. To examine this idea, I calculate weekly abnormal returns in the 12 weeks prior to the earnings announcements in my sample and compare these returns across groups defined by the presence or absence of insider trading. To increase the power of my tests I make three research design choices: first, I examine insider buying (selling) ahead of earnings surprises in the top (bottom) quartile of the earnings surprise distribution *of the prior quarter*. This ensures that I only examine announcements conveying significant news and that the economic significance of this news is available to insiders before the announcement. Second, I only examine announcements preceded by insider buying (with no selling) or insider selling (but no buying). Third, I examine insider buying (selling) where the announcement return of the prior quarter was between the 40<sup>th</sup> and 60<sup>th</sup> percentiles of the distribution of the prior quarter’s announcement return. This ensures that the insider trading I use to classify firms is based on future news and not on a contrarian reaction to past news. Because not all trades executed before the earnings announcement are disclosed before the announcement I carry out my analysis

separately for trades disclosed and not disclosed prior to the announcement. I use the date the insider filed trade information with the SEC as the date of disclosure.

Figure 1 contains four graphs of cumulative, weekly, market-adjusted returns in the eight weeks prior to the earnings announcement. Panel A (panel B) examines disclosed buying before good news announcements (disclosed selling before bad news announcements). Each panel shows three data series based on insider-trading volume: no insider trading, and low (high) disclosed insider trading defined as firm-quarters with insider trading below (above) the median volume of non-zero *Buys* or *Sales* for that quarter. In both panels, the cumulative returns for high-trading firms are more extreme than the cumulative returns for low-trading firms. Ahead of good news, cumulative returns are higher for high-trading firms than for low-trading firms. Ahead of bad news, cumulative returns are lower for high-trading firms than for low-trading firms. The difference in mean, cumulative returns to high and low trading firms during the week prior to the announcement is significant at the 5% level for both buys and sells. The results for high insider buying are consistent with the Table 4 result that insider buying leads to lower announcement returns: this lower return occurs (at least partially) because the insider buying adjusts prices upward ahead of the announcement.

Note that while insider trading over the quarter may be driven by past price movements, such a relation would produce a very different graph. Specifically, if high insider buying is the result of past price movements, we would expect to see prices declining over the quarter for high insider-buying firms. Similarly, we should see price increases over the quarter for high insider-selling firms. The fact that we see price increases (decreases) associated with high insider buying (selling) supports the idea that insider trades are conveying information to the market rather than just responding to the price changes.

Of course, the results in Figure 1 may reflect *only* that insiders trade ahead of price movements, i.e., the return movements following high trading may not be caused by that trading. Evidence that insider trades do in fact convey information comes from examining insider trades that are not disclosed prior to the announcement. Panels C and D of Figure 1 duplicate Panels A and B using insider buys and sells that are not disclosed prior to the earnings announcement. When the trades are not disclosed before the announcement, neither buying nor selling leads to significant

differences in cumulative returns; in fact, high insider buying is associated with lower returns than low insider buying most of the quarter, while high insider selling is associated with higher returns than low (or zero) insider selling. Given that both disclosed and non-disclosed trades are occurring ahead of significant information events, the difference in return patterns is best explained by the signal provided by disclosed trades.<sup>18</sup>

In summary, when insiders buy and sell ahead of strong news announcements the buys and sells disclosed prior to the announcement are associated with larger price movements in the direction of the announcement news than buys and sells not disclosed prior to the announcement.

#### 4.2.4. Hypothesis 2

Hypothesis 2 states that insider trading is endogenously related to the market's reaction to earnings announcements. This endogeneity arises because the insider's information advantage is related to the market's reaction: the more the insider knows relative to the market, the more likely the insider is to trade; *and* the greater the market's revision of beliefs when earnings announcement news is released. At the same time, insider trading conveys information to the market reducing the reaction to the announcement. Thus, any empirical specification of the relation between insider trading before earnings announcements and the market's reaction to the announcement must account for endogeneity between insider trading and the reaction.

To provide a baseline result I first use OLS to regress the market's reaction to the announcement on insider purchases and sales prior to the announcement:

$$\begin{aligned} Reaction_q = & \alpha_0 + \alpha_1 Buys_q + \alpha_2 Sales_q + \alpha_3 Plus_q + \alpha_4 LN(Abs(UE_q)) + \\ & \alpha_5 LN(Number_q) + \alpha_6 LN(Size_q) + \alpha_7 Instown_t + \alpha_8 Trend_t + \alpha_9 LN(Turnover_q) + \\ & Firm-Fixed-Effects + \varepsilon \end{aligned} \quad (3)$$

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<sup>18</sup> Another explanation is that disclosed trades generally occur earlier than non-disclosed trades. Because insiders will only trade if returns have not yet moved in the direction of their private information, non-disclosed (i.e., later) trades will be associated with cumulative returns that are lower (higher) ahead of good (bad) news than disclosed (i.e., earlier) trades. To control for this explanation, I have examined return patterns for non-disclosed trades that occurred at least four weeks prior to the announcement. For these trades, differences in price runups between high non-disclosed trading and low non-disclosed trading are not significant. Thus, the timing of trades is less important than the disclosure of trades in explaining information leakage.

I estimate equation (3) using 249,585 firm-quarters with results reported in Table 5. The main result is that the coefficients on *Buys* and *Sales* are negative but insignificant; thus, OLS estimation provides no support for Hypothesis 2 [results untabulated].

#### 4.2.5. Hypothesis 2—Endogeneity

To control for endogeneity I measure the association between the informativeness of earnings announcements and insider-trading volume with the following set of regressions:

$$Buys_q/Sales_q = \alpha_0 + \alpha_1 Reaction_q + \alpha_2 CAR_{q-1} + \alpha_3 UE_{q-1} + \alpha_4 LN(Size_q) + \alpha_5 PreRet6_q + \alpha_6 B/M_{q-1} + \alpha_7 LN(Turnover_q) + \alpha_8 StdVolume_q + \varepsilon \quad (4a)$$

$$Reaction_q = \alpha_0 + \alpha_1 Buys_q + \alpha_2 Sales_q + \alpha_3 Plus_q + \alpha_4 LN(Abs(UE_q)) + \alpha_5 LN(Size_q) + \alpha_6 LN(Number_q) + \alpha_7 Instown_t + \alpha_8 Trend + \alpha_9 LN(Turnover_q) + Firm-Fixed-Effects + \varepsilon \quad (4b)$$

Equation (4a) is estimated using instrumental variables Tobit; equation (4b) is estimated using Two-Stage Least Squares. Note that in instrumenting for *Buys* and *Sales* all exogenous variables are measured before or contemporaneously with *Buys* and *Sales*; thus, endogeneity between the insider-trading variables and variables contemporaneous with the market reaction is avoided. As in Table 4 I report Anderson and Cragg-Donald (1993) statistics for tests of identification and weak instruments.

Table 5 presents the results from estimation of equations (4a) and (4b).<sup>19</sup> The first two columns reveal that *Buys* (*Sales*) is positively (negatively) associated with *Reaction*. This is consistent with purchases occurring ahead of significant news releases, while sales, which carry higher litigation concerns, decrease before significant news releases. The third column of Table 5 reports that the more insiders trade (both buying and selling), the lower the market's reaction to the announcement.

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<sup>19</sup> Unlike equation 2a (reported in Table 4), equation 4a is estimated using maximum-likelihood instrumental variables Tobit; thus, Table 6A reports marginal effects and robust t-statistics.

To gauge the economic effect of insider trading on market reactions, note that *Buys* and *Sales* are expressed as a percentage of the firm's market value. Thus, a one-unit change in *Buys* corresponds to a change in market value of 100%. Scaling the coefficient on *Buys* down to the effect of a standard-deviation increase in *Buys* corresponds to a change in *Reaction* of -0.38. Similar analysis for *Sales* indicates that a one-standard deviation increase in *Sales* corresponds to a change in *Reaction* of roughly -0.08. For comparison purposes, the standard deviation of *Reaction* is 0.47. The coefficient on *Buys* is significantly more negative than the coefficient on *Sales* (p-value for test of coefficient equality < 0.05) consistent with insider purchases conveying more information than insider sales. Finally, tests for endogeneity reject the null of no endogeneity between insider purchases and market reactions (p-value < 0.001) and between insider sales and market reactions (p-value < 0.001).

Using the number of buys and sells as the measure of insider trading also produces similar results: market reactions to quarterly earnings announcements are lower as the number of insider buys and insider sales increase, while the number of buys (sells) rises (falls) when market reactions are high (results not tabulated).

Good news announcements and announcements with large, absolute earnings surprises are met with a larger market reaction. Coefficients on firm size and institutional ownership are, as expected, negative. The positive coefficient on analyst following is consistent with El-Gazzar (1998) who reports a marginally positive relation between one of his return volatility measures and analyst following.

#### *4.2.6. Role of Trade Disclosure*

Tests of Hypothesis 2 assume that all trades occurring prior to the announcement contribute to the market's information set. As noted in the introduction and in Section 4.2, insiders are required to disclose their trades to the SEC but do so with a lag; trades disclosed prior to the earnings announcement are more likely to be known by market participants than trades which are not disclosed until after the announcement. Thus, I re-estimate equations (4a)-(4b) splitting the trade variables into trades that are disclosed prior to the announcement (*Buys\_D* and *Sales\_D*) and trades that are not disclosed until after the announcement (*Buys\_ND* and *Sales\_ND*).

Results (not tabulated) are as follows. First, disclosed buying and selling continue to be negatively associated with market reactions to earnings announcements. I also find a negative relation between non-disclosed trading and market reactions; however, this appears to be due to correlation between disclosed and non-disclosed trades. Including both disclosed and non-disclosed buying and selling in the regression results in significantly negative coefficients on disclosed buying and selling only (although the significance of the disclosed insider selling coefficient is marginal: one-tailed  $p$ -value  $< 0.10$ ). These results are consistent with the idea that the negative relation between insider-trading volume and market reactions reflects the market learning from trades. If this relation was due to insiders choosing to trade prior to low-reaction announcements, then splitting the sample based on the disclosure status of the trades should not affect the relation between trading and market reaction.

#### *Section 4.2.7. Sensitivity Analyses*

My research design focuses on the effect of mandated disclosures on insider trading. The insider-trading literature has also investigated the relation between voluntary disclosures (e.g., management forecasts of earnings) and insider trading (e.g., Noe, 1999; Cheng and Lo, 2006). This literature shows insiders adjust their trading to take into account information released in managerial forecasts: insiders trade more after releasing earnings forecasts and endogenously increase bad news forecasts and insider purchases. To control for these phenomena, I eliminate observations with a management forecast of earnings between quarterly announcement  $q-1$  and quarterly announcement  $q$ . I gather management forecasts (annual and quarterly) from the FirstCall database. Because these forecasts are sparse before 1994 I run two separate analyses. First, I exclude from my sample any quarterly earnings announcement preceded by a forecast (11,879 observations); second, I exclude from my sample all announcements prior to 1994 and all post-1993 announcements preceded by a forecast. Results for these sub-samples are similar to those presented: insider buying and selling is related to the announcement return and is endogenously related to the market reaction to the announcement.

Changes in insider trading legislation over time may affect the relations between insider trading, announcement news, and market reactions to announcements. Significant insider trading legislation was passed in 1984 and late 1988; thus, I have carried out my main tests on sub-samples of data from before and after 1989 (see Piotroski and Roulstone (2005) for a similar

research design). I find that the relation between insider trades and announcement news, and the effect of insider trades on market reactions are stronger in the earlier sub-sample. Strikingly, the effect of future earnings surprises on insider sales is weaker (statistically and economically) in the post-1990 sub-sample indicating that insiders are increasingly avoiding selling on negative news as legal liability for insider trading grows. This is consistent with insider trading legislation increasing the costs to trading on private information.

Firm size has a significant effect in studies of insider trading. For example, Lakonishok and Lee (2001) find the predictive power of insider trades only exists for small firms while Piotroski and Roulstone (2005) find their strongest relations between insider trading and future earnings news among small firms. To investigate the effect of size on my results, I re-run the main estimations using samples partitioned by the industry-adjusted median market value. For equation 1a (the relation between insider trades and earnings announcement news) the main results of Tables 3A-3B generally hold for both samples; however, the marginal effects of *CAR* on trading are greater for small firms than for large firms. For equation 4b, the negative relation between insider buying and market reaction holds for both samples; for insider selling, the relation is only significantly negative for large firms, while for small firms the relation is positive and marginally significant. Overall, insiders at small firms appear to trade on private information more aggressively than insiders at large firms and the impact of this trading appears to aid investors at both small and large firms. However, the relations documented in the paper are still significant for large firms.

A recent paper by Core et al., (2005) shows that insider trades are consistent with the relation between accruals and stock returns: insiders buy more (less) when accruals are low (high). Given that accruals are associated with future returns and with the realization of those returns at earnings announcements (Sloan, 1996), I investigate whether accruals are driving the relation between insider trading and future announcement returns. To equation (1) I add the rank of accruals calculated using the prior quarter's and upcoming quarter's statement of cash flow. I find that the rank of accruals is associated with trading: insiders buy more when past-quarter accruals are low and sell less when future accruals are high. However, the effect of announcement returns on insider buying (selling) remains strongly positive (negative) (results not tabulated).

## **5. Conclusion**

This paper investigates the effect of insider trading on markets by examining the relation between insider trading and the information in quarterly earnings announcements. Insider trading has long been assumed to be based on private information and to be a source of information to market participants; however, empirical evidence of this in the context of earnings announcements is mixed. I document that insiders' trades are associated with upcoming earnings announcement returns. These associations are incremental to six-month returns before and after the announcement, confirming that insiders are trading on information released at the announcement. Purchases are associated with the upcoming announcement returns up to two quarters in the future. Consistent with legal liability arising from trading on private information, the effect of announcement news on insider selling is economically small and appears to have decreased as legal liability for illegal insider trading has increased. Insider purchases, which are less likely to be associated with securities litigation, are strongly associated with future earnings announcement news.

The relation between insider trades and announcement returns is endogenous: insiders choose to trade based on upcoming announcement news, but insider trades also affect the response to that news. In particular, announcement returns are lower (higher) when insiders are buying (selling) before the announcement. This is partially due to insider buys (sells) moving prices upward (downwards) ahead of the earnings announcement. This is consistent with Givoly and Palmon's (1985) conclusion that insider trades themselves provide price-relevant information to the market. Again, the economic significance of these relations is higher for insider purchases than for insider sales.

The volume of insider trading and the market's reaction to the announcement are endogeneously related: insider buys (sales) increase (decrease) in the market's reaction and the market's reaction decreases in the amount of insider trading (both purchases and sales). These results are consistent with the market learning from insider trading. These findings are robust to controls for other information-related variables such as unexpected earnings, firm size, the number of analysts following the firm, and institutional ownership. When insider trades are divided into trades disclosed (not disclosed) to the SEC prior to the announcement, I find only disclosed

trades are negatively related to market reactions. This suggests that the market only partially reacts to the execution of insider trades and requires public disclosure of the trade to more fully impound the information in the trade. Overall, I interpret the negative relation between insider-trading volume and market reactions as evidence that insider trades convey information to the market and that this information is primarily revealed when the trade is disclosed rather than when the trade occurs. Finally, as with the relation between insider trades and announcement returns, the economic effect of insider purchases on market reactions is greater than the economic effect of insider sales on market reactions.

These results add to our understanding of the informational role of insiders. They provide evidence in favor of the argument (found most prominently in Manne, 1966a, 1966b) that insider trades provide information to the market. They also imply that removing insiders from the market does not lead to a compensating increase in information from other sources at least for the short time frames examined in this study. Thus, allowing some level of insider trading may be optimal for price efficiency.

There are several areas for future research. As discussed in the introduction, this paper leaves unresolved the issue of whether other market forces substitute for the information provided by insiders. In the context of quarterly earnings announcements it is doubtful whether other market participants change their behavior greatly in response to the presence of insider trading. However, over longer time periods, insider activity can affect other market participants. Thus, while this paper suggests the market learns from insider trades, insider trading may be sub-optimal if, for example, it drives out other information acquisition (Fishman and Hagerty, 1992; Bushman, Piotroski, and Smith, 2005).

Consistent with the idea of substitution between insider trading and other information providers are the correlations in Table 2 showing insider-trading volume to be negatively correlated with firm size, analyst following and (for insider purchases) institutional ownership. However, it is not clear why analysts and institutions would avoid following or investing in firms with active insiders. One can argue that analysts would prefer to follow firms with insider trading because the presence of informed traders makes the analysts' information more valuable to less-informed outsiders. Similarly, institutions may wish to acquire firms that offer rewards to obtaining

private information. The equilibrium relation may result from analyst following and institutional ownership reducing the profits to insider trading. An area for future research is to investigate the relation between insider trading and other market sources of information production.

An additional area for future research is the identification of the non-earnings news associated with insider trading. Insider trades have been linked to long-term earnings changes (Ke, Huddart and Petroni, 2003) and to long-term abnormal returns (Seyhun, 1998). The fact that future announcement returns are related to insider trades even when controlling for future earnings surprises suggests that long-term, non-earnings news is associated with insider trades.

Alternatively, insider trades may be driven by knowledge of earnings beyond just the simple measure of earnings surprise. For example, Ke, Huddart and Petroni (2003) relate insider selling to knowledge of negative earnings surprises, *conditional* on prior strings of earnings increases while Core et al. (2006) provide evidence insiders trade on the relative magnitude of accounting accruals. Research along the lines of these analyses could prove useful in explaining the relation between insider trading and announcement returns.

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## Appendix: Variable Definitions

<i>Variable:</i>	<i>Definition</i>
<i>Reaction</i>	The sum of the percentage ranks (within industry-year) of <i>Volatility</i> and <i>Abvol</i>
<i>Volatility</i>	The sum of the daily, standardized, squared abnormal returns over the three days surrounding the earnings announcement
<i>Abvol</i>	Daily share turnover less mean daily share turnover (estimated over the two months prior to the earnings announcement period) scaled by the standard deviation of daily share turnover. Daily share turnover is shares traded scaled by shares outstanding. The daily value of <i>Abvol</i> is summed over the three days surrounding the earnings announcement.
<i>UE</i>	Unexpected earnings: actual earnings less forecasted earnings, scaled by price ten days before the earnings announcement
<i>CAR</i>	The cumulative, market-adjusted return over days -1, 0, and +1 relative to the earnings announcement date
<i>PreRet6</i>	Market adjusted, buy and hold return from six months prior to the announcement to 2 days prior to the announcement
<i>PostRet6</i>	Market adjusted, buy and hold return from 2 days after the announcement to six months after the announcement
<i>B/M</i>	Book to market ratio at the end of the prior quarter
<i>Size</i>	The market value of equity measured ten days prior to the earnings announcement
<i>Number</i>	The number of security analysts issuing a forecast in the month before the quarterly earnings announcement if available; zero otherwise
<i>Instown</i>	The percentage of the firm's shares outstanding that are owned by institutions
<i>Buys</i>	Dollar value of shares purchased by insiders between earnings announcement t-1 and t, scaled by market value of equity
<i>Buys_D (Buys_ND)</i>	<i>Buys</i> that are reported (not reported) to the SEC prior to the announcement
<i>Sales</i>	Dollar value of shares sold by insiders between earnings announcement t-1 and t, scaled by market value of equity
<i>Sales_D (Sales_ND)</i>	<i>Sales</i> that are reported (not reported) to the SEC prior to the announcement
<i>Plus</i>	Indicator variable equal to one if <i>CAR</i> is positive; zero otherwise
<i>Turnover</i>	Shares traded between earnings announcement t-1 and t, scaled by shares outstanding
<i>StdVolume</i>	Standard deviation of daily share turnover between earnings announcement t-1 and t
<i>Trend</i>	Count variable ranging from 0-22 for years 1980-2002

TABLE 1A  
DESCRIPTIVE STATISTICS

Variable	Mean	Standard Deviation	Q1	Median	Compustat Median	Q3
<i>Reaction</i>	1.04	0.47	0.67	1.02	0.995	1.38
<i>Volatility</i>	5.69	18.56	1.07	2.65	2.51	5.85
<i>Abvol</i>	0.47	2.15	-0.41	-0.08	-0.11	0.59
<i>UE</i>	-0.008	1.63	-0.006	0.0002	0.00001	0.0048
<i>Abs(UE)</i>	0.05	1.63	0.001	0.005	0.005	0.02
<i>CAR</i>	0.004	0.086	-0.031	0.0008	0.0002	0.035
<i>Number</i>	1.45	3.41	0	0	0	1
<i>Size (\$millions)</i>	1,483	9,194	40.57	147.35	104.45	625.57
<i>Instown</i>	0.29	0.27	0.05	0.24	0.16	0.48
<i>Buys (shares) (buy quarters)</i>	21,205	209,752	600	2,000	2,100	8,500
<i>\$ Buys (buy quarters)</i>	246,473	2,366,999	9,060	28,360	27,200	94,325
<i>\$ Buys (all quarters)</i>	60,069	1,173,396	0	0	0	0
<i>% of MV Buys (all quarters)</i>	0.043	0.518	0	0	0	0
<i>Sales (shares) (sale quarters)</i>	102,793	5,397,006	3,400	12,908	12,500	49,585
<i>\$ Sales (sale quarters)</i>	2,974,570	36,500,000	56,250	246,353	210,000	1,093,280
<i>\$ Sales (all quarters)</i>	924,926	20,300,000	0	0	0	36,630
<i>% of MV Sales (all quarters)</i>	0.138	1.03	0	0	0	0.0228

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. See the appendix for variable definitions. Compustat Median refers to the median value for all firms with a non-missing quarterly earnings-announcement date and non-missing data aside from insider-trading data. Quarters with insider purchasing ("buy quarters") constitute 24.9% of the sample's firm-quarters; quarters with insider selling ("sale quarters") constitute 31.7% of the sample's firm-quarters.

**TABLE 1B**  
DESCRIPTIVE STATISTICS BY SUB-SAMPLE

Panel A: Trade Statistics by Time of Trade

Variable	Mean	SD	Q1	Median	Q3
<i>\$Buys_Not_Window</i> (Buy quarters)	229,673	2,555,497	6,260	20,640	69,702
<i>\$ Buys_Window</i> (Buy quarters)	170,503	1,403,165	7,752	23,921	77,994
<i>\$ Sales_Not_Window</i> (Sale quarters)	1,800,922	28,600,000	39,700	156,607	631,727
<i>\$ Sales_Window</i> (Sale Quarters)	2,502,059	27,800,000	52,100	215,229	950,000

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. See the appendix for variable definitions. *Window* refers to trades occurring in the month following an earnings announcement; *Not\_Window* refers to trades occurring outside of the one month following an earnings announcement. Reported values are averaged over firm-quarters with non-zero buying or non-zero selling. Quarters with insider purchasing ("buy quarters") constitute 24.9% of the sample's firm-quarters; quarters with insider selling ("sale quarters") constitute 31.7% of the sample's firm-quarters.

Panel B: Trade Statistics by Rank of Insider

Variable	Mean	Standard Deviation	Q1	Median	Q3
<i>\$ Buys_Chief_Officers</i> (Buy quarters)	74,471	534,97	3,920	11,851	38,560
<i>\$ Sales__Chief_Officers</i> (Sale Quarters)	990,229	4,831,104	51,900	192,200	657,500
<i>\$ Buys_Directors</i> (Buy quarters)	195,172	134,907	4,135	12,250	37,000
<i>\$ Sales_Directors</i> (Sale Quarters)	681,962	9,226,441	21,000	75,760	270,000

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. See the appendix for variable definitions. *Chief\_Officers* refers to the CEO, COO, CFO, CIO, and CTO; *Directors* refers to outside (non-executive) directors. Reported values are averaged over firm-quarters with non-zero buying and selling. Quarters with insider purchasing ("buy quarters") constitute 24.9% of the sample's firm-quarters; quarters with insider selling ("sale quarters") constitute 31.7% of the sample's firm-quarters.

TABLE 1B (CONTINUED)

Panel C: Trade Statistics by Pre and Post ITSFEA

Variable	Mean	SD	Q1	Median	Q3
<i>\$ Buys: Pre</i> ( <i>Buy quarters</i> )	245,396	2,026,517	6,000	19,125	64,640
<i>\$ Buys: Post</i> ( <i>Buy quarters</i> )	246,461	2,559,986	10,300	32,705	103,500
<i>\$ Sales: Pre</i> ( <i>Sale quarters</i> )	934,517	4,656,160	35,671	141,670	552,096
<i>\$ Sales: Post</i> ( <i>Sale Quarters</i> )	3,875,501	43,300,000	68,725	310,000	1,442,311

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. See the appendix for variable definitions. *Pre (Post) ITSFEA* refers to trades occurring before 1990 (after 1989). Reported values are averaged over firm-quarters with non-zero buying and selling. Quarters with insider purchasing ("buy quarters") constitute 24.9% of the sample's firm-quarters; quarters with insider selling ("sale quarters") constitute 31.7% of the sample's firm-quarters.

TABLE 1C  
PROFITABILITY OF INSIDER TRADING

$$R_p - r_f = a + MKTRF + SMB + HML + UMD + e$$

Panel A: Four-Factor Intercepts for six-month returns

Insider Measure	Intercept	t-statistic	Insider Measure	Intercept	t-statistic
<i>Buys</i>	0.0054	5.31	<i>Sells</i>	-0.0015	2.23
<i>CEO_Buys</i>	0.0136	2.73	<i>CEO_Sells</i>	0.0010	0.24
<i>Chief_Buys</i>	0.0137	2.86	<i>Chief_Sells</i>	0.0007	0.22
<i>Director_Buys</i>	0.0063	6.44	<i>Director_Sells</i>	-0.0005	0.67

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. *Chief* refers to the CEO, COO, CFO, CIO, and CTO. *Director* refers to outside (non-executive) directors. Firms enter the relevant, monthly insider-trading portfolio if they have had an insider trading event (buy or sell) in the past six months.

Panel B: Four-Factor Intercepts for six-month returns; homogeneous trading

Insider Measure	Intercept	t-statistic	Insider Measure	Intercept	t-statistic
<i>Buys</i>	0.0092	7.05	<i>Sells</i>	-0.0028	3.64
<i>CEO_Buys</i>	0.0137	2.76	<i>CEO_Sells</i>	0.0006	0.14
<i>Chief_Buys</i>	0.0140	2.68	<i>Chief_Sells</i>	0.0007	0.20
<i>Director_Buys</i>	0.0077	7.13	<i>Director_Sells</i>	-0.0018	2.15

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. *Chief* refers to the CEO, COO, CFO, CIO, and CTO. *Director* refers to outside (non-executive) directors. Firms enter the relevant, monthly insider-trading portfolio if they have had an insider trading event (buy or sell) in the past six months *and* have not had an opposing trade (sell or buy) in the same time period.

Panel C: Four-Factor Intercepts for six-month returns; by trade timing

Insider Measure	Intercept	t-statistic	Insider Measure	Intercept	t-statistic
<i>Not_Window_Buys</i>	0.0049	5.07	<i>Not_Window_Sales</i>	-0.0015	2.39
<i>Window_Buys</i>	0.0059	5.59	<i>Window_Sales</i>	-0.0009	1.33

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. *Chief* refers to the CEO, COO, CFO, CIO, and CTO. *Director* refers to outside (non-executive) directors. Firms enter the relevant, monthly insider-trading portfolio if they have had an insider trading event (buy or sell) in the past six months *and* have not had an opposing trade (sell or buy) in the same time period. *Window* refers to trades occurring in the month following an earnings announcement; *Not\_Window* refers to trades occurring outside of the one month following an earnings announcement.

TABLE 2  
CORRELATION STRUCTURE OF KEY VARIABLES

Pearson correlation coefficients

	<i>Reaction</i>	<i>Volatility</i>	<i>Abvol</i>	<i>Number</i>	<i>Size</i>	<i>Instown</i>	<i>UE</i>	<i>CAR</i>	<i>Buys</i>	<i>Sales</i>
<i>Reaction</i>	1.00									
<i>Volatility</i>	<b>0.373</b>	1.00								
<i>Abvol</i>	<b>0.471</b>	<b>0.299</b>	1.00							
<i>Number</i>	<b>0.154</b>	<b>0.050</b>	<b>0.113</b>	1.00						
<i>Size</i>	<b>0.051</b>	<b>0.006</b>	<b>0.030</b>	<b>0.193</b>	1.00					
<i>Instown</i>	<b>0.098</b>	<b>0.023</b>	<b>0.077</b>	<b>0.305</b>	<b>0.129</b>	1.00				
<i>UE</i>	0.001	0.000	-0.001	-0.002	0.000	-0.001	1.00	0.000		
<i>CAR</i>	<b>0.109</b>	<b>0.140</b>	<b>0.028</b>	0.002	-0.002	<b>0.017</b>	<b>0.007</b>	1.00		
<i>Buys</i>	<b>-0.007</b>	-0.001	<b>-0.006</b>	<b>-0.036</b>	<b>-0.011</b>	<b>-0.032</b>	0.000	<b>0.001</b>	1.00	
<i>Sales</i>	<b>0.012</b>	0.002	<b>0.008</b>	<b>-0.015</b>	<b>-0.011</b>	<b>0.024</b>	-0.000	-0.003	<b>0.118</b>	1.00

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002. Bolded coefficients are significant at the 1% level. See the appendix for variable definitions.

TABLE 3A  
DETERMINANTS OF INSIDER BUYS

$$\begin{aligned}
 Buys_q = & \alpha_0 + \alpha_1 CAR_q + \alpha_2 CAR_q * CAR_q + \alpha_3 CAR_{q-1} + \alpha_4 UE_q + \alpha_5 UE_q * UE_q + \alpha_6 UE_{q-1} + \\
 & \alpha_7 LN(Size_q) + \alpha_8 LN(Number_q) + \alpha_9 Instown_t + \alpha_{10} PreRet6_q + \alpha_{11} PostRet6_q + \alpha_{11} B/M_{q-1} + \\
 & \alpha_{12} Trend_t + \alpha_{13} LN(StdVolume_q) + \alpha_{14} LN(Turnover_q) + \varepsilon
 \end{aligned}
 \tag{1}$$

Tobit and OLS marginal effects with absolute, robust t-statistics in parentheses

Independent Variables	Predicted Sign	<i>Tobit</i>	<i>OLS</i>
		<i>N=249,585</i>	<i>N=249,585</i>
<i>CAR<sub>q</sub></i>	+	0.0010 (6.28)	0.0003 (1.68)
<i>CAR<sub>q</sub> * CAR<sub>q</sub></i>	-	-0.0006 (2.12)	0.0001 (0.20)
<i>CAR<sub>q-1</sub></i>	-	-0.0008 (4.14)	-0.0003 (1.90)
<i>UE<sub>q</sub></i>	+	0.0001 (2.45)	0.00000 (1.16)
<i>UE<sub>q</sub> * UE<sub>q</sub></i>	-	-0.0000 (0.45)	0.00000 (1.26)
<i>UE<sub>q-1</sub></i>	-	-0.0000 (1.36)	-0.0001 (0.92)
<i>PreRet6<sub>q</sub></i>	-	-0.0007 (6.68)	-0.0002 (3.31)
<i>PostRet6<sub>q</sub></i>	+	0.0001 (2.95)	0.0001 (2.93)
<i>B/M<sub>q-1</sub></i>	+	0.00002 (0.80)	-0.0000 (0.10)
<i>LN(Number<sub>q</sub>)</i>	?	0.0002 (7.52)	0.0001 (2.98)
<i>LN(Size<sub>q</sub>)</i>	?	-0.00002 (8.09)	-0.0003 (7.07)
<i>Instown<sub>t</sub></i>	?	-0.0006 (6.24)	-0.0003 (2.03)
<i>Trend</i>	?	-0.00003 (4.58)	0.0000 (1.61)
<i>LN(StdVolume)</i>	+	0.0001 (3.67)	0.0002 (3.23)
<i>LN(Turnover)</i>	+	-0.00005 (0.96)	0.0001 (1.62)
Industry Fixed Effects?		Yes	No
Firm Fixed Effects?		No	Yes
ML/Adjusted R-squared		1.60%	9.25%

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002; 2) *Buys* ≤ 1.0, *Sales* ≤ 1.0, and non-zero trading in at least one quarter during the sample. Coefficients on the intercept and indicator variables for one-digit SIC code (column 1), fourth-quarter observations, and firm fixed-effects (column 2) are not reported. See the appendix for variable definitions. "Robust" standard errors are robust to heteroscedasticity and allow for correlation across observations from the same two-digit SIC industry.

**TABLE 3B**  
DETERMINANTS OF INSIDER SALES

$$Sales_q = \alpha_0 + \alpha_1 CAR_q + \alpha_2 CAR_q * CAR_q + \alpha_3 CAR_{q-1} + \alpha_4 UE_q + \alpha_5 UE_q * UE_q + \alpha_6 UE_{q-1} + \alpha_7 LN(Size_q) + \alpha_8 LN(Number_q) + \alpha_9 Instown_t + \alpha_{10} PreRet6_q + \alpha_{11} PostRet6_q + \alpha_{11} B/M_{q-1} + \alpha_{12} Trend_t + \alpha_{13} LN(StdVolume_q) + \alpha_{14} LN(Turnover_q) + \varepsilon \quad (1)$$

Tobit and OLS marginal effects with absolute, robust t-statistics in parentheses.

Independent Variables	Predicted Sign	<i>Tobit</i>	<i>OLS</i>
		<i>N=249,585</i>	<i>N=249,585</i>
<i>CAR<sub>q</sub></i>	-	-0.0009 (4.16)	-0.0003 (1.19)
<i>CAR<sub>q</sub> * CAR<sub>q</sub></i>	-	-0.0004 (0.80)	-0.0000 (0.01)
<i>CAR<sub>q-1</sub></i>	+	0.0034 (13.42)	0.0017 (5.82)
<i>UE<sub>q</sub></i>	-	-0.0001 (2.85)	-0.0000 (1.63)
<i>UE<sub>q</sub> * UE<sub>q</sub></i>	-	-0.0000 (2.11)	0.0000 (0.84)
<i>UE<sub>q-1</sub></i>	+	0.00001 (0.42)	-0.00002 (0.83)
<i>PreRet6<sub>q</sub></i>	+	0.0008 (6.72)	0.0009 (6.47)
<i>PostRet6<sub>q</sub></i>	-	-0.0003 (4.99)	-0.0002 (4.45)
<i>B/M<sub>q-1</sub></i>	-	-0.0017 (9.82)	-0.0005 (5.68)
<i>LN(Number<sub>q</sub>)</i>	?	0.0003 (3.98)	-0.0001 (1.64)
<i>LN(Size<sub>q</sub>)</i>	?	0.0004 (9.30)	0.0001 (0.91)
<i>Instown<sub>t</sub></i>	?	0.0009 (3.26)	0.0009 (2.42)
<i>Trend</i>	?	-0.0002 (9.13)	-0.0001 (7.42)
<i>LN(StdVolume)</i>	+	0.0009 (4.99)	0.0011 (5.63)
<i>LN(Turnover)</i>	+	0.0003 (2.14)	-0.0000 (0.06)
Industry Fixed Effects?		Yes	No
Firm Fixed Effects?		No	Yes
ML/Adjusted R-squared		8.20%	9.42%

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002; 2) *Buys* ≤ 1.0, *Sales* ≤ 1.0, and non-zero trading in at least one quarter during the sample. Coefficients on the intercept and indicator variables for one-digit SIC code (column 1), fourth-quarter observations, and firm fixed-effects (column 2) are not reported. See the appendix for variable definitions. "Robust" standard errors are robust to heteroscedasticity and allow for correlation across observations from the same two-digit SIC industry.

TABLE 4

INSIDER TRADING AND ANNOUNCEMENT RETURNS CONTROLLING FOR ENDOGENEITY

$$Buys_q/Sales_q = \alpha_0 + \alpha_1 CAR_q + \alpha_2 CAR_{q-1} + \alpha_3 UE_{q-1} + \alpha_4 B/M_{q-1} + \alpha_5 LN(Size_q) + \alpha_6 PreRet_q + \alpha_7 LN(Turnover_q) + \alpha_8 LN(Number_q) + \alpha_9 Instown_t + \alpha_{10} Trend_t + \alpha_{11} LN(StdVolume_q) + \varepsilon \quad (2a)$$

$$CAR_q = \alpha_0 + \alpha_1 Buys\_Ind_q + \alpha_2 Sales\_Ind_q + \alpha_3 CAR_{q-1} + \alpha_4 UE_q + \alpha_5 UE_q * UE_q + \alpha_6 B/M_{q-1} + \alpha_7 LN(Size_q) + Firm-Fixed-Effects + \varepsilon \quad (2b)$$

(IV coefficients with absolute t-statistics in parentheses; absolute, robust t-statistics in column 3)

Independent Variables	Predicted Sign	IV Tobit	IV Tobit	IV (2SLS)
		<i>Buys<sub>q</sub></i> N=249,585	<i>Sales<sub>q</sub></i> N=249,585	<i>CAR<sub>q</sub></i> N=249,585
<i>CAR<sub>q</sub></i>	+/-	0.1534 (1.79)	-0.3011 (2.61)	-
<i>Buys<sub>q</sub></i>	-	-	-	-15.57 (3.68)
<i>Sales<sub>q</sub></i>	+	-	-	0.9723 (1.95)
<i>CAR<sub>q-1</sub></i>	-/+/?	-0.0072 (3.12)	0.0186 (5.86)	-0.0218 (3.26)
<i>UE<sub>q</sub></i>	+	-	-	0.0007 (1.07)
<i>UE<sub>q</sub>* UE<sub>q</sub></i>	-	-	-	0.00000 (0.79)
<i>UE<sub>q-1</sub></i>	-/+	-0.0008 (1.89)	0.0013 (2.28)	-
<i>B/M<sub>q-1</sub></i>	+/-/+	-0.0002 (1.19)	-0.0051 (21.02)	0.0027 (2.68)
<i>LN(Size<sub>q</sub>)</i>	?/?/-	0.0002 (1.25)	0.0006 (2.09)	-0.0105 (8.02)
<i>PreRet<sub>q</sub></i>		-0.0040 (5.39)	0.0051 (5.17)	-
<i>LN(Turnover<sub>q</sub>)</i>	+/+/?	0.0004 (1.07)	-0.0002 (0.49)	-
<i>LN(Number<sub>q</sub>)</i>	-/+	0.0007 (11.79)	0.0012 (10.80)	-
<i>Instown</i>	-/+	-0.0046 (3.42)	0.0075 (4.04)	-
<i>LN(StdVolume<sub>q</sub>)</i>	+/+	-0.0002 (5.39)	-0.0006 (13.49)	-
<i>Trend<sub>t</sub></i>	+	0.0005 (4.27)	0.0029 (14.26)	-
Industry Fixed Effects?		Yes	Yes	No
Firm Fixed Effects?		No	No	Yes

Anderson LR test for identification: Chi-square = 272.3 p-value < 0.001

Cragg-Donald test for weak instruments: F = 38.92

Test for exogeneity of *CAR* and *Buys* (*Sales*): Chi-square = 3.99 (13.59) p-value < 0.05 (0.001)

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002; 2)  $Buys \leq 1.0$ ,  $Sales \leq 1.0$ , and non-zero trading in at least one quarter during the sample. Coefficients on the intercept and indicator variables for one-digit SIC code and fourth-quarter observations (equation 2a) and fourth-quarter observations and firm fixed-effects (equation 2b) are not reported. See the appendix for variable definitions. "Robust" standard errors are robust to heteroscedasticity and allow for correlation across observations from the same two-digit SIC industry.

TABLE 5

DETERMINANTS OF MARKET REACTION CONTROLLING FOR ENDOGENEITY

$$Buys_q / Sales_q = \alpha_0 + \alpha_1 Reaction_q + \alpha_2 CAR_{q-1} + \alpha_3 UE_{q-1} + \alpha_4 B/M_{q-1} + \alpha_5 PreRet6_q + \alpha_6 LN(Size_q) + \alpha_7 LN(Number_q) + \alpha_8 Instown_t + \alpha_9 Trend + \alpha_{10} LN(Turnover_q) + \alpha_{10} LN(StdVolume_q) + \varepsilon \quad (4a)$$

$$Reaction_q = \alpha_0 + \alpha_1 Buys_q + \alpha_2 Sales_q + \alpha_3 Plus_q + \alpha_4 LN(Abs(UE_q)) + \alpha_5 LN(Size_q) + \alpha_6 LN(Number_q) + \alpha_7 Instown_t + \alpha_8 LN(Turnover_q) + \alpha_9 Trend + Firm-Fixed-Effects + \varepsilon \quad (4b)$$

IV marginal effects with absolute, robust t-statistics in parentheses

Independent Variables	Predicted Sign	IV Tobit	IV Tobit	IV (2SLS)
		<i>Buys<sub>q</sub></i> N=249,585	<i>Sales<sub>q</sub></i> N=249,585	<i>Reaction<sub>q</sub></i> N=249,585
<i>Reaction<sub>q</sub></i>	+	0.0015 (5.56)	-0.0014 (4.00)	-
<i>Buys<sub>q</sub></i>	-	-	-	-73.56 (3.97)
<i>Sales<sub>q</sub></i>	-	-	-	-8.58 (4.05)
<i>Plus<sub>q</sub></i>	+	-	-	0.0829 (19.77)
<i>LN(Abs(UE<sub>q</sub>))</i>	+	-	-	0.0049 (5.23)
<i>LN(Size<sub>q</sub>)</i>	-/-	-0.00002 (0.77)	0.0002 (3.80)	0.0064 (1.08)
<i>LN(Number<sub>q</sub>)</i>	?/?/-	0.0001 (3.76)	0.0006 (6.76)	0.0234 (7.05)
<i>Instown</i>	?/?/-	-0.0006 (4.62)	-0.0001 (0.66)	-0.0466 (3.27)
<i>LN(Turnover<sub>q</sub>)</i>	+/?/?	-0.0002 (3.65)	0.0002 (2.00)	0.0730 (8.54)
<i>CAR<sub>q-1</sub></i>	-/+	-0.0009 (5.09)	0.0023 (12.00)	-
<i>UE<sub>q-1</sub></i>	-/+	-0.00002 (0.95)	-0.00002 (0.64)	-
<i>PreRet<sub>q</sub></i>	-/+	-0.0005 (6.80)	0.0007 (6.58)	-
<i>LN(B/M<sub>q-1</sub>)</i>	+/-	0.0001 (2.32)	-0.0011 (7.13)	-
<i>LN(StdVolume<sub>q</sub>)</i>	+/?	0.0002 (5.08)	0.0007 (5.41)	-
<i>Trend<sub>t</sub></i>	+	-	-	-0.0040 (4.22)
Industry Fixed Effects?		Yes	Yes	No
Firm Fixed Effects?		No	No	Yes

Anderson LR test for identification: Chi-square = 88.69 p-value <0.001

Cragg-Donald test for weak instruments: F = 17.74

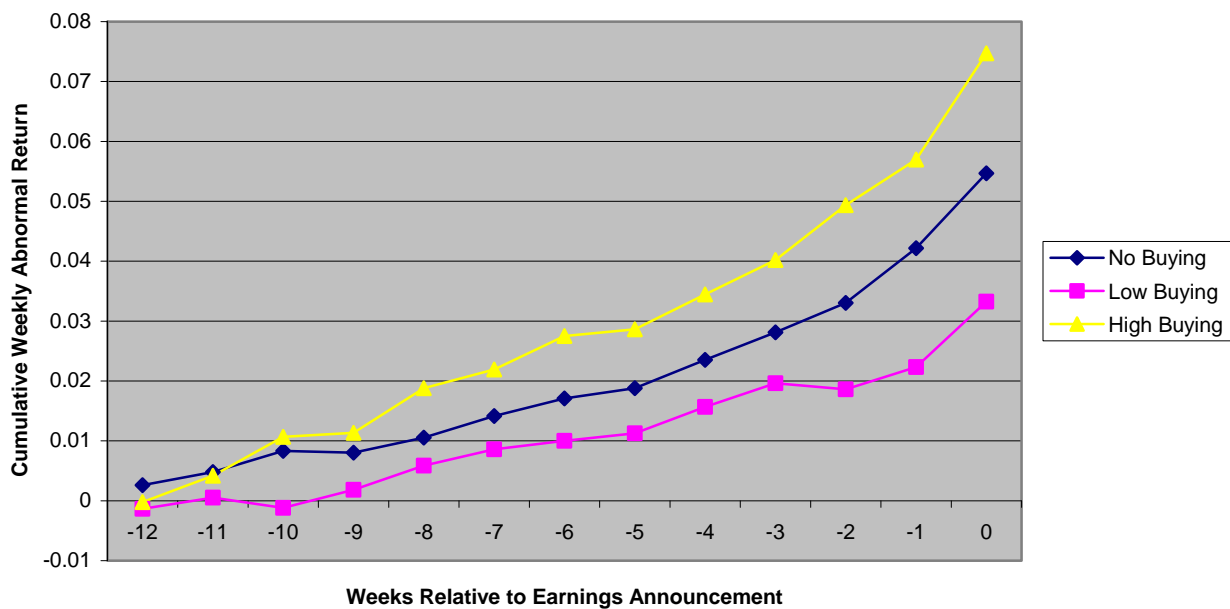
Test for *Buys<sub>q</sub> = Sales<sub>q</sub>* in column 3: F = 15.06 p-value < 0.001

Test for exogeneity of *Reaction* and *Buys (Sales)*: Chi-square = 31.63 (19.68) p-value < 0.001 (0.001)

The sample consists of all firms with: 1) Complete data from Compustat, CRSP, I/B/E/S, CDA/Spectrum, Thomson Financial's Insider Trading Data Feed and the National Archives Insider Trading Summaries for 1980-2002; 2) *Buys* ≤ 1.0, *Sales* ≤ 1.0, and non-zero trading in at least one quarter during the sample. Coefficients on the intercept and indicator variables for one-digit SIC code and fourth-quarter observations (equation 4a) and firm fixed-effects (equation 4b) are not reported. See the appendix for variable definitions. "Robust" standard errors are robust to heteroscedasticity and allow for correlation across observations from the same two-digit SIC industry.

Figure 1  
 Insider Trading and Information Leakage Prior to Earnings Announcements

Panel A: Disclosed Insider Buying Before Good News



Panel B: Disclosed Insider Selling Before Bad News

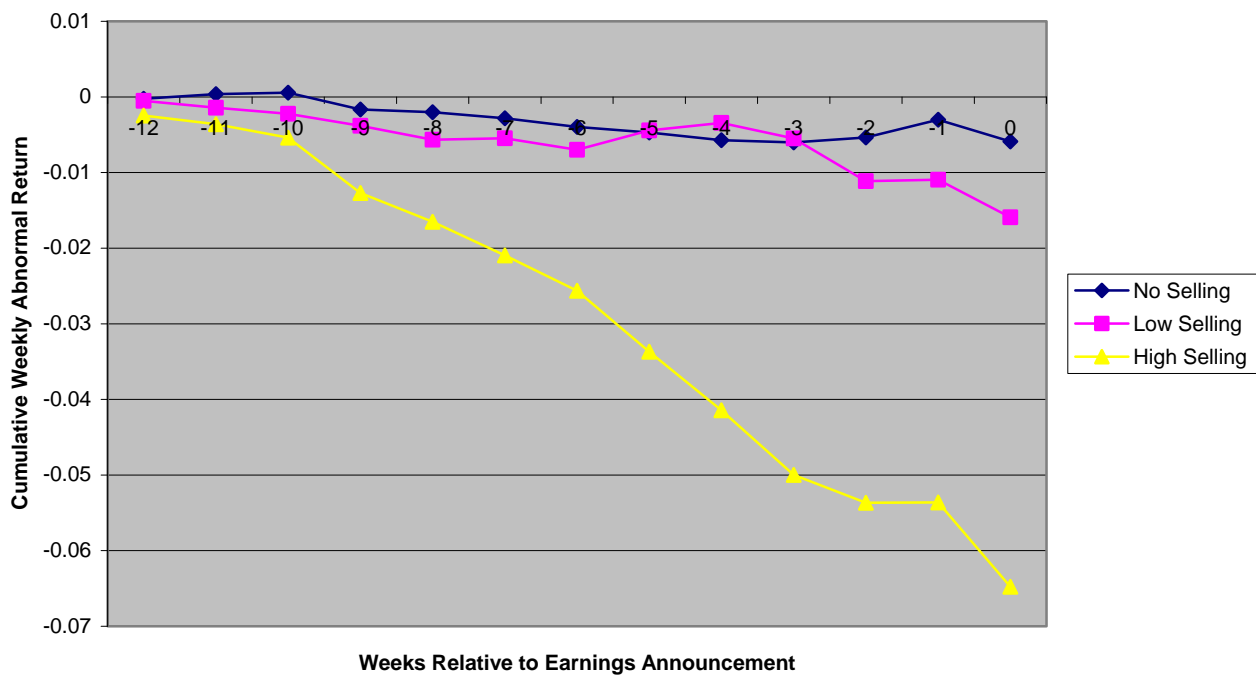
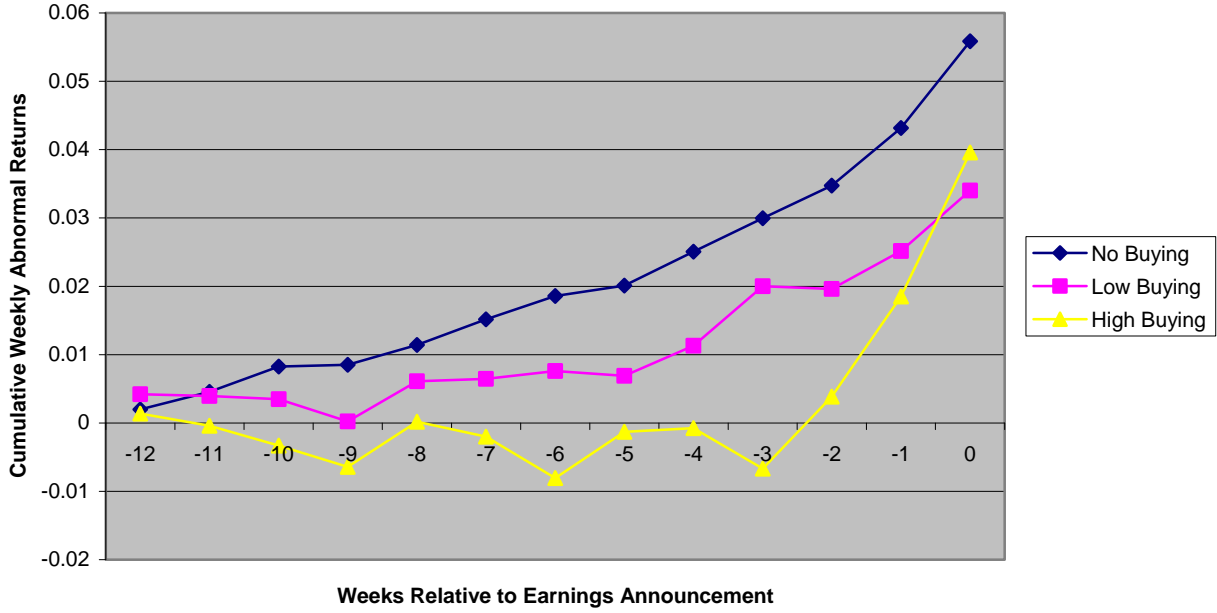


Figure 1 continued

Panel C: Non-Disclosed Insider Buying Before Good News



Panel D: Non-Disclosed Insider Selling Before Bad News

