Insider Trading and Option Returns Around Earnings Announcements

Chin-Han Chiang[1] and Sung Gon Chung[2]

This Draft: January, 2012
(Preliminary version. Please do not cite or circulate)

Abstract

This paper studies the relation between insider trading and option returns around earnings announcements. We show that call (put) options listed under stocks purchased (sold) by insiders earn a significant return premium. This return premium remains significant after controlling for systematic risk, volatility risk, and transaction cost. Underlying stock price movement and volatility jointly serve as the source of this return premium. We attribute the call option premium to a significant run-up in underlying stock price, while the premium of puts is generated by a rise in stock volatility. The option return premium is cross-sectionally correlated with stock lagged returns, volatility, firm size, R&D, and book-to-market ratio.

[1] Chin-Han Chiang (chchiang@smu.edu.sg) is from the Lee Kong Chian School of Business of Singapore Management University.
[2] Sung Gon Chung (sgchung@smu.edu.sg) is from the School of Accountancy of Singapore Management University.

1. Introduction

Insider trading has been in the spotlight of finance studies for decades. The following line from February 1998's *Individual Investor* may well summarize the reason for this: "Company executives and directors know their business more intimately than any Wall Street analyst ever would...Generally, that is the smart money."(p. 54) Corresponding to this article is abundance of literature that finds significant abnormal returns of insider-traded stocks (Jaffe (1974), Finnerty (1976), Baesel and Stein (1979), Lin and Howe (1990), Rozeff and Zaman (1988), Seyhun (1988), and Seyhun (1998)).

Despite the fervent interests in insider trading, the emphasis of much of the research has been on the stock market and on stock returns alone. Studies of the relation between insider trading and stock return volatility as well as other asset markets are largely missing. One relevant paper by Marin and Olivier (2008) theoretically suggests that market uncertainty can rise in the period following insider sales. If we take stock return volatility as a proper measure for uncertainty, Marin and Olivier (2008) indicates that insider sales can result in a rise in stock volatility.

In our view, we can contribute to the body of research on insider trading by examining the association between insider trading and the option market. According to the option pricing theory, option price is jointly determined by stock price and volatility. Therefore, if there is a non-trivial and significant relation between insider trading and stock returns or volatility, but if option market participants do not properly take the relation into account, we might find corresponding abnormal returns in options.

Our analysis focuses on insider trades immediately before the quarterly earnings announcements and options returns measured in the period that includes earnings announcements, hereafter EA. We do this for three reasons. First, we are interested in whether insider trades can provide informative signals to option market participants when the informational uncertainty is the highest, namely right before EA. Second, trading volumes in options is higher around EA (Cao and Ou-Yang (2009)), and our results should be more relevant by looking at this time period. Third, EA (and other informational events) usually carry information contents as discussed in Beaver (1968): if we compare insider-traded against non-insider-traded stock options using the entire sample, the effect we document may be generated by EA rather than insider trading. By concentrating on the periods right before EA, we further control the impact of earnings announcements and can be more confident in concluding that the empirical evidence we report is fully generated by insider trading.

To explore the relation between insider trading, option returns and volatility around earnings announcements, we first consider two simple trading strategies: We buy an at-the-money[3] call option listed under the stock which insiders purchase and buy an equivalent put option under stocks that insiders sell. We only consider options expiring in the following month. We then hold the portfolio until the expiration date of the following month and track the holding period returns. Since insider stock sales (hereafter insider sales) are much more common than insider purchases (hereafter insider purchase), it is difficult to identify whether an insider trade is information-driven. Insider can sell their stocks due to liquidity demands as well as private information. Hence, we take abnormal insider sales, which are defined as sales greater than the last 60 months' average amount, as a proxy for the state in which insiders receive very bad signals about the stock.[4] If the trading volume is particularly large (e.g. abnormal insider sales), a trade is more likely to be made because of new information rather than liquidity demands, and the put option returns measured after abnormal insider sales should provide direct empirical evidence of the market uncertainty indicated by Marin and Olivier (2008).

Combining the option and insider trading data, we find that call options listed under

[3] It is empirically difficult to find exactly at-the-money options. "At-the-money" options here refer to "closest to at-the-money" options.

[4] Abnormal sales are a relevant proxy for worse signals because when insiders have worse information, they should tend to sell a larger amount of shares in a shorter interval than they otherwise would.

stocks insiders purchase earn a statistically significant return premium than those not purchased by them. The return premium can be as large as 17%. Put options, on the other hand, can earn a return premium of 8%. When we consider abnormal insider sales, the return increases to 10% per month and further grows to 15.3% if we alternatively define abnormal sales as those greater than the past 60 month average plus one standard deviation. The return premium of both calls and puts remain significant after controlling for systematic risk (the Fama and French (1993) three factors and the Carhart (1997) momentum factor), volatility risk (the Coval and Shumway (2001) S&P 500 zero-beta straddle) and transaction cost.

The movements of stock price and volatility serve as the two sources of our option returns. In general, stock price movement has an opposite effect on calls versus puts while stock volatility moves both call and put returns in the same direction. In this context, we attribute the call return premium to the significant rise in underlying stock price. The average monthly return premium of an insider-purchased stock is 2.5% during our sample period. Moreover, Marin and Olivier (2008) point out that a large price jump tends to happen in the month immediately following insiders' purchases. This price run-up around EA with large price jumps after insider purchases together contributes to the return premium in call options.

Unlike the case of insider purchases, stock price is relatively stable after insider sales. This is consistent with prior studies that document an asymmetric price change between insider purchases and sales (Lakonishok and Lee (2001), Jeng, Metrick, and Zeckhauser (2003), Friederich, Gregory, Matatko, and Tonks (2002), Fidrmuc, Goergen, and Renneboog (2006), and Marin and Olivier (2008)). For instance, Lakonishok and Lee (2001) study abnormal stock returns of portfolios based on the intensity of insider purchases and sales. They find significantly positive excess 6 month-returns of 4.82% for portfolios of stocks with a strong insider purchase signal, but no significant excess returns for portfolios with a strong sell signal.[5] Marin and Olivier (2008) also show that there is no large price drop immediately after insider sales. Hence, the return premium of put options after insider sales should be generated by the large rise in volatility. With higher stock volatility comes a higher probability that stock price moves out of bounds to make put options more deeply in the money. In such a circumstance, put options earn a positive average return due to the larger price bounce even though stock returns are close to zero *on average*.

This is the first paper to study the relation between insider trading and the option market, and it contributes to several lines of research in finance. First, it provides the first piece of empirical evidence of stock return volatility change after insider sales. In particular, insider sales before EA can provide information about the stock return volatility around the upcoming EA. Consistent with the theoretical argument in Marin and Olivier (2008), stock volatility increases after insider sales. This effect further translates to the put option market, resulting in an abnormal return premium for put options. We find supporting evidence that, while the average stock return after insider sales is not statistically different from zero, stock return volatility increases after insider sales occur, and this increase in volatility is particularly significant after abnormal insider sales. The insignificant stock return after insider stock sales further confirms that the put option premiums after insider sales are generated by the subsequent volatility shoot-up. Second, the abnormal return premiums in the option market after insider sales and purchases suggest that option investors are not better than stock market participants at interpreting insider trading information. The significant call option returns after observing insider purchase indicates that option market participants do not utilize the information contents of insider purchases on future price change. The existence of abnormal option return after insider sales also suggests that the option market fails to anticipate the change in volatility around EA following insider sales. Otherwise this change in

[5] Marin and Olivier (2008) also shows that while a large price jump happens in the month immediately following insiders' purchases, a large drop in the stock price only takes place several months after insiders' sales.

stock price and volatility should be fully reflected in accordingly higher option premiums. To provide further evidence, we examine the difference between the realized volatility and the implied volatility around EA after insider sales to confirm whether option market participants truly underestimate the volatility around EA. We find a significant underestimation of volatility level (i.e. a significant positive difference between realized volatility and implied volatility), particularly in stocks with abnormal insider sales.

We also investigate how option returns relate to characteristics of the underlying stocks, such as past stock returns, firm size, R&D expenditure, and book-to-market ratio. We choose these variables because (1) insiders tend to purchase when stock price falls and sell after price runs up, which suggests that lagged stock return is one of the factors that induce insider trading; (2) firm size and R&D are used as proxies for information asymmetry. It is generally believed that there is a non-trivial relation between insider profits and the degree of information asymmetry; (3) book-to-market ratio is associated with many firm characteristics and returns. We find that call options after insider purchases earn higher and more significant premiums when past stock returns are high, while put options after insider sales earn similar return premiums in both low and high past-return groups. Moreover, option return premiums for both calls and puts after insider trading tend to be higher when the underlying stocks have a higher return volatility in the past 12 months. This suggests that insider trades can provide more useful information to the option market participant in the companies with high uncertainty. The option returns after insider trades are also found to be cross-sectionally correlated with firm size and R&D expenditure.

The remainder of the paper is organized as follows: The next section details our conclusion and interpretation of Marin and Olivier (2008), Section 3 discusses our data and methodology, Section 4 reports the main option return results around earnings announcements, we discuss the sources of returns in Section 5, Section 6 shows our cross-sectional analysis, Section 7 briefly discusses the Sarbanes-Oxley Act, Section 8 includes a series of robustness checks, and in Section 9 concludes our study.

2. Hypothesis Motivated by Marin and Olivier (2008)

This section details our conclusion and interpretation of Marin and Olivier (2008), with a particular focus on the change in market uncertainty after insider sales. We further propose a testable hypothesis of option returns motivated by this change in volatility.

Marin and Olivier (2008) propose a model that theoretically captures the relationship of insider trading and stock price. In general, insiders purchase their firms' stocks when they receive good signals and sell the stocks when the signals are bad. Uninformed traders try to infer the stocks' fundamental values from insiders' trading schemes. One of the key assumptions of the model is the existence of *trading constraints*: that the portfolio holding of each investor cannot go below a given floor. When the signal is good, insiders purchase their firms' stocks without restrictions until they reach their optimal portfolio holdings, and the uninformed traders in the market can perfectly infer the fundamentals of the stocks through observing a series of the trades of the insiders. Conversely, when insiders receive a sufficiently bad signal, even though their "theoretical" optimal holding (which can be different from the holding floor set by the constraint) can fall below the holding floor, with the constraint, insiders are forced to stop selling the stocks when they hit the holding floor. As uninformed traders do not know the signals, they cannot know whether insiders cease trading because the current holding is insiders' optimal portfolio holding, or because insiders have reached the constraint. In other words, even if the uninformed traders are aware that insiders are in possession of bad news, they do not know how bad the news really is. Under this condition, the insiders' trading scheme cannot fully reflect the true fundamentals of the stock, and this raises market uncertainty.

There are cases when the signal is not bad enough and insiders' optimal holding is still above the constraint. In those cases, market uncertainty does not rise after insider sales.

Nonetheless, if we pool all insider sales without distinguishing the severity of bad signals, then *on average*, we should observe a rise in market uncertainty after insider sales.

As option value depends on stock volatility, we hypothesize that this increase in market uncertainty after insider sales can lead to abnormal option returns when option market participants fail to incorporate the increase in uncertainty in the option premium. We test whether this is the case in the following sections.

3. Data and Methodology

In this section, we discuss the data sets and the methodology used to construct option returns.

3.1. Data

The three primary datasets applied in this paper are the Thomson Reuters Insider Filings Data Feed (TRIFDF), the U.S. stock data from the Center for Research in Security Prices (CRSP) and the U.S. option data from OptionMetrics Ivy DB.

The TRIFDF database includes all insider trades reported to the SEC, including transaction dates, types of transactions (open market purchase or sale), transaction price, number of shares traded, relationship code (e.g. CEO, CFO, etc.), etc. Following Marin and Olivier (2008), among all common stocks (with CRSP share code equal 10 and 11), we include only open market purchases (transaction code P) and open market sales (transaction code S). We also exclude small transactions where less than 100 shares were traded. We also eliminate transactions whose reported transaction price is not within 20% of the CRSP closing price on the day or that involve more than 20% of the number of shares outstanding. To minimize the effect of penny stocks and measurement errors, we require stocks to have a price larger than $2 at the beginning of the calendar year. Table I provides summary statistics on aggregate insider trading activity in our sample. On average insider purchase is less frequent than insider sale and to a smaller value.

OptionMetrics LLC. data on the U.S. stock market consist of all common stocks traded on the NYSE, AMEX, and Nasdaq and include information on the strike prices, types of options, expiration dates, open interest, option trading volume and option prices. We apply a series of data filters to select the nearest the money calls and puts listed under each stock. We use only nearest-the-money option because they are the most liquid, and the same practice is wildly applied in the option literature. Further, we eliminate observations with a bid price smaller than 50 cents, or with an ask price lower than the bid price. We also remove all observations of zero option open interest. To be included in the sample, we only consider options expiring in the following month with non-missing delta. Moreover, we restrict options to have moneyness between 0.95 to 1.05 strike-to-stock-price ratios. Among the remaining options, for each stock, we select one call and one put that are nearest the money. That is, for each stock, we now have one call option and one put option, with both of them being nearest the money and expiring in the next month.

The CRSP data set provides daily closing prices, returns, and trading volume of common stocks. We use these data to extract the pattern of price movements in the stock market, such as returns and volatility.

Our sample period is from January 1996 to October 2010, as year 1996 is when OptionMetrics initiated. Both OptionMetrics and CRSP data are recorded on a daily basis.

In addition, we use Compustat database for information of earnings announcement dates and accounting variables in the cross-sectional analysis.

3.2 Option Returns

We first define the "*insider trading window*" and the "*option trading window*." Following Goyal and Saretto (2009) and applying the option expiration date as the cutoff point, we define an "*insider trading window*" from the first trading day following the option expiration date of month t to the expiration date of the next month *t+1*. In the insider trading window, we examine whether there is insider trading. In general, two different types of insider transactions are considered: purchases by the top 12 insiders[6](*PUR12*) and sales by the top 12 insiders (*SAL12*).[7] We particularly focus on the top 12 insiders because it is generally believed that abnormal profits of insider trading are due to high-ranked insiders' possession of advanced information, and it is quite doubtful that all of the insiders have private information of upcoming events. Thus, it is more convincing to assume that only insiders in the top positions have advanced information. An "*option trading window*" starts from the first trading day after the option expiration date of month *t+1* (which immediately follows the end of insider trading window) and ends in the following expiration dates of month *t+2*, during which we form option positions by buying and holding calls and puts throughout the option trading window, and we calculate the holding-period return.

We consider two types of option positions: If we observe insider purchases, we buy a call option at the start of the option trading window and hold it until the following expiration date (the end of the option trading window). Similarly, when we observe insider sales, we buy and hold a put option instead. There are chances that there exist both insider sales and purchases in the same month. In this case, we buy both calls and puts and track the returns of these two portfolios, respectively. We further discuss purchases by the top 12 insiders without observing insider sales (*PUR12NoSAL*) and sales by the top 12 insiders without observing insider purchase (*SAL12NoPUR*) in the Robustness Checks section. Due to the restrictions we place on our sample, there can be no available observations on the first trading day after the monthly expiration date. In such a case we use options in the following day (e.g. the second

---

6 The top 12 insiders are Chief Executive Officer ("CEO"), Chief Financial Officer ("CFO") Chief Operating Officer ("CO"), President ("P"), Chairman of the Board ("CB"), Chief Investment Officer ("CI"), Chief Technology Officer ("CT"), Executive Vice President ("EVP"), Secretary ("S"), Senior Vice President ("SVP"), Vice President ("VP"), Assistant Vice President ("AV").

7 We further discuss purchases by the top 12 insiders without observing insider sales (*PUR12NoSAL*) and sales by the top 12 insiders without observing insider purchase (*SAL12NoPUR*) in the Robustness Checks Section.

trading day).

By construction, both calls and puts are closest to ATM and mature in the next month, and we calculate the option holding period returns by assuming we exercise the option at the end of the option trading window. Therefore, the option return is

$$Ret_{t+1} = \begin{Bmatrix} \frac{\max(S_{t+1}-K,0)-C_t}{C_t} \text{if a Call} \\ \frac{\max(K-S_{t+1},0)-P_t}{P_t} \text{ if a Put} \end{Bmatrix}, \quad (1)$$

where S_{t+1} is the underlying stock price at the end of the option trading window; K is the option strike price; C_t and P_t are option premium of call and put when at which we buy the options. Option premium is calculated using the midpoint of the bid and ask price. As the duration between two consecutive option expiration dates is different from month to month, we convert option returns into monthly basis. We first convert them into daily returns by dividing them by the number of the trading days in between two expiration dates. Then we multiply the daily returns by 21, which is the average number of trading days in a calendar month. Panel B and C in Table I present the summary statistics of call and put returns at an aggregate level.

4. Option Returns: Insider Trading versus Earnings Announcements

To answer whether option investors can earn non-zero returns based on the information of insider trading, we compare monthly returns between options listed under stocks with and without insider trading. We do so by using the following specification on panel data:

$$Ret_{i,t+1} = const + \beta INS_{i,t} + \varepsilon_{i,t+1}, \quad (2)$$

where $Ret_{i,t+1}$ is monthly option returns between two consecutive expiration dates; $INS_{i,t}$ is an indicator function, which equals one if there are insider purchases (sales) and zero otherwise. We consider two different types of insider trading: insider purchases (*PUR12*) and insider sales (*SAL12*); *const* captures the average option returns without insider purchases (sales); β is the coefficient of interest, which measures the return premium investors earn by holding options listed under an insider-traded stock. Throughout the paper, we use double-clustered standard errors, as in Petersen (2009), to adjust for correlation within firms and time.

We only use sample periods around the quarterly earnings announcements. As earnings announcements (and other informational events) usually carry information contents as discussed in Beaver (1968), if we compare insider-traded against non-insider-traded stock options using the entire sample, the effect we document may be generated by earnings announcements rather than insider trading. Concentrating on earnings announcement periods, we further control the impact of earnings announcements and thus can be more confident in concluding that the empirical evidence we report is fully generated by insider trading.

4.1 Call Option Returns & Insider Purchases

In Table II, call options in general earn a significant return of over 13% per month (captured by "*const*"), regardless the underlying stock is purchased by insiders. That is, even without insider purchase in the insider trading window, investors can earn a monthly return of 13% by holding a call option throughout the option trading window.

What is more striking is that call options listed under top 12 insider-purchased stocks (*PUR12*) earn a considerable return premium (β). The magnitude is as substantial as 16.5%. This adds up to a 30% monthly return (*const* plus β) per month. The return premium is statistically significant to a 1% level with a *t*-statistic of 4.85.

4.2 Put Option Returns & Insider Sales

Put options under stocks without insider sales earn an insignificant return (as in Table II). Notice that even though the magnitude is as large as -10% per month, the put option returns appear to be fairly volatile, leading to a small t-statistic. On the contrary, put options listed under insider-sold stocks earn a statistically significant monthly return premium of 8%.

As insider sales are much more common than insider purchase because of the heavy use of stock options in our sample period, to further sort out information-driven insider sales, we consider option returns after "*abnormal*" insider sales (*ASAL1*), which is defined as sales greater than the last 60 month average amount. As reported in Table II, the return premium increases to 10% per month.

In sum, the empirical evidence shows a significant return premium in both call and put options listed under insider-traded stocks. In other words, insider trading is predictive of future option return: investors can earn a positive return by buying a call when observing insider purchases and a put when observing insider sales.

4.3. Risk-Adjusted Option Returns

This section provides the first piece of evidence of whether the significant option return premium after insider trading is a form of compensation for systematic risk. Since options are "derived" securities, we assume that option returns depend on the same sources of risk factors used to explain stock returns. In addition, we define a volatility factor using option straddle which is exclusively associated with options. In details, following Goyal and Saretto (2009), we apply a similar linear factor-model by regressing the option returns on various factors, consisting of the Fama and French (1993) three factors (*MKTRF, SMB*, *HML*), the Carhart (1997) momentum factor (*MOM*), and an aggregate volatility factor (*STRAD*). The aggregate volatility factor, the excess return of a zero-beta S&P 500 index ATM straddle, is constructed as in Coval and Shumway (2001).

We apply the panel data regression of the following specification with panel data:

$$\begin{aligned} Ret_{i,t+1} = {} & \alpha + \alpha_{INS}INS_{i,t} + \beta MKTRF_t + sSMB_t + hHML_t + mMOM_t + vSTRAD_t + \\ & + \beta_{INS}MKTRF_t*INS_{i,t} + s_{INS}SMB_t*INS_{i,t} + h_{INS}HML_t*INS_{i,t} + \\ & + m_{INS}MOM_t*INS_{i,t} + v_{INS}STRAD_t*INS_{i,t} + \varepsilon_{i,t+1}, \end{aligned} \tag{3}$$

where $Ret_{i,t+1}$ is the return of option i; $INS_{i,t}$ is an indicator function which equals one if there is insider purchases (sales) and zero otherwise. $INS_{i,t}$ is further categorized into four difference types of insider trading: Top 12 insider purchases (*PUR12*), Top 12 insider sales (*SAL12*), and abnormal sales (*ASAL1*); β, s, h, m, and v are risk factor loadings of all options; β_{INS}, s_{INS}, h_{INS}, m_{INS}, and v_{INS} capture the difference in factor loadings between options with and without insider trading; α is the abnormal return earned by all options, and α_{INS} captures the abnormal return premium earned additionally by options whose underlying stocks are traded by insiders (either purchases or sales). Estimated factor loadings and alphas are reported in Table III.

After controlling for systematic and volatility risk, call options under insider-purchased stocks continue to earn a 12% abnormal return premium. An abnormal return premium is also found in put options, particularly after abnormal insider sales (*ASAL1*). More interestingly, both types of options load significantly positive on the volatility factor (*STRAD*). This is consistent with the option pricing theory as the greater the volatility, the greater the chance for an option to end up being more ITM. As calls and puts function in opposite direction, their loadings on all factors (β, s, h, and m) other than volatility (v) have an opposite sign.

4.4. Controlling for Transaction Cost

In this section, we test the robustness of our result by further controlling for the transaction cost, such as option bid-ask spread.

Options have a considerably wide bid-ask spread, and this spread enlarges as options move toward maturity (Chiang (2010)). Considering the impact of option bid-ask spread, we assume that investors buy an option contract at its "offer" price instead of midpoint. Table IV shows that investors continue to earn a significant insider premium on options even after controlling for transaction cost. The premium of calls slightly shrinks to 14.3% but remains significantly positive. Put options earn a slightly higher premium of 8.1% for *SAL12*, 10.2% for *ASAL1*.

5. Sources of Option Returns

Given the significant return premium, the next question is the source of the abnormal returns.

The option pricing theory states that option value is jointly determined by stock price and volatility. If there is a non-trivial relation between insider trading and stock returns or stock volatility, similar link should exist in the option market. Ample literature has documented stock returns after insider trading, and they conclude that stocks purchased by insiders earn positive abnormal returns, but stocks sold by insiders do not exhibit negative abnormal returns (Lakonishok and Lee (2001), Jeng, Metrick, and Zeckhauser (2003), Friederich, Gregory, Matatko, and Tonks (2002), and Fidrmuc, Goergen, and Renneboog (2006)). Moreover, large price movements in the month following insider trading are only observed in stocks purchased by insiders (Marin and Olivier (2008)). As for volatility, Marin and Olivier (2008) theoretically shows that market uncertainty (which can be measured by volatility) raises after insider sales.

Table V provides a better grasp of the stock market after insider trades by reporting stock returns and change in volatility between the two sets of stocks (the one with insider purchase (sale) and the other without it) after insider purchases and sales from 1996 to 2010. The difference in returns and change in volatility is captured by the coefficient of $INS_{i,t}$, an indicator function which equals one if there are insider purchases (sales) and zero otherwise.

It has been documented that U.S. stocks, in general, earn higher returns in months when earnings are announced. For instance, Frazzini and Lamont (2007) estimated the magnitude of this earnings announcements premium to be over 7% percent per year. Others also found a similar premium (Savor and Wilson (2011), Chari, Jagannathan, and Ofer (1988), Ball and Kothari (1991), Cohen, Dey, Lys, and Sunder (2007), and Berkman and Truong (2009)). The earnings announcements premium is reflected in Panel A as a significantly positive return of 1% per month. When we compare returns of the two sets of stocks (captured by *INS*), stocks bought by insiders experience a significant price increase in the following month. Specifically, stocks bought by the top 12 insiders earn a 2.2% return premium than those without insider purchases. On the sale side, price of stocks which insiders sell declines, resulting in a lower return than those without insider sales. However insider-purchased stocks, this spread in return is of a considerably smaller magnitude and is not significant. This asymmetry is consistent with a series of studies which concludes that stocks purchased by insiders earn positive abnormal returns but stocks sold by insiders do not exhibit negative abnormal returns.[8] Marin and Olivier (2008) also show that a large price movement in the month immediately after insider trading only takes place on the purchase side.

Stock volatility, on the other hand, works in a different fashion. Panel B reports the log difference in standard deviation of stock returns before and after insider trading. The constant (*const*) measures the overall volatility level for all stocks, while the coefficient of *INS* captures the difference in volatility change between stocks with and without insider trading. The asymmetry also exists in volatility: While insider-purchased stocks experience considerably lower volatility (10.6% lower for *PUR12*), insider-sold stocks show a higher volatility scheme, with a 3.2% higher volatility level than non-insider-sold stocks. This suggests that as insider purchase resolves market uncertainty (when compared to non-insider-traded stocks), insider sales on the contrary exacerbate uncertainty. This volatility asymmetry partially contributes to Marin and Olivier (2008)'s theoretical model that market uncertainty rises when insiders' portfolio holding constraint is binding, and this can happen only in the case of insider sales.

Notice that the above statement is true only if option market participants underestimate

[8] Lakonishok and Lee (2001) study abnormal returns of portfolios based on the intensity of insider purchases and sales. They find significantly positive excess returns of 4.82%for portfolios of stocks with a strong purchase signal, while Excess return of strong sell signal portfolios is insignificant. Jeng, Metrick, and Zeckhauser (2003) show that purchase portfolios (including stocks insiders purchase) earn positive abnormal returns but no significant negative returns for sale portfolio. Friederich, Gregory, Matatko, and Tonks (2002) and Fidrmuc, Goergen, and Renneboog (2006) use UK data and suggest that significantly smaller absolute price reaction to insider sales than to insider purchases.

the volatility in the upcoming periods after insider sales. Specifically speaking, if investors fully anticipate an increase in volatility after insider sales, such expectation is reflected on the parallel increase in option premium and as a result eats the returns. Therefore, the significant option returns indicate option market investors fail to anticipate this increase in volatility after insider sales. To further provide the empirical evidence, we present the difference between implied volatility and realized historical volatility in Panel C of Table V, where HV is the standard deviation of the raw return in the option trading window, and IV is the implied volatility on the first day of the option trading window. All volatility measures are expressed in logarithm. We can see that investors significantly underestimate the volatility of stocks sold by insiders. The *HV-IV* difference is 3.2% for *SAL12*, 4.2% for *ASAL1*. Similar underestimation does not exist in insider-purchased stocks (*PUR12*).

The movement of stock price and volatility together serves as the source of option return premium. In general, fluctuation in stock price has an opposite effect on calls and puts, while volatility moves both call and put returns in the same direction. In more details, since the call (and put) option is, by construction, ATM in the beginning of the option trading window when we create the position, it becomes ITM if stock price increases (decreases) due to insider purchases (sales). With an ITM option, we exercise it and earn a positive return. As for the mechanism of volatility, with higher stock volatility, it is more likely for stock price to fluctuate more dramatically and make the call (put) options ITM.

Putting these two mechanisms together, the overall positive return of all call options and a slightly negative return of puts captured by regression constants in Section 4 can be partly attributed to the earnings announcements premium[9] and partly to a relatively higher level of volatility (the *const* in Table V). The on average higher stock price around earnings

[9] It has been documented that U.S. stocks earn higher returns during months when earnings are announced than during non-announcement months. Frazzini and Lamont (2007) estimated the magnitude of this earnings announcement premium to be over 7% percent per year. Others also found a similar premium (Savor and Wilson (2011), Chari, Jagannathan, and Ofer (1988), Ball and Kothari (1991), Cohen, Dey, Lys, and Sunder (2007), and Berkman and Truong (2009)).

announcements results in a positive return in calls and a negative return in puts. On the other hand, a relative higher volatility contributes to higher returns in both calls and puts. Summing the two effects, call options in general earn positive returns, while returns of put options can vary. In our sample, there is a slightly negative but insignificant return of puts without insider sales.

Stock price and volatility further explains the return premium earned by options listed under insider-traded stocks. For calls, the significant insider premium should be generated by the further stock price increase. As documented in Table V, insider-traded stocks have higher returns than those without insider trading. Moreover, the fact that large price jump is most likely to take place a month after insider purchases (Marin and Olivier (2008)) also together contributes to the return premium in call options. Unlike the calls, with a relatively stable stock price after insider sales, the positive return of put options should be generated by the large rise in volatility. The rationale is that with a significantly higher volatility, there is a higher probability that stock price moves out of bounds and the put option becomes more deeply in the money.[10] Thus, even though "on average" stock returns are close to zero (since we have an insignificant stock return), put options can still earn a positive average returns due to this larger price bounce. As large price dip does not take place until several months after insider sales (Marin and Olivier (2008)), there exist no dramatic stock price movement that can lead to a significant put option premium.

In sum, the results of option returns after insider trading are in line with the stock market price and volatility movements: Because of the run-ups in the underlying stock price, call options earn a significant return premium after insider purchases; Put option premium, on the other hand, is generated by the further increase in stock volatility after insider sales.

[10] Even though it is also more likely that the put will be more out of the money, however, payoff of an out-of-the-money put is zero, regarding the degree of out of moneyness is. However, payoff increases along with the degree of option in-the-moneyness.

6. Cross-Sectional Analysis

We now investigate how option returns relate to the characteristics of the underlying stocks. We first sort stocks into three (two for R&D variable) groups based on a series of characteristic variables. We then apply equal (2) on each group, respectively. The regression coefficients capture the average option return and premium in each particular group. Stock characteristics explored are lagged returns, firm size, R&D expenses, and book-to-market ratio. Regression results of insider premium are shown in Table VI, and we only report the return in the two most extreme groups (group 1 and 3).

6.1 Lagged Returns

A well-documented phenomenon is that insiders tend to purchase when stock price falls and sell when price experiences a series of run-ups.[11] Such a trading scheme suggests that lagged stock return is one of the factors which induces insider trading and night further relate to future returns of stocks and options. In this subsection, we explore insider premium of calls and puts when underlying stocks are sorted based on past six-month lagged returns.

In Panel A, call options earn a higher and more significant premium when past stock returns is high (For *PUR12*, return is 23.6% in the high group compared to 14.3% in the low group). We attribute this higher return to the momentum effect. Based on the price momentum,[12] stock with high past returns continue to outperform those with poor past performance, and the continuingly rising stock price leads to a higher call option premium, as observed in the data.

Put options, on the contrary, shows an opposite pattern: when past return of the underlying stock is low, put options have a higher insider premium. The effect is particularly

[11] Seyhun (1998) studies the stock returns in excess of market and concludes that stock prices fall before insider purchases and rise after insider purchases. For sales, the pattern is reversed. Stock prices rise before insider sales and fall following sales. Jeng, Metrick, and Zeckhauser (2003) also show that, on average, insider sale is preceded by a positive CAR while purchases are preceded by a negative CAR.

[12] See Jegadeesh and Titman (1993).

significant for *ASAL1*: When past return is low, put options earn a return premium of 13.8% compared to 6% when past stock return is high. As volatility is the key engine to drive put option return premium, and previous studies document that volatility tends to increase during economic downturn, distressed stocks with low past returns should have relatively greater volatility and hence leads to higher put option return premium.

6.2 Firm Size and R&D

Since insiders profit from their advanced information, the degree of information asymmetry should be a key factor affecting insiders' payoffs. Previous studies have shown a cross-sectional correlation between firms' information asymmetry and insider's abnormal returns. For instance, Kyle (1985) finds a positive relation between insiders' profits and insiders' informational advantage. Aboody and Lev (2000) show insider trading profit is positively associated with the firms' R&D expenditure. Lakonishok and Lee(2001) and Seyhun (1998) show that insider purchases in smaller firms predict future returns but not larger firms.

Following Aboody and Lev (2000), Lakonishok and Lee (2001), and Seyhun (1998), we use firm size and R&D as two proxies for information asymmetry. In Panel B of Table VI, call (and put) option earn a similar premium in both small and large firms when the sample is restricted to the top 12 insiders, indicating that top insiders across all sizes of firms possess similar degree of information advantages over outsiders.

We probe deeper into the relation between information asymmetry and insider option premium by relaxing the top 12 insider restriction and including all insiders other than the beneficial owners. The untabulated test shows that, consistent with the information asymmetry theory, option premium in small firms is much larger, particularly in call options (Call return premium of small firms is 30% compared to 4% in large firms; Put return premium is 12% of small firms and 8% of large firms).

Results based on R&D also support the information asymmetry theory. Reported in Panel C, firms with R&D earn a 15% higher return in calls and a 3% higher returns in puts than those without R&D, and it is true even when we confine the sample to the top 12 insiders. This could potentially indicate that R&D is a stronger proxy for information asymmetry.

6.3 Book-to-Market Ratio

Panel D sorts stocks based on their book-to-market ratio (BM), and both call and put consistently earn a higher premium in the low book-to-market group. This empirical finding can be explained with previous studies which find that insiders earn significantly higher abnormal returns in low book-to-market stocks (Jeng, Metrick, and Zeckhauser (2003)). As low BM stocks experience an increase (decrease) in price after insider purchases (sales), such a price movement leads to the relatively higher option return.

The book-to-market result we show here can be further linked to the R&D factor. The low-BM firms are, for most of the time, those with the highest growth opportunities (e.g. technology firms) and thus a higher level of R&D. This type of firms accordingly undergoes a greater information asymmetry and thus experience higher option premium similar as Subsection 6.2.

7. Robustness Checks

In this section, we check the robustness of our results by using alternative samples.

7.1. Insider Purchases (Sales) Without Sales (Purchases)

In this section, we further consider option returns after observing another two types of insider trades: purchases by top 12 insiders without observing sales (*PUR12NoSAL*) and sales by top 12 insiders without observing purchases (*SAL12NoPUR*).

The results in Table VII show that call and put options continue to earn significant return premium, and the effect is slightly stronger than *PUR12* and *SAL12*. This return premium remains significantly positive after controlling for risk and transaction cost.

8. Impact of The Sarbanes-Oxley Act

In this section we consider the potential impact of the Sarbanes-Oxley Act (SOX), enacted in 2002. Before SOX, insiders are required to report their trades by the 10th day of the month that follows the trading month. Reporting requirements have tightened after SOX as it requires reporting to the SEC within two business days following the insider's transaction dates. The passage of the act potentially raises the litigation risk faced by insiders. Moreover, studies show that financial reports become more transparent after the SOX, which gives insiders less information advantage.[13] All in all, the passage of the SOX can reshape insiders' trading behavior and reduce the price impact of insider trading.

In Table VIII, we report the option returns in the post-SOX period (August, 2002 to October, 2010). The magnitude of call option premium (*SAL12*) shrinks and become insignificant. Only call options under stocks experiencing insider purchases *without* sales earn a significant return premium but with diminishing statistical significance. The put option premium after insiders sell remains significant and is of a similar magnitude. One potential explanation is that the SOX only attenuates the increase (decrease) in stock price (as call option premium is mostly derived from the increase in stock price, and it is also the gain insiders attain by trading stocks.) but did not change the volatility of stock. In other words, while it is harder for *stock* market participants to make money by trading stocks based on insider information, volatility betters can still earn a premium.

[13] Other papers note that the passage of the act, which substantially increased the penalties for earnings manipulation, materially reduced the incidence of accounting-based earnings management (Cohen, Dey, and Lys (2008), Graham, Harvey, and Rajgopal (2005), and Hutton, Marcus, and Tehranian (2009)).

9. Conclusion

In this paper, we show that the underlying stock market and the option market are aligned and the price impact of insider trading in the equity market disseminates to the option market. Option investors do not seem to interpret insider trading information better than stock market participants do, and the option price does not adjust itself to the fundamental level, leading to the abnormal return premium. Investors who take advantage of insider trading information can earn a return premium by holding option contracts. The return premium remains significant after controlling for systematic risk, volatility risk, and transaction cost. The sources of option return premiums differ: call option premiums are generated by a subsequent price run-up after insider purchase, and put option premiums are due to an increase in volatility when insiders sell the underlying stock.

References

Aboody, David, and Baruch Lev, 2000, Information asymmetry, rd, and insider gains, *The Journal of Finance* 55, 2747 – 2766.

Baesel, Jerome B., and Garry R. Stein, 1979, The value of information: Inferences from the profitability of insider trading, *The Journal of Financial and Quantitative Analysis* 14, 535 – 571.

Ball, Ray, and S. P. Kothari, 1991, Security returns around earnings announcements, *The Accounting Review* 66, 718 – 738.

Beaver, William H., 1968, The Information Content of Annual Earnings Announcements, *Journal of Accounting Research*, Vol. 6, 67-92

Berkman, Henk, and Cameron Truong, 2009, Event day 0? after-hours earnings announcements, *Journal of Accounting Research* 47, 71 – 103.

Cao, Henry H., and Ou-Yang, Hui, 2009, Differences of Opinion of Public Information and Speculative Trading in Stocks and Options, *Review of Financial Studies* 22, 299-335

Carhart, Mark M., 1997, On persistence in mutual fund performance, *The Journal of Finance* 52, 57 – 82.

Chari, V. V., Ravi Jagannathan, and Aharon R. Ofer, 1988, Seasonalities in security returns: The case of earnings announcements, *Journal of Financial Economics* 21, 101 – 121.

Chiang, Chin-Han, 2010, Stock returns on option expiration dates: Price impact of liquidity trading, Working Paper

Cohen, D., A. Dey, and T. Lys, 2008, Real and accrual-based earnings management in the pre- and post-Sarbanes Oxley periods, *The Accounting Review* 83, 757 – 787.

——, and S. Sunder, 2007, Earnings announcement premia and the limits to arbitrage, *Journal of Accounting and Economics* 43, 153 – 180.

Coval, Joshua D., and Tyler Shumway, 2001, Expected option returns, *The Journal of Finance* 56, 983 – 1009.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3 – 56.

Fidrmuc, Jana P., Marc Goergen, and L. U. C. Renneboog, 2006, Insider trading, news releases, and ownership concentration, *The Journal of Finance* 61, 2931 – 2973.

Finnerty, Joseph E., 1976, Insiders and market efficiency, *The Journal of Finance* 31, 141 – 1148

Frazzini, Andrea, and Owen Lamont, 2007, The earnings announcement premium and trading volume, *NBER Working Paper*.

Friederich, Sylvain, Alan Gregory, John Matatko, and Ian Tonks, 2002, Short-run returns around the trades of corporate insiders on the London stock exchange, *European Financial Management* 8, 7 – 30.

Goyal, Amit, and Alessio Saretto, 2009, Cross-section of option returns and volatility, *Journal of Financial Economics* 94, 310 – 326

Graham, J., Campbell R. Harvey, and S. Rajgopal, 2005, The economic implications of corporate financial reporting, *Journal of Accounting and Economics* 40, 3 – 73.

Hutton, Amy P., Alan J. Marcus, and Hassan Tehranian, 2009, Opaque financial reports, r2, and crash risk, *Journal of Financial Economics* 94, 67 – 86.

Jaffe, Jeffrey F., 1974, Special information and insider trading, *The Journal of Business* 47, 410 – 428.

Jegadeesh, Narasimhan, Sheridan Titman, 1993, Returns to buying winners and selling lowers: Implications for stock market efficiency, *Journal of Finance* 48, 65-91

Jeng, Leslie A., Andrew Metrick, and Richard J. Zeckhauser, 2003, Estimating the returns to insider trading: A performance-evaluation perspective, *The Review of Economics and Statistics*.

Kyle, Albert S., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315 – 1335

Lakonishok, J, and I Lee, 2001, Are insider trades informative? *Review of Financial Studies* 14, 79 – 11.

Lin, Ji-Chai, and John S. Howe, 1990, Insider trading in the OTC market, *The Journal of Finance* 45, 1273 – 1284.

Marin, Jose M., and Jacques P. Olivier, 2008, The dog that did not bark: Insider trading and crashes, *The Journal of Finance* 63, 2429 – 2476.

Petersen, Mitchell A., 2009, Estimating standard errors in finance panel data sets: Comparing approaches, *Review of Financial Studies* 22, 435 – 480.

Rozeff, Michael S., and Mir A. Zaman, 1988, Market efficiency and insider trading: New evidence, *The Journal of Business* 61, 25 – 44.

Savor, P., and M. Wilson, 2011, Earnings announcements and systematic risk, *Working Paper*.

Seyhun, H. Nejat, 1988, Insiders' profits, costs of trading, and market efficiency, *Journal of Financial Economics* 16, 189 – 212.

——, 1992(a), Why does aggregate insider trading predict future stock returns, *Quarterly Journal of Economics* 107, 1303 – 1331.

——, 1998, Investment intelligence: From insider trading, MIT Press, Cambridge, Mass.

Table I: Summary Statistics

This table reports some summary statistics on aggregate insider trading activity and option returns. Fraction shows the average fraction of firms with at least one insider trade per year; No. of Trades is the average number of sales or purchases per year and firm; Daily Average Amount is the average of the daily dollar value of insider trades. The sample consists of insiders open market trades from 1996 to 2010 in common stock traded in NYSE, Amex, and NASDAQ. Panel B and C report summary statistics of monthly option returns over a sample of 1996 to 2010. The top 12 insiders are Chief Executive Officer ("CEO"), Chief Financial Officer ("CFO") Chief Operating Officer ("CO"), President ("P"), Chairman of the Board ("CB"), Chief Investment Officer ("CI"), Chief Technology Officer ("CT"), Executive Vice President ("EVP"), Secretary ("S"), Senior Vice President ("SVP"), Vice President ("VP"), Assistant Vice President ("AV").

Panel A: Insider Trades					
	Top 12 insiders	Other insider	Beneficial owner		
Purchase					
Fraction	0.178	0.281	0.031		
No of trades	0.465	0.754	0.301		
Daily average amount (Milliion $)	0.408	0.616	4.499		
Daily median amount (Milliion $)	0.053	0.052	0.483		
Sales					
Fraction	0.478	0.48	0.057		
No of trades	4.077	3.531	0.438		
Daily average amount (Milliion $)	1.748	2.193	16.601		
Daily median amount (Milliion $)	0.373	0.282	0.827		
Panel B: Call Option Returns					
	Mean	Std Dev	Median	Skewness	Kurtosis
Entire Sample	0.06	1.61	-0.72	2.63	16.31
Months with EA	0.14	1.71	-0.75	2.38	10.18
Months without EA	0.03	1.56	-0.70	2.77	20.59
Panel C: Put Option Returns					
	Mean	Std Dev	Median	Skewness	Kurtosis
Entire Sample	-0.12	1.57	-0.88	3.44	44.65
Months with EA	-0.08	1.53	-0.88	2.44	9.86
Months without EA	-0.13	1.59	-0.88	3.90	59.89

Table II: Option Returns After Insider Trading With Earnings Announcements

This table reports the option returns after insider trading when earnings announcements are in the option trading window. We define an "insider trading window" from the first trading day following the option expiration date in month t to the expiration date in the next month *t+1*. In the insider trading window, we identify whether we observe insider trading. We consider two different types of insider trading: purchases by the top 12 insiders (*PUR12*) and sales by the top 12 insiders (*SAL12*). The "option trading window" starts from the expiration date in month *t+1* and ends in the following expiration dates of month *t+2*, during which we form option positions by buying-and-holding options. Monthly option returns after insider trading are measured by using a pooled panel regression:

$$Ret_{i,t+1} = const + \beta INS_{i,\, t} + \varepsilon_{i,\, t+1},$$

Where $Ret_{\ i,t+1}$ is monthly option returns in measured in the option trading window; $INS_{i,t}$ is an insider trading indicator function, which equals one if there are insider purchases (sales) and zero otherwise; *const* captures the overall mean option returns without insider purchases (sales); β is the coefficient of interest, which measures the return premium investors earn by holding options listed under an insider-traded stock. Standard errors are double-clustered. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Call Return	Put Return	
	PUR12	SAL12	ASAL1
INS	0.165***	0.077***	0.100***
	(4.85)	(3.63)	(3.01)
const	0.131***	-0.099	-0.095
	(3.18)	(-1.81)	(-1.72)

Table III: Risk-Adjusted Option Returns After Insider Trading

This table presents risk-adjusted option returns when earnings announcements are in the option trading window from the following panel regression:

$$Ret_{i,t+1} = \alpha + \alpha_{INS} INS_{i,t} + \beta MKTRF_t + sSMB_t + hHML_t + mMOM_t + vSTRAD_t + \\ + \beta_{INS} MKTRF_t * INS_{i,t} + s_{INS} SMB_t * INS_{i,t} + h_{INS} HML_t * INS_{i,t} + \\ + m_{INS} MOM_t * INS_{i,t} + v_{INS} STRAD_t * INS_{i,t} + \varepsilon_{i,t+1}$$

where $Ret_{i;t+1}$ and $INS_{i;t}$ are as defined in Table (III) *MKTRF, SMB*, *HML* are the Fama and French (1993) three factors; *MOM* is the Cahart (1997) momentum factor, *STRAD* is the Coval and Shumway (2001) S&P500 zero-beta straddle. Standard errors are double-clustered. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Call Return	Put Return	
	PUR12	SAL12	ASAL1
α	0.116***	-0.047	-0.044
	(3.49)	(-1.50)	(-1.41)
α_{INS}	0.113***	0.053***	0.081***
	(4.15)	(3.34)	(3.49)
β	10.035***	-9.915***	-9.911***
	(9.74)	(-9.43)	(-9.57)
s	2.035	-2.253	-2.205
	(1.87)	(-1.81)	(-1.80)
h	1.057	-2.253	-2.114
	(1.05)	(-1.89)	(-1.79)
m	1.770***	-1.442	-1.450
	(2.62)	(-1.70)	(-1.74)
v	0.166***	0.218***	0.215***
	(4.68)	(4.88)	(4.74)
β_{INS}	-1.224	-0.769	-1.647**
	(-1.33)	(-1.60)	(-2.51)
s_{INS}	-1.856**	0.558	0.555
	(-2.47)	(0.95)	(0.75)
h_{INS}	1.006	0.855	-0.176
	(0.76)	(1.81)	(-0.24)
m_{INS}	-2.965***	-0.557	-0.771
	(-3.75)	(-1.26)	(-1.27)
v_{INS}	-0.003	-0.018	-0.007
	(-0.06)	(-0.66)	(-0.20)
Adj. R_2	0.09	0.15	0.15

Table IV: Option Returns After Controlling for Transaction Costs

This table reports option returns when option returns are calculated using the option offer price. We apply the same panel regression as in Table (II), with the same assumption on the standard errors. Earnings announcements are in the option trading window. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Call Return	Put Return	
	PUR12	SAL12	ASAL1
INS	0.143***	0.081***	0.102***
	(4.51)	(3.90)	(3.08)
const	0.049	-0.167***	-0.162***
	(1.30)	(-3.33)	(-3.20)

Table V: Stock Returns and Volatility After Insider Trading

This table reports the stock market returns and change in volatility after insider trading. We first define an insider trading window from the first trading day following the option expiration date in month t to the expiration date in the next month *t+1*. In the insider trading window, we identify whether there is insider trading. We consider two different types of insider trading: purchases by the top 12 insiders (*PUR12*) and sales by the top 12 insiders (*SAL12*). The "return measuring window" starts from the expiration date in month *t+1* and ends in the following expiration dates of month *t+2*, during which we form option positions by buying-and-holding options. Panel A reports monthly stock returns when earnings announcements are in the return measuring window, measured in the return measuring window; Panel B reports log difference between standard deviation of stock returns *i* the return measuring window and the standard deviation of stock returns in the insider trading window, when earnings announcements are in the return measuring window. A pooled panel regression is applied and standard errors are double-clustered. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Panel A: Returns with EAs		
	PUR12	SAL12	ASAL1
INS	0.022***	-0.005	-0.007
	(3.27)	(-1.80)	(-1.59)
const	0.012***	0.009	0.009
	(2.64)	(1.89)	(1.80)
	Panel B: Spread in Std. Dev. with EAs		
	PUR12	SAL12	ASAL1
INS	-0.106***	0.032***	0.035***
	(-6.06)	(5.28)	(5.33)
const	0.120***	0.119***	0.121***
	(4.61)	(4.40)	(4.50)
	Panel C: HV-IV		
	PUR12	SAL12	ASAL1
INS	0.00	0.032***	0.042***
	(0.04)	(2.93)	(3.08)
const	-0.057***	-0.075***	-0.073***
	(-4.72)	(-6.01)	(-5.95)

Table VI: Cross-Sectional Analysis of Option Returns

This table reports call and put option returns controlling for stock characteristics. We apply the same panel regression as in Table (II), with the same assumption on the standard errors. Earnings announcements are in the option trading window. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

Panel A: Past Six-Month Lagged Stock Returns						
	Call Return		Put Return			
	1 (Low)	3 (High)	1 (Low)	3 (High)	1 (Low)	3 (High)
	PUR12	PUR12	SAL12	SAL12	ASAL1	ASAL1
INS	0.143	0.236***	0.080**	0.063	0.138***	0.060
	(1.86)	(2.65)	(2.36)	(1.75)	(2.64)	(1.65)
const	0.175***	0.096	-0.118**	-0.044	-0.115**	-0.038
	(3.59)	(1.67)	(-2.10)	(-0.71)	(-2.09)	(-0.58)
Panel B: Firm Size						
	1 (Small)	3 (Large)	1 (Small)	3 (Large)	1 (Small)	3 (Large)
	PUR12	PUR12	SAL12	SAL12	ASAL1	ASAL1
INS	0.245***	0.226**	0.097***	0.086***	0.119***	0.103***
	(2.63)	(2.53)	(3.33)	(3.94)	(2.59)	(2.98)
const	0.120**	0.114**	-0.054	-0.147***	-0.048	-0.140**
	(2.42)	(2.56)	(-1.00)	(-2.60)	(-0.88)	(-2.49)
Panel C: R&D						
	Without R&D	With R&D	Without R&D	With R&D	Without R&I	With R&D
	PUR12	PUR12	SAL12	SAL12	ASAL1	ASAL1
INS	0.089	0.233***	0.063***	0.085***	0.081**	0.105***
	(1.84)	(3.85)	(2.67)	(2.70)	(2.24)	(2.65)
const	0.109**	0.146***	-0.086	-0.108**	-0.083	-0.102**
	(2.42)	(3.46)	(-1.33)	(-2.23)	(-1.27)	(-2.07)
Panel D: Book-to-Market Ratio						
	1 (Low)	3 (High)	1 (Low)	3 (High)	1 (Low)	3 (High)
	PUR12	PUR12	SAL12	SAL12	ASAL1	ASAL1
INS	0.301***	0.016	0.089***	0.040	0.134***	0.003
	(2.92)	(0.25)	(3.02)	(1.19)	(2.82)	(0.07)
const	0.111**	0.158***	-0.081	-0.118	-0.077	-0.113
	(2.39)	(2.98)	(-1.77)	(-1.75)	(-1.65)	(-1.69)

Table VII: Insider Purchases (Sales) Without Sales (Purchases)

This table reports the option returns after insider trading when earnings announcements are in the option trading window. We consider two different types of insider trading: purchases by the top 12 insiders without sales (*PUR12NoSAL*) and sales by the top 12 insiders without purchases (*SAL12NoPUR*). All others remain the same as they are in Table II. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Call Return	Put Return
	PUR12NoSAL	SAL12NoPUR
INS	0.170***	0.083***
	(5.53)	(3.84)
const	0.132***	-0.10
	(3.20)	(-1.83)

Table VIII: Option Returns in the Post-SOX Period

This table reports option returns using the post Sarbanes-Oxley Act sample when earnings announcements are in the option trading window. We apply the same panel regression as in Table (II), with the same assumption on the standard errors. Two and three asterisks denote significance at the 5% and 1% levels, respectively.

	Call Return		Put Return		
	PUR12	PUR12NoSAL	SAL12	ASAL1	SAL12NoPUR
INS	0.113	0.129**	0.071***	0.082***	0.074***
	(1.77)	(2.45)	(4.04)	(3.00)	(4.01)
const	0.085	0.085	-0.079	-0.073	-0.079
	(1.36)	(1.36)	(-0.93)	(-0.86)	(-0.93)