Information, Trading and Product Market Interactions: Cross-Sectional Implications of Informed Trading

HEATHER E. TOOKES *

ABSTRACT

I present a simple model of informed trading in which asset values are derived from imperfectly competitive product markets and private information events occur at individual firms. The model predicts that informed traders may have incentives to make information-based trades in the stocks of competitors, especially when events occur at firms with large market shares. In the context of 759 earnings announcements, I use intraday transactions data to test the hypothesis that net order flow and returns in the stocks of non-announcing competitors have information content for announcing firms.

*Yale School of Management, 135 Prospect Street, New Haven, CT 06520-8200. Phone: 203-436-0785; E-mail: heather.tookes@yale.edu. This paper is based on part of my dissertation at Cornell University. I am grateful to Maureen O'Hara (Chair), David Easley, Robert Masson and Roni Michaely for many helpful discussions. I would also like to thank Warren Bailey, Carliss Baldwin, Scott Bauguess, Sudipto Bhattacharya, Joshua Coval, Judith Chevalier, John Griffin, Michael Hertzel, Kenneth Kavajecz, Norris Larrymore, Jonathan Macey, Adam Reed, Laura Starks, David Scharfstein, Matthew Spiegel, Robert Stambaugh (the editor), Bhaskaran Swaminathan, Eric Theissen, Nancy Wallace, James Weston, an anonymous referee, seminar participants at Cornell University, the 2003 European Finance Association Meetings, Arizona State, Yale SOM, U.C. Berkeley, Stanford, Harvard, UNC-Chapel Hill, the 2004 American Finance Association Meetings, the 2004 Batten Finance Conference, Yale Law School and MIT-Sloan for their useful suggestions. Any errors are my own.

How does an informed trader's propensity to trade on inside information in a given company's stock vary with industry and firm characteristics? Using a simple model of informed trading in which asset values are derived from imperfectly competitive product markets and where private information events occur at firms, I examine the question of where informed traders choose to transact.[1] This paper adds to existing research by explicitly linking informed trading in stock markets to the structure of competition in product markets. It also provides new evidence on the process of information diffusion across stocks as we vary the location at which private information is observed. Given privately observed information at a particular location (firm), informed traders may choose to trade in the stocks of related firms (in the same industry, for example). In addition to cross-stock trading incentives, this paper examines cross-sectional differences in where informed trading is likely to occur.

I present a very simple model of informed trading in the context of both *firm-specific* and *industry-wide* information events. I assume that asset values are derived from a Cournot duopoly with asymmetric constant marginal costs. Small, wealth-constrained informed traders decide whether to trade on privately observed information regarding a given firm's future production costs in that firm's stock or the stock of a competitor. I solve for the conditions under which competitor trading will occur.[2] The model provides structure to the intuition of how information impacts more than one firm in an industry. We often start with returns as the basic element of financial models. What distinguishes the approach in this paper and in the literature on financial and product market interactions (e.g., Brander and Lewis (1986); Maksimovic and Titman (1991); Chevalier and Scharfstein (1996); Allen and Phillips (2000); Hou and Robinson (2006)) is that it takes one step back and explicitly accounts for the characteristics of firms and industries that generate returns. I begin with economic fundamentals to provide economic intuition as to what generates differences in stocks' sensitivities to common information and how these sensitivities interact with insiders' trading strategies.

Beyond the implication that some insiders may choose to trade in the stocks of competing firms, there are additional cross-sectional predictions. First, the amount of information-based trading in a company's stock is predicted to decrease in firm market share. In the Cournot example used in this paper, large market shares stem from competitive advantage. Stocks of firms with large market shares are less attractive locations for information-based trades because these firms are strong (i.e., low-cost, more competitive). The stock prices of small firms exhibit higher sensitivity to shocks as a result of product market weakness, which creates opportunities for informed traders to extract higher excess returns from trades. In addition to competitor trading incentives, the well-known product market structure provides a link between firm size (within industries) and volatility that has not been emphasized. Second, as would be expected, the type of private information ("competitive" versus "industry-wide") is important. Competitor trading incentives are much larger when the information is regarding an industry-wide shock since these shocks have first-order effects on the profitability of all firms. Finally, as is common in the microstructure literature, liquidity matters. Informed traders are more likely to trade in liquid stocks because of their ability to "hide" their trades in these stocks.

A natural way to test these conjectures is to identify those traders who are informed and to collect data on their trading portfolios. Because these data are unavailable, I take an alternative approach. I use aggregate transaction data and estimate cross-stock price impacts of net order flow to infer information content of trades and information transmission. The intuition is that if market makers learn from the trading process, they will update prices based on information from order flow and returns in all relevant securities. In the context of 759 quarterly earnings announcements (times in which information asymmetry is likely to be high) in 128 industries, I examine information transmission across stocks. Consider announcing Firm A and competing Firm B. If it is optimal for informed traders to trade in the stock of B, then order flow in B should have information content for A, even when the information event is known to have occurred at A (and not at B). The main empirical findings support the hypothesis that non-announcing competing firms' stocks are locations for information-based trades. I find that order flows and returns in the stocks of non-announcing competitors have information content for announcing-firm returns, even after controlling for lagged own-firm returns and both contemporaneous and lagged own-firm order flow. In addition, analysis of cross-sectional variation in the cross-stock price impact of trades and returns provides some evidence that the information content varies systematically with variables identified in the main model.

Transactions of informed traders are of interest because a central implication of asymmetric information models in the market microstructure literature is that these trades convey price-relevant information to markets (e.g., Kyle (1985), Glosten and Milgrom (1985)). Order flow (net buyer-initiated volume) is particularly useful in this paper since the price impact of trades reflects aggregation of traders' information. This is distinct from price changes due to public information, which can occur without trading (see e.g., Evans and Lyons (2002b)). Most empirical studies of price discovery in stock markets have focused on the extent to which trading leads to price revisions in the context of individual securities (e.g., Hasbrouck (1991); Madhavan, Richardson and Roomans (1997); Dufour and Engle (2000) for stocks) or across securities that are different claims to the same underlying asset (e.g., Biais and Hillion (1994); Easley, O'Hara and Srinivas (1998); Chan, Chung and Fong (2002); Chakravarty, Gulen and Mayhew (2004); Cao, Chen and Griffin (2005) for options and underlying stocks; Harris (1989) and Chan (1992) for futures and stocks). Only in recent years has empirical focus shifted towards price discovery in multiple stock settings (e.g., Chordia, Roll and Subrahmanyam (2000); Hasbrouck and Seppi (2001); Harford and Kaul (2005)). These papers have documented common components of order flows and liquidity across stocks.[3,4] The current paper sheds further light on where (within industries) we should expect price discovery to occur.

This study also contributes to literature on insider trading and regulation. Registered insiders face regulatory constraints in own-firm trades that they do not face when they trade in the stocks of their competitors. They are also likely to be informed in settings in which information events occur at individual firms, making incentives for competitor trading particularly strong. Most empirical studies of trading by officers and directors of U.S. firms investigate abnormal returns to own-firm trades (e.g., Jaffe (1974); Finnerty (1976); Seyhun (1986); Lakonishok and Lee (2001); Jeng, Metrick and Zeckhauser (2003)). Understanding variation in informed traders' incentives should help distinguish insiders who are likely to make information-based trades in own-firm stock from those who are more likely to trade for non-speculative reasons. This paper is not the first to link informed trading to product markets. The questions that have been addressed relate to how one firm can distort profits from entry by trading in the securities of other firms whose values are dependent on its actions (see e.g., Hansen and Lott (1995); Fishman and Hagerty (1992)) or the impact of own-firm trading by an insider who is also a manager choosing output levels (Jain and Mirman (2000)). The current paper focuses on informed trading in competitive stock markets with multiple securities and is the first to empirically examine the potential role of product market competition in cross-stock price discovery.

This paper is organized as follows. In Section I, I present a very simple model of informed trading in the context of both firm-specific and industry-wide information events. This section concludes with a discussion that maps the implications of the model to the empirical tests. Section II contains the empirical analysis of cross-stock net order flow and returns relationships during both "normal" and earnings announcement periods. Section III concludes.

I Hypothesis Development

The following provides a simple framework formalizing the hypotheses and main intuition. Firms compete in a Cournot product market and private information is revealed to insiders at a given firm. The term "insiders" is very broad and applies to all traders who are informed when an information event occurs. This would include corporate insiders and employees, as well as analysts following the firm who have access to information before it is released to the market.[5] What is important is the location at which the information is observed. Insiders trade either in the stock of the firm at which the event occurred or in a competitor's stock. The main results are that competitor trading incentives exist and that these incentives vary systematically with firm market share within industries and with the type of information ("firm-specific" versus "industry-wide"). As will be clear in the discussion, "firm-specific" information carries that name only because it relates to firm-specific costs. The information itself is relevant to the values of all firms due to the oligopolistic market structure.

A Model

I modify the sequential trade model in Easley, O'Hara and Srinivas (1998) to consider informed trading in stocks that derive their values from a single, imperfectly competitive industry. Uncertainty stems from the firms' random production costs, which can take two possible values: $c_i - \Delta c$ or $c_i + \Delta c$. With probability θ, an information event will occur at Firm i, in which true costs are privately revealed to Firm i's insiders. Two assets ("Firms") trade in an equity market prior to competition in the product market. Ownership of a given firm represents rights to all cashflows from the asset's production of the good.[6]

Timing

The exact timing is as follows: In period 0, nature decides whether an information event will occur. If an information event occurs, a perfect signal regarding Firm 1's future costs is revealed to Firm 1's insiders (i.e., let i=1). With probability δ the signal will reveal a low state (high future costs) for Firm 1; with probability $(1-\delta)$ the signal will reveal a "high" state. In period 1, a day of stock market trading occurs. In period 2, a public signal regarding c_1 is revealed to all market participants. This ensures efficient production decisions. Because the informed are assumed to behave competitively, as long as period 1 contains sufficiently many rounds of trading, revelation of cost will actually occur before period 2. Beginning in period 3, the product market meets and all profits are realized and returned to shareholders. Figure 1 provides a timeline.

[FIGURE 1 ABOUT HERE]

Market Participants

There are four types of equity market participants: Firm 1's insiders (those with access to Firm 1's private information); Firm 1's uninformed liquidity traders; Firm 2's uninformed liquidity traders; and a market maker.[7]

Insiders are risk-neutral and competitive. Although it may be the case that the number of registered insiders at individual firms is small, the potential group of indirect insiders (e.g., other employees, temporary insiders, analysts and family members) and the possibility of unintentional leakage makes the number of potentially informed individuals large. This increases the likelihood that informed traders will behave competitively. Insiders are wealth-constrained investors who seek to maximize return on their $1 investment. This return maximization assumption reflects borrowing restrictions found in real markets. If an information event occurs at Firm 1, Firm 1's insiders are always informed. Uninformed traders trade for exogenous liquidity reasons and are equally likely to buy or sell. The fractions of each type of trader in the market are as follows:

μ are informed if there is an information event regarding Firm 1's costs.

$(1-\mu)$ are uninformed liquidity traders. Of these, fractions: f sell Stock 1; f buy Stock 1; g sell Stock 2; and g buy Stock 2. Let $2f + 2g = 1$.

All traders arrive and submit orders sequentially to a competitive market maker. Following each trade, the market maker revises his quotes using Bayes' rule. "Own-firm trades" are defined as trades in the stock of Firm 1 by Firm 1's insiders (Firm 1 is the information source). "Competitor trades" are trades in the stock of Firm 2 by Firm 1's insiders. Figure 2 provides the probabilistic structure.

[FIGURE 2 ABOUT HERE]

Trading Strategies

The imperfectly competitive product market setup means that a change in costs for Firm 1 changes equilibrium profitability and produces potential insider trading profits at both firms. I assume that traders cannot execute trades in both securities simultaneously; therefore, insiders face a trading location decision: trade in own-firm stock or that of a competitor. When Firm 1's insiders observe a signal, there are four possible equilibria: (1) all insiders trade in own-firm stock; (2) all insiders trade in the stock of the competing firm; (3) they mix between Stocks 1 and 2; (4) they refrain from trading. In the case of a low signal, the fraction of insiders trading in Stock 1 is $\alpha_L \, \epsilon \, [0,1]$, and $(1-\alpha_L)$ trade in Stock 2. Equilibrium requires that market makers set bid and ask prices that result in zero expected profits given optimal behavior of informed traders.

B The Product Market

Consider a standard Cournot duopoly with a single homogenous good and asymmetric constant marginal costs. Starting from this well-known structure allows us to formulate the intuition behind the hypothesized link between insiders' trading strategies and firm and industry characteristics within the context of a well-understood market.[8] What has not been emphasized previously is the link between product market weakness (which produces a small market share and firm size) and implicit leverage of firms. These stem *directly* from competitive disadvantage and create insider trading incentives.

Given costs $C_i(q_i) = c_i q_i$ and a linear inverse demand function $p(Q) = a - bQ$, firms simultaneously choose quantities q_i (where $Q = \sum q_i$). Equilibrium profits from production are returned to shareholders as dividends. The well-known first order conditions for Cournot-Nash Equilibrium give quantities and profits:

$$q_i^* = \frac{a - c_i - bq_j^*}{2b}; \qquad \pi_i^* = \left[\frac{a + \sum_{k=1}^{2} c_k}{3} - c_i\right]^2 \frac{1}{b} \tag{1}$$

It is clear from (1) that a firm with a high cost will produce a low quantity (i.e., high c_i firms are small due to competitive disadvantage) and realize a lower profit. Consider changes in profitability with respect to changes in a given firm's costs:

Own profitability:

$$\frac{\partial \pi_i^*}{\partial c_i} = \frac{-4}{3b}\left[\frac{a + \sum_{k=1}^{2} c_k}{3} - c_i\right] \tag{2}$$

Competitor profitability:

$$\frac{\partial \pi_i^*}{\partial c_j} = \frac{2}{3b}\left[\frac{a + \sum_{k=1}^{2} c_k}{3} - c_i\right] \tag{3}$$

Clearly, an increase in the competitive costs of Firm i decreases the value of that firm and increases the value of the competitor. Before turning to the stock market, in which the possibility of trade by insiders will affect prices, it is useful to consider cross-sectional differences in return volatility (sensitivity of profits to the information). The percent changes in profitability with respect to a Δc increase in Firm 1's cost are:

$$\text{Firm 1: } \frac{\frac{\partial \pi_1^*}{\partial c_1}\Delta c}{\pi_1^*} = \frac{-4\Delta c}{[a + c_2 - 2c_1]} \quad \text{and} \quad \text{Firm 2: } \frac{\frac{\partial \pi_2^*}{\partial c_1}\Delta c}{\pi_2^*} = \frac{2\Delta c}{[a + c_1 - 2c_2]} \tag{4}$$

Because earnings streams in high-cost (small) firms are more volatile, insiders are more likely to choose to trade in the stocks of small competitors. If Firm 2's costs are sufficiently high (i.e., $5c_2 - 4c_1 > a$) then Firm 2's profitability will be more sensitive to Firm 1's firm-specific costs than

Firm 1's profitability.

C The Stock Market

Firm 1's insiders observe changes in future costs. In order to establish a product market link, denote the value of Firm i given changes in costs for Firm 1 as:

$$V_i^{\Psi} \approx \pi_i^* + \frac{\partial \pi_i^*}{\partial c_1} \Delta c_1 \tag{5}$$

where the signal $\Psi \epsilon$ {H,L} denotes state of the world at Firm 1.

The objective is to characterize the conditions under which insiders choose to trade in competitors' stocks. Consider the equilibrium strategy of an insider making the first trade of the day. $E[V_{it}/\Psi]$ is the expected value of Stock i given observed (perfect) signal Ψ, b_{it} is the market maker's bid for Stock i at time t, a_{it} is the ask for Stock i at time t. The trading rule is: Sell if $E[V_i/\Psi] < b_{1t}$; Buy if $E[V_i/\Psi] > a_{2t}$; No trade in Stock i otherwise. Based on the optimal strategy within a given stock, the insiders compare returns across stocks and choose their optimal trading location. This decision suggests where we might expect price discovery to occur.

C.1 Market Maker's Opening Quotes

To illustrate the impact of private information regarding product market parameters on equilibrium spreads, consider the market maker's opening quotes and the equilibrium strategy of an insider making the first trade of the day. Let Firm 1's insiders receive a low signal (high own-firm costs). The unconditional expected value of Stock i at time t is:

$$V_{it}^* = E[V_{it}] = \delta_t V_i^L + (1 - \delta_t) V_i^H \tag{6}$$

Given a trade in either Stock 1 or Stock 2, the market maker will update his belief regarding δ_t

using Bayes' rule and, by Equation (6), revises his belief regarding the expected values of both stocks. For example, the bid for Stock 1 at time t is b_{1t}=E[V$_{1t}$/Sell Stock 1]. Since my focus is on the first trade of the day, I drop the t subscript.

The bid and ask prices for Stock 1:

$$b_1 = V_1^* - \frac{(1-\delta)[V_1^H - V_1^L]\theta\delta\mu\alpha_L}{f(1-\mu\theta)+\theta\delta\mu\alpha_L}; \quad a_1 = V_1^* + \frac{(1-\delta)[V_1^H - V_1^L]\theta\delta\mu\alpha_H}{f(1-\mu\theta)+\theta(1-\delta)\mu\alpha_H} \tag{7}$$

The bid and ask prices for Stock 2:

$$b_2 = V_2^* - \frac{(1-\delta)[V_2^L - V_2^H]\theta\delta\mu(1-\alpha_H)}{g(1-\mu\theta)+\theta(1-\delta)\mu(1-\alpha_H)}; \quad a_2 = V_2^* + \frac{(1-\delta)[V_2^L - V_2^H]\theta\delta\mu(1-\alpha_L)}{g(1-\mu\theta)+\theta\delta\mu(1-\alpha_L)} \tag{8}$$

Clearly, the deviation of bid and ask prices from the expected values of each asset is increasing in the fraction of insiders who choose to trade in that security. In this example, if none of Firm 1's insiders trade in Stock 2 (i.e., $\alpha_L = \alpha_H = 1$), then $a_2 = b_2 = V_2^*$ and there would be no spread in the competitor's stock.

When Firm 1's insiders observe a low signal, they trade in Stock 2 if

$$\frac{V_2^L - a_2}{a_2} > \frac{b_1 - V_1^L}{b_1} \tag{9}$$

The remainder of the analysis considers the case of a low signal, so the subscript on α_L is dropped. To provide intuition, I solve for the conditions under which insiders choose a pure strategy in competitor trades. That is, when will $\alpha = 0$?

C.2 Pure Strategy in Competitor Trades

Lemma 1: After observing a low signal regarding firm-specific costs, a sufficient condition for Firm 1's insiders to trade in Stock 2 is:

$$\frac{(V_2^L - V_2^*)g(1-\theta\mu)}{V_2^* g(1-\theta\mu) + \theta\delta\mu V_2^L} > \frac{V_1^* - V_1^L}{V_1^*} \tag{10}$$

The argument is as follows: Let $\alpha = 0$. If, given that all insiders trade in Stock 2, returns from trade in that stock are greater than own-firm returns, then it must be the case that $\alpha = 0$. From Equation (7), when $\alpha = 0$ there is no informed trading in Stock 1 and $b_1 = V_1^*$. Returns from the sale of Stock 1 are:

$$\frac{b_1 - V_1^L}{b_1} = \frac{V_1^* - V_1^L}{V_1^*} \tag{11}$$

If the insider buys Stock 2, returns are:

$$\frac{V_2^L - a_2}{a_2} = \frac{(V_2^L - V_2^*)g(1-\theta\mu)}{V_2^* g(1-\theta\mu) + \theta\delta\mu V_2^L} \tag{12}$$

■

From (10), it is clear that increasing liquidity traders in Firm 2 (increasing g) increases the propensity of Firm 1's insiders to trade in that stock. A lower prior on the low signal (δ) also increases returns to trading in Stock 2.

Importantly, in this set-up, V has a structure (it is product market profitability). We can use this fact to gain additional insight into the links between product market characteristics and trading location.

Lemma 2: The range of microstructure parameters (δ, θ, μ, f, g) for which there will be a pure strategy in competitor trades is increasing in own-firm market share and decreasing in the market share of the competing firm.

Lemma 2 formalizes the intuition that because small firms within industries tend to be weak (e.g., they are new and vulnerable to shocks or they have another competitive disadvantage), the sensitivity of their values to information is high. This makes their stocks attractive venues for information-based trading. To see why this holds, return to the product market, from which the traded assets derive their values. Recall from Equation (5) that $V_i^{\Psi} \approx \pi_i^* + \frac{\partial \pi_i}{\partial c_k}\Delta c_k$. Firm i's market share is:

$$s_i^* = \frac{q_i^*}{\sum_{k=1}^{2} q_K^*} = \frac{a + c_j - 2c_i}{2a - c_1 - c_2} \tag{13}$$

Equations (1), (2) and (3) gave equilibrium profit and changes in profitability with respect to changes in costs. Substituting these and (13), and letting $\delta = 1/2$ (for simplification), Inequality (10) becomes:

$$s_1 g(1 - \theta\mu) - 2s_2[g(1 - \theta\mu) + \frac{\theta\mu}{2}] > \frac{2\Delta c\theta\mu}{2a - c_1 - c_2} \tag{14}$$

Holding industry constant, the left-hand side of Inequality (14) is strictly increasing in Firm 1's market share and strictly decreasing in Firm 2's market share. Within an industry, small stocks are more susceptible to informed competitor trades. This within-industry market share result also has between-industry implications. All else equal, the range of parameters over which there will be a pure strategy in competitor trading is increasing in industry concentration (see the Appendix for details).

D Industry-wide News

Section (C.2) focused on firm-specific (competitive) costs c_i. In most industries, stock returns are characterized by positive co-movement. This suggests that uncertainty is instead regarding industry-wide variables. It is straightforward to modify the model to examine the case in which private information pertains to industry-wide costs and insiders instead observe a change in a cost c_I, common to both firms. The cost for Firm i in industry I is given by $C_i(q_i) = (c_i + c_I)q_i$. The percent change in profitability of Firm i with respect to a Δc_I increase in industry-wide costs is:

$$\frac{\Delta \pi_i}{\pi_i^*} = \frac{-2\Delta c_I}{a + c_j - 2c_i - c_I} \tag{15}$$

From (15) whenever $c_j > c_i$:

$$\frac{|\Delta \pi_j|}{\pi_j^*} > \frac{|\Delta \pi_i|}{\pi_i^*} \tag{16}$$

There are several differences between the industry-wide and competitive cost cases (Inequalities (15) and (4), respectively). The most important is that the sensitivity of profitability to industry-wide costs is larger for the weakest (highest idiosyncratic cost) firms. Inequality (16) says that (all else constant) insiders in large firms would always want to trade on information regarding industry-wide shocks in the stocks of smaller, more volatile competitors. This is not always true with competitive information and provides a link between size and volatility stemming directly from the Cournot setup. The intuition is analogous to models of informed trading in options (e.g., Easley, O'Hara and Srinivas (1998)) in that leverage stemming from the product market makes weak competitors' stocks attractive.[9] This link between size and informed trading is also consistent with findings in Fishe and Robe (2004) in which stockbrokers who obtained advance copies of *Business Week* tended to choose smaller firms for their pre-announcement trades. Also note that from Inequality (15), the sensitivity of profitability of the firm at which the information event occurs is $\frac{1}{2}$ of that in the idiosyncratic cost case, further increasing competitor trading incentives. Another difference is that returns are positively correlated when information pertains to industry-wide costs. Therefore, the top two branches in Figure 2 would be the choice between selling Firm 1 and selling Firm 2.

In the industry-wide case, the conditions for a pure strategy in competitor trades (analogous to

Inequality (14)) becomes:

$$s_1 g(1-\theta\mu) - s_2[g(1-\theta\mu) + \frac{\theta\mu}{2}] > \frac{-\theta\mu\Delta c_I}{2a - c_1 - c_2 - 2c_I} \tag{17}$$

What distinguishes the industry-wide cost case is that the conditions in Inequality (17) are much less restrictive on the range of microstructure parameters over which insiders will choose to engage in competitor trading (i.e., Inequality (14)). As in the competitive information case, the range for which there exists a pure strategy in competitor trades is strictly increasing in the market share of Firm 1 and decreasing in the market share of Firm 2.

E Asymmetric Impact of Insider Trading Regulation

While this paper applies to settings in which insider trading is unregulated, the presence of regulation makes the analysis potentially more relevant. Let p represent the expected fraction of own-firm trading profits that an insider keeps. If there are no regulations then $p = 1$. Under current laws, p can be negative (insiders must disgorge profits, plus they face civil penalties of up to three times profit or avoided loss under 15 U.S.C. 78 u-1). For negative p, it is clear that, whenever possible, insiders will want to trade in competing firms' stocks. Consider the more realistic case in which monitoring is imperfect and $p \in (0, 1)$. In this context, Equation (14) becomes:

$$s_1 g(1-\theta\mu) - 2ps_2[g(1-\theta\mu) + \frac{\theta\mu}{2}] > \frac{2p\Delta c\theta\mu}{2a - c_1 - c_2} \tag{18}$$

Clearly, regulation shifts information risk to the stocks of competitors, especially when competitors are weak/small. This asymmetry may be important to policy makers. In particular, traditional insiders face constraints in trading the securities of their own firms that they do not face when they choose to trade in the stocks of their competitors (i.e., Section 16 of the Securities and Exchange Act of 1934 requires own-firm trade reporting and prohibits both own-firm short sales and short-swing profit taking). Also, establishing a breach of a fiduciary duty to the source of privately observed information has been the basis for courts to determine whether illegal insider trading has occurred (see e.g., Bainbridge (2000)). Breach of fiduciary duty to the firm (and its shareholders) is clear in the case of own-firm trading on the basis of material private information and is less clear in the case of competitor trading. Legal scholars hold that, under current laws, competitor trading may be legal in many circumstances.[10]

In addition to government regulation, firm-level policies can restrict competitor trading. In light of the incentives highlighted in this paper, one might expect firms to self-regulate if they expected such incentives to harm shareholders. To explore whether in practice employment contracts restrict executives and employees from trading the stocks of competitors, I reviewed the current code of conduct policies in 60 firms: all of the Dow 30 stocks and 30 randomly selected from the Nasdaq 100.[11] Most firms are silent on the issue of competitor trading.[12,13] Importantly, where these policies do exist, they would work against empirical findings of cross-stock price impact. It also may not be reasonable to expect strict adherence and enforcement. For example, Bettis, Coles and Lemmon (2000) report some evidence (albeit reduced) of own-firm insider trading during corporate blackout periods.

F Implications and Motivation for Empirical Analysis

The two primary implications are: (1) competitor trading incentives may exist and (2) incentives will vary systematically with firm and industry characteristics as well as type of information ("competitive" versus "industry-wide"). While it is clear that competitor trading incentives can exist when firms operate in the same industry, what distinguishes the model is that the imperfectly competitive industry structure provides both a mechanism through which linkages exist and predictions as to when competitor trading incentives are likely to be strongest. To test these, one would ideally identify all of those traders who are at a given firm and analyze their entire trading portfolios. Given that these data are unavailable, I infer information content based on the estimated price impact of cross-stock net order flow and returns to test for consistency with the competitor trading hypothesis. Informed trades are not directly identified; however, the price impact reveals the market maker's *expectation* that trades contain value-relevant information.

Four possible equilibria are discussed in the previous section: pure strategy in own-firm trades; pure strategy in competitor trades; mixed strategy in which insider trades in both own and competitor stocks with positive probabilities; no trade. A goal of the empirical analysis is to identify which of these equilibria is most consistent with actual trading and returns relationships. In the earnings announcement setting, an empirical finding suggesting an informational role for trading and returns of the announcing firm and no information contained in those of a competitor implies a pure strategy equilibrium in own-firm (in this case, the announcing firm) trades. The reverse finding implies a pure strategy equilibrium in competitor trades. Evidence of informative order flow and returns in both announcers and competitors is consistent with a mixed-strategy equilibrium, in which some informed trade in the stock of the announcing firm and some trade in the stocks of competitors. No information in announcing and competing firm order flows and returns implies no informed trading. These relationships are summarized in Table I.

[TABLE I ABOUT HERE]

II Earnings Announcements and Cross-Stock Net Order Flow and Returns Relationships

The model in Section I suggests that grouping stocks based on industry and then estimating cross-stock price impacts of order flow and returns (especially in event settings) might improve our understanding of cross-stock price discovery. In the empirical analysis, I infer information content from cross-stock price impacts, measured over "normal" trading periods as well as the days preceding and following 759 earnings events. These windows allow me to vary the information environment to examine whether there are changes in the structure of information diffusion when we vary the location at which private information is observed. A finding that the information content of trading in competitors' stocks decreases near earnings announcements would be inconsistent with competitor trading.

Earnings release periods provide a useful basis for testing since information asymmetry during these periods is likely to be high (in the notation of Section I, θ close to 1) and it is possible to identify the location at which the event occurred. The assumption that these announcements allow informed traders to value future cashflows is in line with evidence (e.g. Christophe, Ferri and Angel (2004)) of informed trading in announcing firms during the days prior to earnings announcements. Many firms engage in self-regulation and restrict own-firm trades by insiders prior to earnings announcements (see Bettis, Coles and Lemmon (2000)). Competitor trading might be most evident during these pre-announcement "blackout" periods. In addition, Demarzo, Fishman and Hagerty (1998) show that the optimal insider trading regulation involves allowing small information-motivated trades and imposing penalties for large trades. This is important since it suggests that some insider trading will be allowed and that trading data should reflect at least some informationally motivated trades.

The main empirical model is in the spirit of Chan, Chung and Fong (2002) and Easley, O'Hara and Srinivas (1998). Both studies investigate the price discovery process across options and underlying stocks, where the main regression equation of interest is one in which the dependent variable is the five-minute change in the stock price.

A Data and Sample Selection

Industry and Event Selection

The initial sample consists of all common stocks that appear on both *CRSP* and *COMPUSTAT* at any time during the period 1993 to 2002. A valid announcement is an earnings announcement by an NYSE/AMEX firm that occurs within 90 days of quarter end and which does not occur within two trading days of an earnings announcement by another firm in the industry. Industries are defined as all firms with the same primary *COMPUSTAT* 4-digit SIC code.[14] Consistent with the information transfer literature (e.g., Freeman and Tse (1992)), I require announcers and competitors to have December fiscal year ends in order to synchronize quarters. I also require that each industry have at least eight quarters with valid announcements over the 1993 to 2002 period. Earnings announcement dates are obtained from *COMPUSTAT*.[15] While earnings release dates for all competitors (including those listed on the NASDAQ) are used to identify valid announcements, only NYSE and AMEX stocks' net order flows and returns are analyzed in order to avoid confounding findings related to different trading mechanisms.

Intraday transactions data are from the *Trades and Quotes (TAQ)* database. Consistent with prior studies (e.g., Easley, O'Hara and Srinivas (1998); Chan, Chung and Fong (2002)), I impose an active trade filter of 50 trades per day in order to attenuate problems associated with non-synchronous trading. From the group of active competitors for a given announcement, one competing firm is randomly selected for analysis.[16] All announcements in which there is at least one active announcing and one active competing firm are included in the final sample of 128 industries (4-digit SIC codes) and 759 valid earnings announcements.

Sample Description and Summary Statistics

There are 398 unique firms in the sample, occupying 128 different industries. The firms are large, with average market capitalization in *CRSP* NYSE/AMEX/Nasdaq Decile 9. This is due to selection criteria, in particular the active trade filter (which eliminates the smallest firms), but should not cause important selection bias since within industry variation is important to the analysis, not size. Forty five percent of competing firms have market shares less than the announcing firm.

Table II provides a summary of price reactions and trading volumes over the five-day event window (days −2 to +2). Abnormal event-period price reactions are defined as the absolute value of the sum of abnormal returns over the event window dates −2 to +2. The mean (median) abnormal price changes during the event window are 6.5% (4.4%) for announcing firms and 4.9% (3.4%) for competitors. Pre-event price changes are estimated over days −2 and −1 and exhibit similar variation. The mean (median) abnormal price changes are 3.2% (1.9%) for announcing firms; 2.7% (1.9%) for competitors. The magnitudes of these price changes suggest that there is information contained in the earnings announcements and that information begins to be incorporated into prices prior to the actual announcement date. Consistent with the main model, announcement period price changes are larger for the 343 announcements in which competitors have smaller market shares than the announcer (5.9% versus 4.5%).

To provide a description of event-period trading volume, I define abnormal trading as volume relative to average daily trading volume over the calendar year ending thirty days prior to each announcement. From Table II, volumes in both announcers and competitors appear to increase during earnings announcement periods. That these volumes accompany price changes motivates a closer examination of the information content of trading volumes.

The average dollar volumes in Table II suggest that, on average, competitors' stocks are more liquid than those of announcing firms. Inequality (14) implies that information-based trading is more likely to occur in the stocks of weak competitors; it also suggests that, all else equal, informed traders prefer to trade in liquid stocks. Therefore, careful analysis of cross-sectional variation in the price impact of trading and returns in competing firms will need to control for differences in liquidity.

The data in Table II also indicate that the values of the firms are sensitive to common information, with the historical return and volume correlations among announcers and competitors are positive and high, with average historical correlations of approximately .32 for returns and .19 for trading volume.[17] The empirical intra-industry information transfer literature (e.g., Foster (1981) and Freeman and Tse (1992) for earnings announcements; Hertzel (1991) for repurchases; Lang and Stulz (1992) for bankruptcies; Laux, Starks and Yoon (1998) for dividends; Bittlingmayer and Hazlett (2000) for litigation) documents that information releases affect the values of both announcers and competitors. This literature does not consider trading activity in non-announcing competitors in the periods surrounding announcements. The analysis in this section documents these relationships.

[**TABLE II ABOUT HERE**]

The next step involves closer (intraday) examination of order flows and returns. The primary goal is to characterize cross-stock information transmission during both "normal" and announcement periods. The main tests are based on cross-stock net order flow and returns relationships during benchmark period as well as pre-, post-, and earnings announcement days. Benchmark observations are measured over ten trading days (the five days ending two weeks prior to the announcement and five days beginning two weeks following the announcement), since information asymmetry related to the announcers' earnings should be lower at these times.[18]

Construction of Volume and Return Series for the Intraday Analysis

I divide each trading day into 78 successive five-minute intervals from 9:30 a.m. until 4:00 p.m. ET. Stock return in interval t is defined as the log ratio of quote midpoints at the end of intervals t and t−1. Returns are based on quote midpoints in order to reduce the effects of bid ask bounce.[19] I assume that quotes are set symmetrically about the expected value and that they reflect all public information.

Following Chan, Chung and Fong (2002), I calculate net stock trading volume (buyer-initiated volume minus seller-initiated volume) using the Lee and Ready (1991) trade classification algorithm. As in Chan, Chung and Fong (2002) and Easley, O'Hara and Srinivas (1998), all return and net trade volume variables are standardized using the mean and standard deviation of the series for each individual stock over each trading day. Standardization allows for pooling across firms in order to increase the power of the empirical tests.

B Empirical Model

To shed light on the informational role of cross-stock net order flow and returns, I take the basic econometric approach adapted from Hasbrouck (1991) for the case of multiple securities in Chan, Chung and Fong (2002). The interactions between returns and order flow are modeled as a vector autoregressive system. The main focus is on the null that net order flows in competitors' stocks have no information content for announcing firms' returns (after controlling for announcing firms' net order flows and lagged returns).[20]

I estimate the following system:

$$R_t = \alpha + \sum_{i=0}^{k} \beta_i V_{t-i} + \sum_{i=1}^{k} \gamma_i R_{t-i} + \sum_{i=0}^{k} \sum_{w=1}^{W} \beta_i^w V_{t-i} D^w + \sum_{i=1}^{k} \sum_{w=1}^{W} \gamma_i^w R_{t-i} D^w + \epsilon_t \tag{19}$$

$$V_t = \kappa + \sum_{i=1}^{k} \delta_i V_{t-i} + \sum_{i=1}^{k} \theta_i R_{t-i} + \sum_{i=0}^{k} \sum_{w=1}^{W} \delta_i^w V_{t-i} D^w + \sum_{i=1}^{k} \sum_{w=1}^{W} \theta_i^w R_{t-i} D^w + \upsilon_t \tag{20}$$

In the above system, R_t is a (2 x 1) return vector $[R_t^a R_t^c]'$ where superscripts a and c denote announcers and competitors, respectively; V_t is a (2 x 1) signed net order flow vector $[V_t^a V_t^c]'$. R_t is the standardized return over five-minute return interval t and V_t is standardized net order flow (buyer-initiated volume minus seller-initiated volume).[21] Coefficient matrices (2 x 2) are: β_i, γ_i; δ_i and θ_i. Superscript W indicates pre-event, event and post-event windows (days -2 to -1, day 0 and days +1 to +2, respectively). The dummy D^w is equal to 1 if the day is in the event window, 0 otherwise. Intercepts (α and κ) and disturbance terms (ϵ_t and υ_t) are 2 x 1. Because net order flow and return series are standardized, errors are assumed to be homoskedastic.

Equations (19) and (20) are similar to the standard VAR except that contemporaneous net order flows appear on the right-hand side in the returns equations; however, only lagged explanatory variables appear in the net order flow equations. As in Hasbrouck (1991), this is based on the assumption that net order flow can contemporaneously cause quote revisions, while contemporaneous quote revisions cannot cause net order flow. Event window interactions are included to allow cross-stock order flow and returns relationships to vary when the information event is known to have occurred (i.e., near earnings announcements). If most price discovery takes place within own-firm stock, cross-stock coefficients during the event window (e.g., $\beta_i^c + \beta_i^w D^w$ and $\gamma_i^c + \gamma_i^w D^w$ in the announcing firm return equation) will be zero. Both pre- and post- event periods are of interest since information asymmetry (and subsequent price discovery) can exist following public announcements (see e.g., Kim and Verrecchia (1997)). Consistent with that intuition, in the context of foreign exchange, Evans and Lyons (2002b) find greater price impact of trades when public information is flowing rapidly. These interactions will be explored in greater depth in the cross-sectional tests (Section E).

C Main Hypotheses

The two primary predictions from Section I are that competitor trading incentives (1) exist and (2) will vary systematically with firm and industry characteristics. Estimation of Equations (19) and (20) allows for an examination of the first implication. The announcing firm returns equation, R_t^a (Equation (19)), is the primary focus of the analysis.

C.1 Announcing Firm Returns

The model in Section I suggests that if information is revealed in the stocks of non-announcing competitors, β_i^c, the coefficients on non-announcing competing firm net order flow, will be significantly different from zero. Because announcing firm market makers may not directly observe cross-stock net order flow, they might infer net order flow from observed competitor returns. In that case, γ_i^c, the coefficients on non-announcing competing firm returns, would be significantly different from zero. I interpret empirical findings of an informational role for either competitor order flow or returns as evidence consistent with an informational role for trading in competitors' stocks. Equation (19) is estimated to test the following hypotheses:

$H0_1$: In the announcing firm returns equation (R_t^a), competing firm net order flow has no information content. $\beta_i^c = 0$ *i=0,...k*

$H0_2$: In the announcing firm returns equation (R_t^a), competing firm returns have no information content. $\gamma_i^c = 0$ *i=1,...k*

The empirical specification allows for variation in cross-stock information flow across event windows. If all learning takes place within own-firm stock at the time of the announcement then the sum of the estimated coefficients on competitor order flow and returns for the event windows will be zero. From Equations (19) and (20):

$H0_{1w}$: $\beta_i^c + \beta_i^w D^w = 0$ and *$H0_{2w}$:* $\gamma_i^c + \gamma_i^w D^w = 0$.

Recall from Equation (19) that subscripts i on coefficients β and γ represent lagged five-minute intervals. Because markets are not frictionless, past signed order flows of non-announcing competitors may also have information content.

There is no ex ante hypothesis regarding the nature of the information contained in the announcements; however, the positive historical return correlation between announcing firms in the sample (mean of .32) suggests that industry-wide information content tends to dominate competitive information ($\gamma_i^c, \beta_i^c > 0$).

C.2 Competing Firm Returns

If price discovery takes place across stocks rather than within the context of individual stocks, the null hypotheses are identical to the announcing firm tests:

$H0_3$: In the competing firm returns equation (R_t^c), announcing firm net order flow has no information content. $\beta_i^a = 0$ *i=0,...k*

$H0_4$: In the competing firm returns equation (R_t^c), announcing firm returns have no information content. $\gamma_i^a = 0$ *i=1,...k*

For event windows: *$H0_{1w}$:* $\beta_i^a + \beta_i^{aw} D^w = 0$ and *$H0_{2w}$:* $\gamma_i^a + \gamma_i^{aw} D^w = 0$.

C.3 Cross-sectional Considerations

In Section E, I explicitly investigate these predictions by allowing coefficients of the main model to vary with relative market shares, industry concentration and return correlations as well as both liquidity and leverage controls.

C.4 Who Trades? An Interpretation of Cross-stock Information Content

Before presenting the empirical results, I address an important issue regarding the types of traders whose trades might generate cross-stock information linkages. The main model in Section I describes insiders as those who privately observe an information event when it occurs at a particular firm (these could be traditional insiders, employees, analysts following a firm, etc.). Traders either directly observe the information event or they are uninformed. In reality, it may be that some traders gain informational advantages by observing trades by informed agents and that their subsequent trades generate cross-stock linkages. While these "sophisticated traders" have an informational advantage, they are initially uninformed. Unfortunately, it is difficult to determine whether informative trades are being made by insiders, as defined in Section I, or by sophisticated traders. However, what matters is the location (stock) in which these traders choose to transact, not how a particular trader becomes informed. If sophisticated traders choose to make cross-stock trades, given their superior information, they would facilitate information transmission in ways that are consistent with the main model.

Importantly, if sophisticated traders learn from the trades of traditional insiders, the insiders and sophisticated traders will differ only in the extent to which their trades in a particular firm are subject to regulatory scrutiny. Asymmetric regulation (e.g., Section 16 constraints on own-firm trades) implies that whenever it is optimal for a traditional insider to trade in the stock of the announcing firm, it must also be optimal for a sophisticated trader to do so. The reverse does not necessarily hold. One can then interpret an empirical finding that information flows from the stock of a competing firm to the announcing firm as evidence of competitor trading by either (i) insiders, as described in Section I, or (ii) both insiders and sophisticated traders.

D Competitor Trading Incentives? Results of the Cross-Stock Spillover Analysis

The results of estimation of Equations (19) and (20) are presented in Tables IIIa and IIIb. The discussion focuses on benchmark results and pre- and post-event period interactions. Event-day results are not emphasized due to variation in timing of the announcements (i.e., some announcements occur between 9:30 a.m. and 4:00 p.m., so event day 0 will contain both pre- and post-announcement trades).

D.1 Announcing-Firm Returns Equation

The estimated coefficients on competing firm order flow and returns in the announcing firm equation (R_t^a, Equation (19)) are of greatest interest. Consistent with the maintained hypothesis, the results in Table IIIa provide evidence that trading and returns in competing firms' stocks have explanatory power for the stocks of announcing firms, *even after controlling for contemporaneous and lagged announcing-firm order flow and lagged announcing-firm returns.* This is important since it is often assumed that price discovery takes place within a single security rather than through interaction across related markets.[22] Further, the coefficients on the event-period interactions show that cross-stock learning continues even during periods in which it is known that an information event has occurred at the announcing firm. In fact, the insignificant estimates of event-window interaction terms indicates that the cross-stock learning remains largely unchanged in the aggregate sample. Another important observation from the tables is that the magnitudes of the estimated coefficients decline with lag length, suggesting a rapid incorporation of information into prices.

[TABLE IIIa ABOUT HERE]

Note that the model is estimated using 6 lags; however, only 3 are reported in the tables (for brevity). Six lags are chosen based on examination of autocorrelations and cross-autocorrelations and for consistency with prior studies.[23] One potential concern is the possibility that any observed price impacts are reversed over longer lags, leading the truncation at six lags to produce spurious results. The observed declining magnitudes of the estimated coefficients in the table, at least in part, address this concern.

D.2 Competitor Returns Equation

The results from the competitor returns equation are presented in Table IIIb and are qualitatively similar to the results in the announcing firm equation. Order flow equations (20) are estimated but not reported (for brevity) since returns equations are the central focus.

[TABLE IIIb ABOUT HERE]

D.3 Joint Tests, Direction of Information Flow and Benchmark Comparison

In addition to the individual cross-stock coefficients, their joint significance is of interest. Table IV presents the sums of the estimated coefficients on competing firm returns and net order flow from the announcing firm returns Equation (19). I also present sums of the coefficients on announcing-firm returns and order flow from the competing-firm returns equations. I test the joint null hypothesis that the sums of the cross-stock coefficient estimates are not statistically different from zero. To provide further insight into the direction of information transmission, I also test the cross-equation restriction that the cross-stock price impacts of order flow and returns are the same for announcers and competitors: (1) $\sum_{i=0}^{6} \beta_i^c - \sum_{i=0}^{6} \beta_i^a = 0$ and (2) $\sum_{i=0}^{6} \gamma_i^c - \sum_{i=0}^{6} \gamma_i^a = 0$. If the difference in the magnitudes of these estimated coefficients is significantly different from zero, then evidence is consistent with a flow of information from the stocks of one group of firms to another.

Consistent with competitor trading, Table IV indicates that information flows via both returns and order flows in competitors' stocks even when an information event is known to have occurred at a particular firm. Event-window interactions indicate that announcing-firm order flow does have a larger cross-stock price impact during the pre-event period, but (importantly) there is no corresponding decrease in the cross-stock price impact of competitor order flow. During this pre-event period the cross-stock price impact of announcing-firm returns decreases and order flow increases, suggesting that market makers expect more information from trades prior to the announcement. Competitor order flow and returns remain informative for announcing-firm stock returns.

The results in Table IV indicate that competitor order flow actually becomes more informative during the post-event period. This could be a result of information from trading in the sense of superior processing of information contained in the announcement (e.g., in Kim and Verrecchia (1997)) as opposed to traditional "informed/insider trading" on non-public information.

[**TABLE IV ABOUT HERE**]

Table IV presents pooled results for all events and announcer-competitor pairs. I also divide the sample in half according to the relative market shares of the announcer and competitor. Results are in Table V. Panel A shows results of estimating the structure of information transmission when competitors are relatively small and Panel B shows results for relatively large competitors. It is evident that the structure of price discovery changes during the event period and relative size plays an important role. In the benchmark period, information tends to flow via returns from relatively large firms to relatively small ones, whereas information from order flow is transmitted in both directions regardless of relative size. The returns findings are consistent with the findings in Hou (2003) that returns on large firms lead returns on small firms within the same industry. During the pre-event period, there appears to be greater information transmission via order flow and less transmission via returns between announcers and smaller competitors. This is consistent with market makers expecting to learn more from order flow during periods in which information asymmetry is high. While the sign of the estimated coefficient on the pre-event window interaction with small-competitor order flow is positive, as predicted (i.e., that there is informed trading in the stocks of smaller competitors), it is not significant at conventional levels. For larger competitors, there are no significant changes during the pre-event period; however, during the post-event period, there is actually an increase in the informativeness of competitor order flow. This is somewhat surprising, but may be related to the liquidity of the stocks of larger competitors. The cross-sectional analysis in the next section will control for liquidity.

[TABLE V ABOUT HERE]

To summarize, the main conclusion from the announcing-firm returns equation is that competing-firm order flow and returns convey information for announcing-firm returns, even after controlling for contemporaneous and lagged own-firm net order flow and lagged own-firm returns. This cross-stock information transmission is evident even during periods in which an information event is known to have occurred at the announcing firm.[24]

E Cross-Sectional Relationships

The results in the previous section are important since they are consistent with the competitor trading incentives described in Section I. However, beyond an informational role for trading in competitors' stocks, the model presented in Section I also suggests that competitor trading will vary with firm market shares and the type of information expected to be contained in the announcement ("competitive" versus "industry-wide"). For a deeper analysis of the process by which information is incorporated into the prices of related securities, I re-estimate the announcing-firm returns equation (R_t^a), allowing the estimated coefficients on competitor order flow and returns to vary with relative market shares, industry concentration, return correlations (measured ex ante). I also control for differences in liquidity and leverage.

The model is specified as follows:

$$R_t^a = \delta X + \sum_{i=0}^{6} \beta_{ix}^c V_{t-i}^c X + \sum_{i=0}^{6} \sum_{w=1}^{3} \beta_{ixw}^{cw} V_{t-i}^c X D^w + \sum_{i=1}^{6} \gamma_{ix}^c R_{t-i}^c X + \sum_{i=1}^{6} \sum_{w=1}^{3} \gamma_i^{cw} R_{t-i}^c D^w +$$

$$\sum_{i=0}^{6} \beta_i^a V_{t-i}^a + \sum_{i=0}^{6} \sum_{w=1}^{3} \beta_i^{aw} V_{t-i}^a D^w + \sum_{i=1}^{6} \gamma_i^a R_{t-i}^a + \sum_{i=1}^{6} \sum_{w=1}^{3} \gamma_i^{aw} R_{t-i}^a D^w + \epsilon_t \qquad (21)$$

The specification is the same as Equation (19), but a vector X of cross-sectional variables and the associated coefficients have been added. The components of X are: 1, relative market share, HHI, return correlation, relative liquidity and relative debt.

1. *RHSARE* is relative market share, defined as the (log) ratio of year t−1 shares of sales in the industry to competitor share.
2. *HHI* is industry concentration, defined as the sum of squared market shares in industry i during year t−1.
3. *RETC* is the stock return correlation of the announcers and competitors, calculated with daily data for the year ending thirty days prior to the earnings announcement.
4. *RLIQ* is relative liquidity, defined as the (log) ratio of daily turnover in the competitor stock to announcer stock during the year ending thirty days prior to the announcement.

5. *RDEBT* is relative debt, defined as the (log) ratio of announcing-firm leverage to the leverage of the competing firm. Leverage ratios are defined as total debt divided by book value of equity in year $t-1$.

Based on the hypothesis that relatively weak firms are attractive venues for information-based trades, I expect that relative market share will increase the information content of competing-firm net order flow and returns. I also expect higher cross-stock information content when the returns of the announcers and competitors tend to be highly correlated. Here, historical return correlation is a proxy for the relative amounts of industry-wide versus competitive information. I also include industry *HHI* since I expect cross-stock information content from competitors in more concentrated industries. I control for liquidity and leverage with the *RLIQ* and *RDEBT* interactions. Informed traders may prefer to trade in more liquid stocks, implying less competitor stock information content when announcing-firm stock is relatively liquid; on the other hand, equilibrium price impacts of trade in illiquid stocks will be greater if it is possible that information-based trades will occur in those stocks. Ex ante, this suggests that it is important to control for liquidity; however which of these effects dominates is an empirical question. The model presented in Section I assumes all-equity firms. Because capital structure will impact stock price volatility, I include a relative leverage variable to control for differences in volatility associated with leverage.

Table VI presents the results. The standard errors on estimated coefficients are noisier due to the number of parameters being estimated; however, the results indicate that cross-sectional characteristics are important. There are several important observations. First, the results from the pre-announcement period suggest that when the market share of the announcer is large relative to the competitor, competitor order flow becomes more informative. This is consistent with the cross-sectional predictions in Section I. Interestingly, the reverse holds for returns. That is, when announcers are relatively large, there is less cross-stock information flow in competitor returns. It may be that public information is quickly reflected in larger stocks' returns (consistent with the findings in the cross-stock return autocorrelation literature e.g., Lo and MacKinlay (1990); Badrinath, Kale and Noe (1995); Sias and Starks (1997)), whereas information from trades can flow in the opposite direction.

Second, the expected type of information matters. During the benchmark period, the estimated coefficients on the historical return correlation interaction are positive and significant for both order flow and returns. In fact, this proxy for relative amount of industry-wide versus competitive information is the most important determinant of cross-stock information transmission during "normal" periods. During the pre-event period, this sign actually switches and more competitive information matters. It might be that competitive information becomes relatively more important near earnings announcements.

Finally, the most significant cross-sectional differences are related to the changes of the pre-event period. During the post-event period, estimated coefficients on the cross-sectional interactions are insignificant, with the exception of market share. After the information is released to the public, there is less cross-stock information from the trades in relatively small competitors.

[**TABLE V ABOUT HERE**]

III Conclusions

In this paper, I present a simple model of informed trading in which asset values are derived from imperfectly competitive product markets and information events occur at individual firms. Information-based trades can occur in the stocks of firms other than the firm at which an information event occurs. The primary cross-sectional implication is that when information events occur at dominant, large market share firms, insiders are more likely to make information-based trades in the stocks of competitors. The intuition for this result is that firms with large market shares are less vulnerable to shocks, making them less attractive locations for information-based trades. A second prediction is that the informed trader's trading location decision also depends on the content of privately observed information ("competitive" versus "industry-wide").

The empirical investigation examines the hypothesis that informed trade may occur in stocks of competitors. In particular, for a sample of 759 earnings announcements, I use aggregate trade data to examine cross-stock net order flow and returns relationships. The most important finding is that even during announcement periods, trading and returns in competitors' stocks have information content beyond that contained in own-firm order flow and returns. This is consistent with competitor trading. While the strongest cross-sectional evidence is that information type ("competitive" versus "industry-wide") determines the informativeness of cross-stock trading and returns, there also is some evidence that relative market shares play a role in pre-announcement price discovery.

Notes

[1]The terms "informed traders" and "insiders" refer to all traders who are informed when an information event occurs at a given firm. Broadly, this would include corporate insiders, employees, their tippees and analysts following the firm who have access to information before it is released to the market.

[2]In practice, while little is known regarding the extent to which competitor trading occurs, there is anecdotal evidence. Consider a *Wall Street Journal* article pointing to an information leak regarding the development of a medical device by Boston Scientific. In the hours prior to the public announcement, trading in Boston Scientific was halted, but Johnson & Johnson shares declined 2.5% on high trading volume. In addition, "there was an even sharper drop in the same period of shares of SurModics Inc., a smaller company that supplies an important component of J&Js." *WSJ 9/18/2003 C3.*

[3]There is a small theoretical literature on informed trading in multiple stock settings, where securities have correlated fundamentals (e.g., Subrahmanyam (1991); Gorton and Pennacchi (1993); Caballe and Krishnan (1994); Bhattacharya, Reny and Spiegel (1995)). This paper differs in focus from these in that I examine the role of product markets in generating the correlated fundamentals and implications of varying the location (firm) at which private information is observed.

[4]Program trading has become increasingly important, with average weekly volume as a percentage of NYSE volume up from 19 in 1999 to 57% in 2005 (source: NYSE.com). See Harris, Sofianos and Shapiro (1994) for relationships between program trading and price movements.

[5]Following the adoption of Regulation Fair Disclosure in October 2000, analysts are less likely to have access to firms' material nonpublic information.

[6]Rights to future T-period cashflows might be a more realistic interpretation. Because the solution to the T-period game is the same as the one-shot solution, a single production period is assumed.

[7]This can be extended to include insiders at Firm 2. The resulting intuition regarding trading incentives is the same. I present the basic case for purposes of exposition.

[8]Examples can be found in, e.g., Henderson and Quandt (1980).

[9]Back (1993) shows a distinct informational role for options in that they increase the types of signals the market receives.

[10] See e.g., Bainbridge (2000); Ayres and Bankman (2001); Ayres and Choi (2002). Ayers and Bankman (2001) note that the default rule when firms are silent on the issue of competitor trading by employees is unclear. While not the focus of this study, competitor trading by firms is legal.

[11]Policies are as of May 2006 and are possibly tighter than restrictions during the 1993 to 2002 period (following Sarbanes Oxley in 2002).

[12] Trading on material information in the stocks of rivals is explicitly restricted in 12 of 60 cases (6 each of Dow and Nasdaq-100 firms). This is substantially fewer than the 18 cases in which customers, suppliers and partners are explicitly mentioned. The codes of an additional 18 firms do not specifically mention competitors but might be interpreted to include rivals. Vague statements or silence on the issue might exist to provide firms with some discretion in blocking competitor trading. I would like to thank the referee for this point and for motivating this line of inquiry.

[13]In their conflict of interest statements, I find explicit mention of *ownership* in competitors in 35 of 60 cases. Firms care about levels of holdings, but silence and broad language governing trading implies they care less about gains made from acquiring/disposing of competitors' stock. The allowed ownership ranges are large (usually between 1 and 5% of the competitors' shares outstanding or 10 to 25% of wealth) and may not constrain employee trading gains. It is also significant that seven firms prohibit short positions in own-firm stock by employees. Gains from shorting competitors would be possible, as there are no examples of shorting restrictions in any other firm's securities.

[14]Financial institutions and conglomerates (SIC codes 6000-6299, 6600-6999 and 9997) are excluded.

[15]Where *COMPUSTAT* dates are unavailable, I/B/E/S dates are used. Announcement dates (and times) are confirmed via a *Factiva* newswire search. Announcements in which news dates and *COMPUSTAT/IBES* dates differ by more than one day are deleted. Otherwise, newswire dates are used. The author gratefully acknowledges Thompson Financial for providing the earnings announcement data as part of a broad academic program to encourage earning expectations research.

[16]The model in this paper includes only two alternatives for trading location. Most industries have several competitors and informed traders may choose to transact in several stocks (or in options). Analyzing only one competitor's stock would bias results against a finding of significant information content of non-announcing firm order flow and returns.

[17]Correlations measure average co-movement and potentially understate competitor trading opportunities since an informed trader would know the type of privately observed information and the

correct cross-stock trading directions.

[18]The pre-event benchmark is based on findings in Chae (2005), which reports abnormally low own-firm turnover beginning on day -10 and continuing through day -3 relative to earnings news. The post-event benchmark assumes that announcement-related uncertainty is resolved within 10 days.

[19]If the bid and ask quotes are not updated simultaneously, the bid-ask bounce is not entirely eliminated and quote midpoints will exhibit a portion of the bounce. However, two points should be noted: (1) potential problems are reduced relative to transactions prices; and (2) this would primarily impact estimated autocorrelations in own-firm returns rather than cross-stock relationships.

[20]While different in focus and methods, the commonality in liquidity literature suggests the importance of order flow beyond own-firm stock. Using 15 broad industry classifications, Harford and Kaul (2005) find that both aggregate market index and industry order flows explain returns and that market index order flows are more important on average. Chordia *et al.* (2000) report larger coefficients on industry variables than market variables for 3 of 5 measures of liquidity. Note that there are substantial differences between these studies and the empirical model in this paper. In Harford and Kaul (2005) the only explanatory variables are order flows (i.e., all lagged returns are excluded). In addition, industry and market index order flows are calculated by summing the number of trades across stocks. This measure is less relevant to the current paper since it under-weights small firms' impact. Chordia *et al.* (2000) measure variation in liquidity, not returns.

[21]The model is also estimated using net trades, rather than net volume. The R-square for the returns regressions using trades is substantially higher (.17 versus .14), but results are not qualitatively different. Net volume results are presented, following the literature.

[22]The importance of own-security order flow and lagged returns has been well-documented across a range of security markets (see e.g., Evans and Lyons (2002) for foreign exchange markets).

[23]I estimated the model over longer intervals (up to 10 lags). The conclusions are unchanged.

[24]I re-estimated Equations (19) and (20) for several subsamples: "high event-period price reaction" announcements; pre- and post- NYSE minimum tick reductions (eighths to sixteenths in 1997 and to one penny in 2001); and the 119 cases in which the announcements are the first quarterly announcements in the industry. While there is some variation in the magnitude of the coefficients across subsamples, the evidence of cross-stock learning is robust.

References

Aboody, David and Baruch Lev, 2000, Information asymmetry, R&D and insider gains, Journal of Finance 45, 2747-2766.

Allen, Jeffrey W. and Gordon M. Phillips, 2000, Corporate equity ownership, strategic alliances, and product market relationships, Journal of Finance 55, 2791-2815.

Anthony, Joseph H., 1988, The interrelation of stock and option market trading volume data, Journal of Finance 43, 949-961.

Ayres, Ian and Joseph Bankman, 2001, Substitutes for insider trading, Stanford Law Review 54, 235-294.

Ayres, Ian and Stephen Choi, 2002, Internalizing outsider trading, Michigan Law Review 101, 313-408.

Badrinath, S. G., Jayant R. Kale and Thomas H. Noe, 1995, Of shepherds, sheep, and the cross-autocorrelations in equity returns, Review of Financial Studies 8, 401-30.

Back, Kerry, 1993, Asymmetric information and options, Review of Financial Studies 6, 435-472.

Bainbridge, Stephen M., 2000, "Insider Trading," in *The Encyclopedia of Law & Economics* 772-812 (Vol. III, Edward Elgar Publishing).

Bettis, Carr, Jeffrey Coles and Michael Lemmon, 2000, Corporate policies restricting trading by insiders, Journal of Financial Economics 57, 191-220.

Bhattacharya Utpal, Philip J. Reny and Matthew Spiegel, 1995, Destructive interference in an imperfectly competitive multi-security market, Journal of Economic Theory 65, 136-70.

Biais, Bruno and Pierre Hillion, 1994, Informed trading in stock and options markets, Review of Financial Studies 74, 743-780.

Bittlingmayer, George and Thomas W. Hazlett, 2000, DOS Kapital: Has antitrust action against Microsoft created value in the computer industry? Journal of Financial Economics 55, 329-359.

Brander, James A. and Tracy R. Lewis, 1986, Oligopoly and financial structure: The limited liability effect, American Economic Review 76, 956-970.

Caballe, Jordi and Murugappa Krishnan, 1994, Imperfect competition in a multi-security market with risk-neutrality, Econometrica 62, 695-704.

Cao, Henry, Zhiwu Chen and John Griffin, 2005, The information content of option volumes prior to takeover announcements, Journal of Business 78, 1073-1109.

Chae, Joon, 2005, Trading volume, information asymmetry, and timing information, Journal of Finance 60, 413-442.

Chakravarty, Sugato, Huseyin Gulen and Stewart Mayhew, 2004, Informed trading in stock and option markets, Journal of Finance 59, 1235-1258.

Chan, Kalok, 1992, A further analysis of the lead-lag relationship between the cash market and stock index futures market, Review of Financial Studies 5, 123-152.

Chan, Kalok, Peter Y. Chung and Wai-Ming Fong, 2002, The informational role of stock and option volume, Review of Financial Studies 15, 1949-1975.

Chevalier, Judith A. and David S. Scharfstein, 1996, Capital-market imperfections and countercyclical markups: Theory and evidence, American Economic Review 86, 703-25.

Chordia, Tarun, Richard Roll and Avanidhar Subrahmanyam, 2000, Commonality in liquidity, Journal of Financial Economics 56, 3-28.

Christophe, Stephen E., Michael G. Ferri and James J. Angel, 2004, Short-selling prior to earnings announcements, Journal of Finance 59, 1845-1876.

DeMarzo, Peter M., Michael Fishman and Kathleen M. Hagerty, 1998, The optimal enforcement of insider trading regulations, Journal of Political Economy 106, 602-32.

Dufour, Alfonso and Robert F. Engle, 2000, Time and price impact of a trade, Journal of Finance 55, 2467-98.

Easley, David and Maureen O'Hara, 1987, Price, trade size and information in securities markets, Journal of Financial Economics 19, 69-90.

Easley, David, Maureen O'Hara and P.S. Srinivas, 1998, Option volume and stock prices: Evidence on where informed traders trade, Journal of Finance 53, 431-465.

Evans, Martin and Richard Lyons, 2002a, Order flow and exchange rate dynamics, Journal of Political Economy 110, 170-80.

Evans, Martin and Richard Lyons, 2002b, Time-varying liquidity in foreign exchange, Journal of Monetary Economics 49, 1025-1051.

Finnerty, Joseph E., 1976, Insiders and market efficiency, Journal of Finance 31, 1141-1148.

Fishe, Raymond P.H. and Michael A. Robe, 2004, The impact of illegal insider trading in dealer and specialist markets: evidence from a natural experiment, Journal of Financial Economics 71, 461-88.

Fishman, Michael J. and Kathleen M. Hagerty, 1992, Insider trading and the efficiency of stock prices, Rand Journal of Economics 23, 106-22.

Foster, George, 1981, Intra-industry information transfers associated with earnings releases, Journal of Accounting and Economics 3, 201-32.

Freeman, Robert N. and Senyo Y. Tse, 1992, An earnings prediction approach to examining inter-company information transfers, Journal of Accounting and Economics 15, 509-23.

Glosten, Lawrence and Paul Milgrom, 1985, Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders, Journal of Financial Economics 14, 71-100.

Gorton, Gary and George G. Pennacchi, 1993, Security baskets and index-linked securities, Journal of Business 66, 1-27.

Hansen, Robert G. and John R. Lott, Jr., 1995, Profiting from induced changes in competitors' market values: The case of entry and entry deterrence, Journal of Industrial Economics 43, 261-76.

Harford, Jarrad and Aditya Kaul, 2005, Correlated order flow: Pervasiveness, sources, and pricing effects, Journal of Financial and Quantitative Analysis 40, 29-55.

Harris, Lawrence, 1989, The October 1987 S&P 500 stock-futures basis, Journal of Finance 44, 77-99.

Harris, Lawrence, George Sofianos and James E. Shapiro, 1994, Program trading and intraday volatility, Review of Financial Studies 7, 653-685.

Hasbrouck, Joel, 1991, Measuring the information content of stock trades, Journal of Finance 46, 179-207.

Hasbrouck, Joel and Duane J. Seppi, 2001, Common factors in prices, order flows and liquidity, Journal of Financial Economics 59, 383-411.

Heflin, Frank, K.R. Subramanyam and Yuan Zhang, 2003, Regulation FD and the financial information environment: Early evidence, Accounting Review 78, 1-37.

Henderson, James M., Richard M. Quandt, 1980, *Microeconomic Theory : A Mathematical Approach, 3rd Edition* (McGraw-Hill, New York).

Hertzel, Michael G., 1991, The effects of stock repurchases on rival firms, Journal of Finance 46, 707-716.

Hou, Kewei, 2003, Information diffusion and the lead-lag effect in stock returns, Working Paper, Ohio State University.

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

Jain, Neelam and Leonard J. Mirman, 2000, Real and financial effects of insider trading with correlated signals, Economic Theory 16, 333-353.

Jeng, Leslie A., Andrew Metrick and Richard Zeckhauser, 2003, Estimating the returns to insider-trading: A performance-evaluation perspective, Review of Economics and Statistics 85, 453-71.

Johannes, Laura and Ron Windslow, 2003, Johnson & Johnson Shares Fall After Leak of Study on Rival , *Wall Street Journal,* September 18, C3.

Kim, Oliver and Robert E. Verrecchia, 1997, Pre-announcement and event-period information, Journal of Accounting and Economics 24, 395-419.

Kyle, Albert S., 1985, Continuous auctions and insider trading, Econometrica 53, 1315-35.

Lakonishok, Josef and Inmoo Lee, 2001, Are insider trades informative? Review of Financial Studies 14, 79-111.

Lang, Larry H. and Rene M. Stulz, 1992, Contagion and competitive intra-industry effects of bankruptcy announcements, Journal of Financial Economics 32, 45-60.

Laux, Paul, Laura T. Starks and Pyung Sig Yoon, 1998, The relative importance of competition and contagion in intra-industry information transfers: An investigation of dividend announcements, Financial Management 27, 5-16.

Lee, Charles and Mark Ready, 1991, Inferring trade direction from intraday data, Journal of Finance 46, 733-746.

Lo, Andrew W. and Craig A. MacKinlay, 1990, When are contrarian profits due to stock market overreaction? Review of Financial Studies 3, 175-205.

Madhavan, Ananth, Matthew Richardson and Mark Roomans, 1997, Why do security prices change? A transaction-level analysis of NYSE stocks, Review of Financial Studies 10, 1035-1064.

Maksimovic, Vojislav and Sheridan Titman, 1991, Financial policy and reputation for product quality, Review of Financial Studies 4, 175-200.

Masson, Robert T. and Ananth Madhavan, 1991, Insider trading and the value of the firm, Journal of Industrial Economics 39, 333-353.

Seyhun, H. Nejat, 1986, Insiders' profits, costs of trading and market efficiency, Journal of Financial Economics 16, 189-212.

Seyhun, H. Nejat, 1998, *Investment Intelligence from Insider Trading* (The MIT Press, Cambridge).

Sias, Richard W. and Laura T. Starks, 1997, Return autocorrelation and institutional investors, Journal of Financial Economics 46, 103-131.

Stephan, Jens A. and Robert E. Whaley, 1990, Intraday price change and trading volume relations in the stock and options markets, Journal of Finance 45, 191-220.

Subrahmanyam, Avanidhar, 1991, A theory of trading in stock index futures, Review of Financial Studies 4, 17-51.

IV Appendix

This appendix provides additional discussion of the model presented in Section I.

A1. Mixed Strategies $\alpha\epsilon$(0,1)

The analysis and intuition for the mixed-strategy case is almost identical to the $\alpha = 0$ case. Recall that if the conditions for a pure strategy in competitor trades do not hold, there are two possibilities: (1) pure strategy in own-firm trades; or (2) a mixed-strategy equilibrium. For the intuition behind a mixed-strategy equilibrium, consider a case in which the expected sensitivity of firm value to the private information is equal across the two securities. If all of Firm 1's insiders choose to trade in own-firm stock, the market maker's quotes will take into account full informed participation in Stock 1 and Stock 2's quoted spreads would reflect no expected informed participation. This would give at least some of Firm 1's insiders incentive to trade in Stock 2.

After observing a low signal regarding firm-specific costs, Firm 1's insiders will trade in Firm 2's stock with positive probability if:

$$\frac{(V_2^H - V_2^L)}{V_2^*} > \frac{(V_1^H - V_1^L)f(1-\theta\mu)}{V_1^* f(1-\theta\mu) + \delta V_1^L \theta\mu} \tag{A1}$$

The argument is as follows: Let $\alpha = 1$ (pure strategy in own-firm trades). If, given that all insiders trade in Stock 1, returns from trade in Stock 2 are greater than own-firm returns, then it must be that $\alpha < 1$. When $\alpha = 1$, returns to trade in Stock 1 (given a low signal) are:

$$\frac{b_1 - V_1^L}{b_1} = \frac{(1-\delta)(V^H - V_1^L)f(1-\theta\mu)}{(\delta V_1^L + (1-\delta)V_1^H)f(1-\theta\mu) + \delta V_1^L \theta\mu} = \frac{(1-\delta)(V_1^H - V_1^L)f(1-\theta\mu)}{V_1^* f(1-\theta\mu) + \delta V_1^{L1} \theta\mu} \tag{A2}$$

For Stock 2, returns are:

$$\frac{V_2^L - a_2}{a_2} = \frac{(1-\delta)(V_2^H - V_2^L)}{(\delta V_2^L + (1-\delta)V_2^H)} = \frac{(1-\delta)(V_2^H - V_2^L)}{V_2^*} \tag{A3}$$

■

Given that the conditions for a mixed strategy equilibrium are satisfied, the equilibrium α^* for the first trade of the day is:

$$\alpha^* = \frac{f(V_1^H - V_1^L)[(1-\theta\mu)gV_2^* + \theta\delta\mu V_1^{L1}] - g(V_1^H - V_1^L)f(1-\theta\mu)V_1^*}{\theta\delta\mu[g(V_2^H - V_2^L)V_1^L + f(V_1^H - V_1^L)V_2^L]} \tag{A4}$$

Substituting product market parameters into (A1) provides conditions for a mixed-strategy equilibrium that are analogous to Inequality (14):

$$s_1[f(1-\theta\mu) + \frac{\theta\mu_1}{2})] - 2s_2 f(1-\theta\mu) > \frac{2\Delta c\theta\mu}{2a - c_1 - c_2} \tag{A5}$$

Informed competitor trading is more likely when own firms have large market shares. Conditions for a pure strategy in own-firm trades are analogous, but Inequality (A5) is reversed.

A2. Industry HHI

The within-industry market share result in Inequality (14) also has between-industry implications. Consider two industries identical in all respects except the marginal cost of the lowest-cost firm, Firm L. Market share is decreasing in c, so the lowest-cost firm will have $s_L^I > \frac{1}{2}$. A standard measure of industry competitiveness is the Hirschman-Herfindahl Index (HHI), the sum of squared market shares. Higher HHI suggests a less competitive industry. In the Cournot example:

$$HHI = s_L^2 + (1 - s_L)^2 = F(s_L(c_L, c_H)) \tag{A6}$$

This is strictly increasing in s_L for s_L greater than $\frac{1}{2}$. If c_L decreases, both HHI and competitor trading incentives increase. Between industries, *all else equal, the range of microstructure parameters for which there will be a pure strategy in competitor trades is increasing in industry concentration (HHI).*

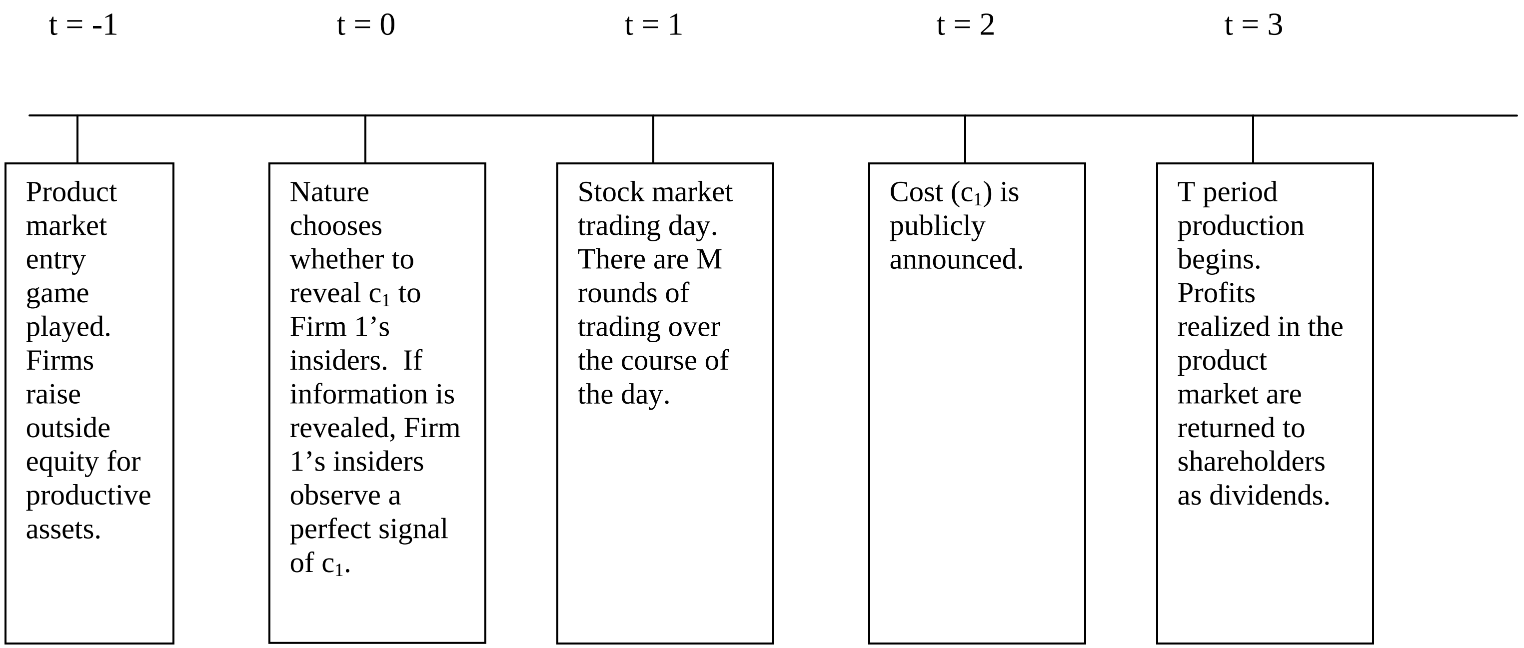

Figure 1. Timeline

This figure shows the timeline of events.

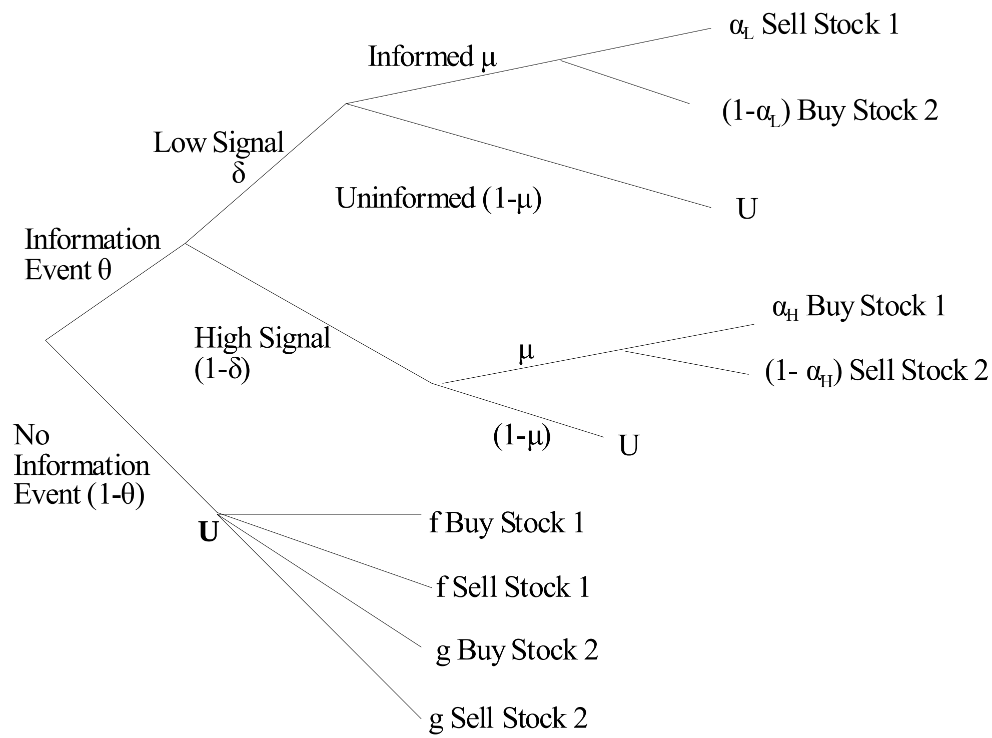

Figure 2. Structure of Stock Trading: Firm-Specific (Competitive) Information Event

This figure gives the structure of information revelation and stock market trading. With probability θ, nature reveals a perfect signal of future own-firm costs to Firm 1's insiders. The signal reveals a low state with probability δ and a high state with probability $(1-\delta)$. Fractions μ and $(1-\mu)$ traders are informed and uninformed, respectively. Of the $(1-\mu)$ uninformed, fractions f buy/sell Stock 1 and g buy/sell Stock 2. Uninformed nodes U are equal and $2f+2g = 1$. Fractions α_L and α_H are the informed traders who choose to trade in Stock 1 after observing a low signal and high signal, respectively.

Table I
Empirical Implications

This table presents the four possible equilibrium strategies for informed traders: pure strategy in own-firm trades; pure strategy in competitor trades; mixed strategy, in which informed trader trades in both own and competitor stocks with positive probabilities; no trade. "Yes" and "No" indicate whether returns and order flow of announcing and competing firms are predicted to have information content across stocks during periods in which information events occur at individual firms. Note that the main model suggests an informational role for order flow across own- and competing firms; however, because order flow may not be directly observable across stocks, returns may also have cross-stock information content.

Cross-stock information content?	**Own-Firm Order Flow**	**Competitors' Order Flow**
Type of Equilibrium		
Pure Strategy in Announcer Stock	Yes	No
Pure Strategy in Competitor Stock	No	Yes
Mixed Strategy	Yes	Yes
No trade	No	No

Table II

Summary of Trading Volume, Returns and Firm Characteristics

This table summarizes the sample of announcers and competing firms. There are 759 valid announcements in 128 industries (4-Digit SIC codes). For each valid announcement, I require at least one actively traded competitor on the NYSE or AMEX. Trading volume and price changes (returns) are based on *CRSP* data. Trade data are from *TAQ*. Event period volumes, price changes and trades are calculated over days -2 to +2 relative to the announcement day. "Pre-Event" volumes, trades and price changes are calculated over days -2 and -1. Abnormal price changes are based on market models estimated over the benchmark 365 calendar days ending 30 days prior to the announcement. Trading volume and return correlations are calculated over the same period. Event period abnormal trading volume is defined as $[V_e/V_B]$ where V_e is average daily event period volume and V_B is benchmark daily volume. Event period abnormal trades are defined as $[T_e/T_B]$. Market shares and industry HHI (sum of sqared market shares of all *COMPUSTAT* firms in the same 4-digit SIC code as the announcing firm) are based on year t-1 total sales.

	Announcing Firms			Competitors		
	Mean	Median	Std. Dev	Mean	Median	Std. Dev
Volume and Returns						
Avg. Daily Volume ($000)	27,593	9,700	51,229	32,889	12,738	62,282
Avg. Daily Trades	446	208	790	501	232	775
Event Period Abnormal Price Change (%)	0.14%	0.14%	0.09	0.29%	-0.06%	0.06
|Event Per. Abnormal Price Change| (%)	6.46%	4.43%	0.07	4.86%	3.43%	0.05
Pre-Event Abnormal Price Change (%)	0.26%	-0.10%	0.07	0.13%	0.07%	0.04
|Pre-Event Abnormal Price Change| (%)	3.16%	1.92%	0.06	2.70%	1.92%	0.00
Event Period Abnormal Trades	1.37	1.19	0.94	1.14	1.02	0.58
Pre-Event Abnormal Trades	1.43	1.24	0.95	1.14	1.01	0.62
Event Period Abnormal Volume	1.56	1.29	1.81	1.19	1.01	0.63
Pre-Event Abnormal Volume	1.24	0.98	2.31	1.19	0.96	0.85
Industry and Firm Characteristics						
Firm Market Share	0.18	0.13	0.18	0.21	0.15	0.19
Industry HHI	0.2594	0.2190	0.1671	0.2594	0.2190	0.1672
Trading Volume Correlation with Announcer	1.000	1.000	0.000	0.186	0.177	0.155
Return Correlation with Announcer	1.000	1.000	0.000	0.316	0.292	0.175
Equity Market Capitalization ($M)	6,427	2,090	10,701	9,010	3,111	23,948

Table III(a)
Signed Order Flow and Returns of Announcing and Competing Firms

This table presents regression results where the dependent variable is announcing firm return over 5-minute interval t. Independent variables are lagged returns and both lagged and contemporaneous order flows in announcing and competing firms. R_t and RC_t denote announcer and competitor returns, respectively. They are defined as $\log(P_t/P_{t-1})$, where P_t is the quote midpoint at the end of 5-minute interval t. Order flows are denoted V_t and VC_t and are defined as buyer- minus seller-initiated volume. All variables are standardized using mean and standard deviation of returns and order flows for each firm over each trading day. The full set of equations (estimated separately by OLS) are:

$$R_t, RC_t = \alpha + \sum_{i=1}^{6}\beta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w} R_{t-i} D^w + \sum_{i=1}^{6}\beta_{6+i} RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{6+i,w} RC_{t-i} D^w + \sum_{i=0}^{6}\gamma_i V_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{i,w} V_{t-i} D^w + \sum_{i=0}^{6}\gamma_{7+i} VC_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{7+i,w} VC_{t-i} D^w + \varepsilon_t$$

$$V_t, VC_t = \kappa + \sum_{i=1}^{6}\delta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\delta_{i,w} R_{t-i} D^w + \sum_{i=1}^{6}\delta_{6+i} RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\delta_{6+i,w} RC_{t-i} D^w + \sum_{i=1}^{6}\theta_i V_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w}\theta_{t-i} D^w + \sum_{i=1}^{6}\theta_{6+i} VC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\theta_{6+i,w} VC_{t-i} D^w + \upsilon_t$$

D^w is a dummy vector indicating event window (pre-event, event day and post-event). Benchmark periods are 10 trading days: 5 days ending two weeks prior to the announcement and 5 days beginning two weeks following the announcement. The pre-announcement period are days -2 and -1 relative to the announcement. Post-announcement period are days +1 and +2. * denotes .1 significance level, ** denotes .05 significance level and *** denotes .01 significance level. There are 772,418 observations. The model is estimated using 6 lags; however, only results from lags 0 to 3 are included in the table (for brevity).

Dependent Variable=R_t, Announcing firm

			Event Window Interactions					
	All Periods (Including Benchmark)		Pre-Announcement Period		Event Date		Post-Announcement Period	
Explanatory Variables	Estimated Coefficient	t-value	Estimated Coefficient	t-value	Estimated Coefficient	t-value	Estimated Coefficient	t-value
Intercept	0.001	0.78						
R_{t-1}	-0.052***	-37.43	0.021***	6.19	0.044***	8.89	0.019***	5.64
R_{t-2}	-0.028***	-20.08	0.008**	2.52	0.024***	4.81	0.010***	2.88
R_{t-3}	-0.016***	-11.38	0.005	1.55	-0.002	-0.34	0.009***	2.65
V_t	0.342***	288.29	0.010***	3.43	-0.045***	-11.47	-0.011***	-3.96
V_{t-1}	0.033***	25.71	-0.008***	-2.61	-0.011**	-2.47	-0.001	-0.25
V_{t-2}	0.003**	2.40	-0.003	-1.05	-0.004	-0.91	-0.003	-1.04
V_{t-3}	0.000	-0.36	0.000	-0.15	0.002	0.49	-0.006*	-1.79
RC_{t-1}	0.021***	15.49	0.000	-0.10	-0.009*	-1.95	-0.003	-0.98
RC_{t-2}	0.013***	9.77	0.000	-0.01	-0.008*	-1.68	0.000	-0.08
RC_{t-3}	0.007***	5.29	-0.001	-0.16	0.000	-0.02	-0.002	-0.57
VC_t	0.026***	22.04	-0.003	-1.03	-0.007*	-1.75	-0.003	-0.88
VC_{t-1}	-0.004***	-2.85	-0.001	-0.26	0.009***	2.09	0.005*	1.71
VC_{t-2}	-0.003**	-2.49	0.002	0.48	0.004	0.84	0.004	1.32
VC_{t-3}	0.001	0.69	-0.002	-0.68	0.000	-0.08	-0.001	-0.47
Adjusted R-Square	0.1417							

Table III(b)
Signed Order Flow and Returns of Announcing and Competing Firms

This table presents regression results where the dependent variable is competing firm return over 5-minute interval t. Independent variables are lagged returns and both lagged and contemporaneous order flows in announcing and competing firms. R_t and RC_t denote announcer and competitor returns, respectively. They are defined as $\log(P_t/P_{t-1})$, where P_t is the quote midpoint at the end of 5-minute interval t. Order flows are denoted V_t and VC_t and are defined as buyer- minus seller-initiated volume. All variables are standardized using mean and standard deviation of returns and order flows for each firm over each trading day. The full set of equations (estimated separately by OLS) are:

$$R_t, RC_t = \alpha + \sum_{i=1}^{6}\beta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w}R_{t-i}D^w + \sum_{i=1}^{6}\beta_{6+i}RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{6+i,w}RC_{t-i}D^w + \sum_{i=0}^{6}\gamma_i V_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{i,w}V_{t-i}D^w + \sum_{i=0}^{6}\gamma_{7+i}VC_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{7+i,w}VC_{t-i}D^w + \varepsilon_t$$

$$V_t, VC_t = \kappa + \sum_{i=1}^{6}\delta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\delta_{i,w}R_{t-i}D^w + \sum_{i=1}^{6}\delta_{6+i}RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\delta_{6+i,w}RC_{t-i}D^w + \sum_{i=1}^{6}\theta_i V_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w}\theta_{t-i}D^w + \sum_{i=1}^{6}\theta_{6+i}VC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\theta_{6+i,w}VC_{t-i}D^w + \upsilon_t$$

D^w is a dummy vector indicating event window (pre-event, event day and post-event). Benchmark periods are 10 trading days: 5 days ending two weeks prior to the announcement and 5 days beginning two weeks following the announcement. The pre-announcement period are days -2 and -1 relative to the announcement. Post-announcement period are days +1 and +2. * denotes .1 significance level, ** denotes .05 significance level and *** denotes .01 significance level. There are 772,418 observations. The model is estimated using 6 lags; however, only results from lags 0 to 3 are included in the table (for brevity).

Dependent Variable=RC_t, Competing firm

			Event Window Interactions					
	All Periods (Including Benchmark)		Pre-Announcement Period		Event Date		Post-Announcement Period	
Explanatory Variables	Estimated Coefficient	t-value	Estimated Coefficient	t-value	Estimated Coefficient	t-value	Estimated Coefficient	t-value
Intercept	0.001	0.74						
R_{t-1}	0.024***	17.51	-0.008**	-2.26	-0.002	-0.40	-0.005	-1.52
R_{t-2}	0.012***	8.79	0.002	0.58	-0.002	-0.37	0.002	0.68
R_{t-3}	0.009***	6.82	-0.007**	-1.96	-0.005	-0.97	0.001	0.23
V_t	0.024***	19.84	0.001	0.26	-0.003	-0.66	-0.006*	-1.94
V_{t-1}	-0.002	-1.54	0.002	0.71	0.000	0.08	-0.001	-0.23
V_{t-2}	-0.009**	-2.28	0.001	0.40	0.002	0.44	-0.003	-0.91
V_{t-3}	-0.001	-0.66	-0.001	-0.31	0.003	0.61	0.003	0.92
RC_{t-1}	-0.054***	-38.56	0.005	1.43	0.015***	3.37	0.004	1.30
RC_{t-2}	-0.027***	-19.69	-0.002	-0.52	0.006	1.30	0.004	1.24
RC_{t-3}	-0.015***	-10.83	-0.003	-0.87	0.002	0.43	-0.001	-0.36
VC_t	0.342***	286.07	-0.009***	-3.06	-0.005	-1.26	-0.001	-0.18
VC_{t-1}	0.027***	20.83	0.004	1.41	-0.005	-1.16	0.002	0.77
VC_{t-2}	0.004***	3.06	-0.002	-0.60	-0.007	-1.56	-0.003	-1.04
VC_{t-3}	-0.002	-1.34	-0.002	-0.60	-0.001	-0.26	0.000	0.10
Adjusted R-Square	0.1410							

Table IV
Joint Significance of Event Window-Varying Coefficients

This table presents the sum of the estimated coefficients on cross-stock order flow and returns from the announcer and competitor returns equations.

$$R_t, RC_t = \alpha + \sum_{i=1}^{6}\beta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w} R_{t-i} D^w + \sum_{i=1}^{6}\beta_{6+i} RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{6+i,w} RC_{t-i} D^w + \sum_{i=0}^{6}\gamma_i V_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{i,w} V_{t-i} D^w$$
$$+\sum_{i=0}^{6}\gamma_{7+i} VC_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{7+i,w} VC_{t-i} D^w + \varepsilon_t$$

The dependent variable is 5-minute return. Independent variables are lagged returns and both lagged and contemporaneous order flows in announcing and competing firms. R_t and RC_t denote announcer and competitor returns, respectively. Announcer and competitor order flows are denoted V_t and VC_t and are defined as buyer- minus seller-initiated volume. All variables are standardized using mean and standard deviation of returns and order flows for each firm over each trading day.

"All periods" are all observations from both the benchmark and event periods. The benchmark period is defined as the 5 trading days ending 2 weeks prior to the announcement and 5 trading days beginning two weeks following the announcement. Pre-event days are days -2 to -1 relative to the announcement date; event day is day 0; post-event days are days +1 and +2. "To Announcer from Competitor" indicates information flow from order flow/returns in the competing firm to the announcer (coefficients on competing firm order flow/returns in the announcing firm returns equations). "From Announcer to Competitor" indicates information flow from order flow/returns in the announcing firm to the competitor.

Superscript *a* corresponds to a rejection of the null hypothesis at the .01 significance level; *b* represents the .05 significance level; and *c* represents the .10 significance level.

	All Periods	Pre-Event Interaction	Event Day Interaction	Post-Event Interaction
Returns				
To Announcer From Competitor	0.056[a]	-0.001	-0.028[b]	-0.011
From Announcer To Competitor	0.061[a]	-0.020[b]	-0.006	-0.003
Difference	-0.005	0.019	-0.022	-0.008
Order Flow				
To Announcer From Competitor	0.020[a]	0.001	0.011	0.016[b]
From Announcer To Competitor	0.016[a]	0.014[c]	0.007	-0.005
Difference	0.004	-0.012	0.003	0.021[a]

Table V

Joint Significance of Event Window-Varying Coefficients (by Relative Size)

This table presents the sum of the estimated coefficients on cross-stock order flow and returns from the announcer and competitor returns equations:

$$R_t, RC_t = \alpha + \sum_{i=1}^{6}\beta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w}R_{t-i}D^w + \sum_{i=1}^{6}\beta_{6+i}RC_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{6+i,w}RC_{t-i}D^w + \sum_{i=0}^{6}\gamma_i V_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{i,w}V_{t-i}D^w + \sum_{i=0}^{6}\gamma_{7+i}VC_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{7+i,w}VC_{t-i}D^w + \varepsilon_t$$

The dependent variable is 5-minute return. R_t and RC_t denote announcer and competitor returns, respectively. Announcer and competitor order flows are denoted V_t and VC_t and are defined as buyer- minus seller-initiated volume. All variables are standardized using mean and standard deviation for each firm over each trading day.

"Small (Large) Competitors" are those firms with market shares that are smaller (larger) than announcing firms. D is a vector of dummy variables indicating pre-event period, event and post-event windows (w = 1 , 2 and 3 respectively). For announcing firm returns, the null hypotheses are $\sum_i \beta_{6+i} = 0$ and $\sum_i \gamma_{7+i} = 0$. Similarly, for competing firm returns, the null hypotheses are $\sum_i \beta_i = 0$ and $\sum_i \gamma_i = 0$. "All periods" are all observations from both the benchmark and event periods. The benchmark period is defined as the 5 trading days ending 2 weeks prior to the announcement and 5 trading days beginning two weeks following the announcement. Pre-event days are days -2 to -1 relative to the announcement date; event day is day 0; post-event days are days +1 and +2. "To Announcer from Competitor" indicates information flow from order flow/returns in the competing firm to the announcer (coefficients on competing firm order flow/returns in the announcing firm returns equations). "From Announcer to Competitor" indicates information flow from order flow/returns in the announcing firm to the competitor.
Superscript *a* corresponds to a rejection of the null hypothesis at the .01 significance level; *b* represents the .05 significance level; and *c* represents the .10 significance level.

	All Periods	**Pre-Event Interaction**	**Event Day Interaction**	**Post-Event Interaction**
PANEL A: SMALL COMPETITORS				
Returns				
To Announcer From Competitor	0.038[a]	-0.023[c]	-0.002	-0.010
From Announcer To Competitor	0.079[a]	-0.037[a]	0.002	0.001
Difference	-0.041[a]	0.014	-0.004	-0.011
Order Flow				
To Announcer From Competitor	0.017[a]	0.016	-0.008	0.003
From Announcer To Competitor	0.009[c]	0.024[c]	0.007	0.001
Difference	0.008	-0.008	-0.014	0.003
PANEL B: LARGE COMPETITORS				
Returns				
To Announcer From Competitor	0.072[a]	0.017	-0.050[a]	-0.012
From Announcer To Competitor	0.046[a]	-0.006	-0.012	-0.006
Difference	0.026[a]	0.023	-0.038	-0.006
Order Flow				
To Announcer From Competitor	0.022[a]	-0.011	0.026[c]	0.026[b]
From Announcer To Competitor	0.021[a]	0.006	0.007	-0.010
Difference	0.001	-0.017	0.019	0.036[b]

Table VI
Information Content of Competitor Order Flow and Return: Cross-Sectional Analysis

This table presents the sum of the estimated coefficients on competitor order flow and returns from the announcer returns equation, with interaction variables:

$$R_t = \delta X + \sum_{i=1}^{6}\beta_i R_{t-i} + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{i,w} R_{t-i}D^w + \sum_{i=1}^{6}\beta_{6+i,X} RC_{t-i}X + \sum_{i=1;w=1}^{i=6;\,w=3}\beta_{6+i,w,X} RC_{t-i}XD^w + \sum_{i=0}^{6}\gamma_i V_{t-i} + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{i,w} V_{t-i}D^w + \sum_{i=0}^{6}\gamma_{7+i,x} VC_{t-i}X + \sum_{i=0;w=1}^{i=6;\,w=3}\gamma_{7+i,w,X} VC_{t-i}XD^w + \varepsilon_t$$

R_t and RC_t denote announcer and competitor returns, respectively (based on 5-minute quote midpoints). Order flows are denoted V_t and VC_t and are defined as buyer- minus seller-initiated volume. D is a vector of dummy variables indicating pre-event period, event and post-event windows (w = 1 , 2 and 3 respectively). Pre-event days are days -2 to -1 relative to the announcement date; event day is day 0; post-event days are days +1 and +2.
Relative market share (*RSHARE*) is defined as the ratio of year t-1 announcing firm shares of sales in the industry to competitor share. Relative liquidity (*RLIQ*) is ratio of announcer to competitor turnover. Return correlation (*RETC*) is the daily stock return correlation of the announcing and competing firms. HHI is the sum of squared market shares based on year t-1 sales. Turnover and return correlations are measured using daily data during the year ending thirty days prior to the announcement. Relative leverage is the (log) ratio of competitor leverage to announcer leverage. Leverage ratios are defined as total debt/(debt plus market value of equity in year t-1). All ratios are calculated as ln(ratio+1). There are 772,418 valid observations.

Superscript *** corresponds to a rejection of the null hypothesis at the .01 significance level; ** represents the .05 significance level; and * represents the .10 significance level.

		Event Window Interactions		
	All Periods (including Benchmark)	**Pre-Event**	**Event Day**	**Post-Event**
Returns				
$\sum\beta_{i,d}$	0.068	-0.182	0.033	-0.090
Interactions (Variable$\sum\beta_{i,d}$*):*				
Relative Market Share (*RSHARE*)	-0.011	-0.083*	0.058	-0.029
Industry HHI (*HHI*)	0.013	-0.059	0.020	-0.020
Relative Liquidity (*RLIQ*)	-0.016	-0.015	0.019	-0.031
Relative Debt (*RDEBT*)	-0.021	-0.083	0.107	-0.033
Return Correlation (*RETC*)	0.133***	-0.007	0.031	0.019
Order Flow				
$\sum\gamma_{i,d}$	-0.013	0.150	-0.018	0.091
Interactions (Variable$\sum\gamma_{i,d}$*):*				
Relative Market Share (*RSHARE*)	-0.001	0.022**	-0.017	-0.019*
Industry HHI (*HHI*)	0.003	-0.023	0.005	-0.008
Relative Liquidity (*RLIQ*)	-0.013	0.055**	0.024	0.004
Relative Debt (*RDEBT*)	-0.016	0.030	-0.045	-0.004
Return Correlation (*RETC*)	0.064***	-0.116**	-0.004	-0.002
Adjusted R-Square	0.142			