Supplier Short Selling and Customer News

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ABSTRACT

This paper examines whether short sellers exploit information in economically linked firms to undertake profitable trades. Using newly available information on firm-level customer-supplier-competitor relationships and Reg SHO daily short sales data, we find that the short selling of supplier stock increases with negative post-news customer returns, and that the relation becomes more pronounced in supplier information asymmetry. The results show no relationship between short selling of the upstream supplier and downstream customer news in 3-party economic links, but suggest increased short selling of the supplier's closest rival based on unfavorable customer news even if the rival is not the customer's supplier. Finally, short sellers do not trade supplier stock prior to customer news announcements, suggesting evidence of trades based on public information. Overall, these results indicate an information intermediary role of short sellers in economically linked firms.

Keywords: Short Sales, News, Earnings Announcements, Customer-Supplier Relations

JEL Classification Number: G11, G23, G32

Short sellers are shown to be more informed than other investor types (e.g., Drake, Rees, and Swanson, 2011; Reed, 2013). Specifically, existing studies find that short selling is linked to the subsequent firm's fundamentals[1] and to future returns.[2] These studies primarily focus on short selling of a particular firm's stock based on information about the firm itself. Another strand of literature documents an important role of information transfers in the context of related or economically linked firms, as these firms are typically exposed to common economic shocks (e.g., Foster, 1981; Olsen and Dietrich, 1985). Recent research in this literature shows to what extent customers' information gets transferred to their suppliers.[3] To the best of our knowledge, no study has yet explored whether short sellers act as informed traders not only based on the information about the firm itself, but also to take advantage of information about the related firms. The goal of this study is therefore to evaluate whether the perceived high information processing ability of short sellers allows them to exploit information across the supply chain to achieve profitable trades. In particular, we examine whether there is any association between post-news customer returns and supplier short selling. This research pursuit is important as it explores a channel through which short sellers could increase stock price efficiency in financial markets.

Prior research finds that limited investor attention gives rise to gradual information processing, which in turn results in return predictability across assets in various contexts,[4] as well as in economically connected corporations.[5] Return predictability suggests that market participants who pay close attention to information and process it quickly could take advantage of information revelation to make profitable trades. It is conceivable that short sellers could undertake such a role. Cohen and Frazzini (2008), however, find that mutual fund managers, who are also perceived as informed traders, trade the supplier stock on customer news only if they have stockholdings in both the customer and the supplier, but trade the supplier stock only with a significant lag to customer news if they only hold the customer stock. Such a finding underscores the inability of one type of

[1] Among others, see Dechow, Hutton, Meulbroek, and Sloan (2001); Geczy, Musto, and Reed (2002).

[2] For instance, Seneca (1967); Figlewski (1981); Desai et al. (2002); Boehme, Danielson, and Sorescu (2006); Boehmer, Jones, and Zhang (2008); Diether, Lee, and Werner (2009).

[3] See, for example, Pandit, Wasley, and Zach (2011); Chu, Tian, and Wang (2014); Guan, Wong, and Zhang (2015).

[4] See Lo and MacKinlay (1990); Brennan, Jegadeesh, and Swaminathan (1993); Badrinath, Kale, and Noe (1995); Hong, Torous, and Valkanov (2007).

[5] For instance, Cohen and Frazzini (2008); Menzly and Ozbas (2010).

informed investors to take advantage of information transfers across the supply chain in a prompt manner. In a similar fashion, Cohen and Lou (2012) examine how the same information affects firms that necessitate straightforward information processing versus their complex-to-analyze counterparts, and show significant return predictability from the former to the latter group of firms, which strengthens in firm complexity. It is plausible to view short sellers' information processing in customer-supplier relationships versus their information processing in non-economically linked firms (i.e., of the firm itself rather than of related firms) in a corresponding fashion to that of Cohen and Lou's (2012) complex versus easy-to-understand firms. Earlier literature, however, documents that short sellers exhibit stronger information processing skills compared to those of other informed investors. Thus, we posit that short sellers take advantage of information transfers along the supply chain as increased supplier short selling is associated with post-news negative customer returns.

Our analyses focus on the following four related issues. First, we examine the contemporaneous relation between customer news announcement returns and supplier short selling. Our study employs (i) Reg SHO short sales transaction-level data, aggregated to the daily level, for the period January 3, 2005 to July 6, 2007; (ii) the newly available unique Factset Revere database that provides information on firm-level networks of customers, suppliers, and competitors; and (iii) the Ravenpack database for all corporate non-earnings news and Compustat for earnings news release dates. Our sample contains 2,402 (2,680) supplier firms and 2,061 (2,898) customer firms in Ravenpack (earnings) news sample, and there are 11,477 customer-supplier relations with customer non-earnings news and 19,576 customer-supplier links with customer earnings news.[6] Such a large sample offers an opportune platform to examine the link between post-news customer returns and supplier short selling. Second, motivated by prior studies showing that information asymmetry enhances return predictability, we assess whether the established relation between customer news announcement returns and supplier short selling varies with the level of supplier information asymmetry. Third, we explore whether the link between post-news customer returns and supplier short selling extends across the entire supply chain and examine customer-supplier information transfers

[6]The Ravenpack news database also includes corporate earnings news, but to maintain consistency with the existing literature (see, for example, Christophe, Ferri, and Angel (2004)), we obtain customer earnings news announcement dates from Compustat while customer non-earnings news from Ravenpack.

(i) to the supplier industry as well as (ii) to upstream supplier-downstream customer settings for 3-party links inclusive of upstream supplier, midstream firm, and downstream customer. Finally, we investigate whether short sellers trade supplier stock prior to, rather than at or immediately after the customer news, thereby offering insights into the potential use of private information by short sellers when making trades pertinent to customer-supplier relations.

We establish a strong negatively significant relationship between post-news customer returns and supplier short selling, while incorporating the various measures that have been previously shown to relate to short selling, market return, as well as supplier firm-year, firm-month, or industry-year fixed effects. Such a result implies that short sellers take advantage of customer news revelation to undertake profitable supplier trades, thereby exhibiting a superior information processing ability in customer-supplier settings. Our findings are robust to alternative measures of short selling (i.e., abnormal short selling and relative short selling), several return windows around the announcement date, and across both the customer non-earnings news sample constructed from Ravenpack and the customer earnings news sample from Compustat.

To further address the robustness of our tests, we employ a multitude of filters to mitigate the possibility that our established link between post-news customer returns and supplier short selling could be driven by confounding events, especially by supplier rather than customer news, and obtain consistent results. We also design samples that capture a change in a customer-supplier relationship from linked to delinked and vice versa. Our analysis uncovers evidence of a significant relationship between post-news customer returns and supplier short selling in the linked sample (i.e., firms that establish a customer-supplier relationship after no such relationships in the prior year), but finds no significant relationship in the delinked sample (i.e., firms with no customer-supplier relationship although such a relation existed in the previous year). Further, we identify all supplier and all customer competitors in each customer-supplier pair, and construct two samples by matching (i) each customer to pseudo supplier, and (ii) each supplier to pseudo customer by industry, closest size, and book-to-market characteristics. We find no significant relationship between customer news announcement returns and supplier short selling in such pseudo customer-supplier settings. These sensitivity tests mitigate the possibility that the documented link captures other effects. Instead,

they provide further support to our main hypothesis as they suggest a robust relationship between post-news customer returns and supplier short selling.

We then explore whether the relationship between customer news announcement returns and supplier short selling varies with supplier information asymmetry. Prior studies show that information asymmetry results in more gradual information dissemination and thus suggests an increased return predictability (e.g., Brennan, Jegadeesh, and Swaminathan, 1993; Badrinath, Kale, and Noe, 1995; Alldredge and Cicero, 2015). We test whether short sellers are able to exploit information across the supply chain to a larger extent in instances of higher potential return predictability due to lower information transparency. We employ several information asymmetry measures and find robust evidence that the link between post-news customer returns and supplier short selling strengthens in supplier information asymmetry, when high information asymmetry is captured by the low number of supplier news articles, supplier being a non-S&P 500 index member, low supplier institutional ownership, and low number of analysts covering the supplier. We, however, show no significant effect when information transparency is captured by the geographic distance between the customer and supplier or the supplier distance to Wall Street, both measured as straight line distance between zip codes. Broadly, the results suggest a role of supplier information asymmetry in short sellers' ability to take a greater advantage of the customer information for profitable supplier trades.

We also ascertain whether the established link between customer news announcement returns and supplier short selling manifests extensions across the entire supply chain. We do so by undertaking two tests. In the first test, we identify supplier closest and distant rivals in each customer-supplier pair, and examine whether information transfers in customer-supplier links propagate to supplier industry. In the second test, we identify 3-party links focusing on upstream supplier, midstream firm, and downstream customer, and examine whether downstream customer news bears any role for upstream supplier short selling. Results show evidence of increased supplier closest rival's short sales based on customer negative news announcement returns, even though the rival is not the customer's supplier, while finding no relation of downstream customer news to upstream supplier short selling.

Finally, we investigate whether short sellers trade the supplier stock prior to customer news announcements, thereby providing insights into short sellers' use of public versus private information in customer-supplier relationships. We find no evidence of supplier short selling prior to public releases of customer news. This finding implies that short sellers may not have access to private information prior to news releases, but that they have the ability to process public information quickly upon its revelation to exploit profitable trades.

This research contributes to extant literature in several directions. First, to the best of our knowledge, this study is the first to test the information intermediary role of short sellers in customer-supplier relationships. One strand of literature presents strong evidence of short sellers' superior information processing ability (e.g., Boehme, Danielson, and Sorescu, 2006; Diether, Lee, and Werner, 2009; Drake, Rees, and Swanson, 2011; Reed, 2013), while another documents significant return predictability across assets in various contexts, inclusive of the supply chain links (e.g., Cohen and Frazzini, 2008; Menzly and Ozbas, 2010). We add to these strands of literature by showing that short sellers exhibit superior information processing skills by exploiting public information of customer firms to undertake profitable trades of supplier firms. This finding underscores a channel through which short sellers play an important role in the financial markets to enhance price efficiency.

Second, our study contributes new evidence regarding information transfers from customer-supplier pairs across the supply chain. Barrot and Sauvagnat (2016) examine firm-level shock propagation in production networks and find that the negative effects on sales growth spill over to supplier rivals. The research on information propagation from customer-supplier links to other industry firms is otherwise limited. Our work therefore sheds light in this regard by providing evidence that short sellers process customer-related information to undertake profitable trades not only of the supplier firm but also of the rival firm, which itself is not the supplier. We also show no evidence of the role of information transfers for short selling between the two most distant nodes across the supply chain – upstream suppliers and downstream customers. It is noteworthy that the pursuit of the above issues addresses the call for this research inquiry by Dietrich (2011), who claims the importance of producing evidence "whether information externalities extend beyond

supplier-customer relationships to other firms" as such knowledge would enhance the understanding of cross-sectional correlation among firms.

Third, we add to studies that focus on short sellers' use of private versus public information for undertaking profitable trades. Christophe, Ferri, and Angel (2004) and Christophe, Ferri, and Hsieh (2010) demonstrate that short sellers exploit private information to trade prior to earnings announcements and analyst downgrades, respectively. Instead, Engelberg, Reed, and Ringgenberg (2012) focus on the large database of all corporate news and report that short sellers trade based on public information. We contribute to this research by underscoring that short sellers do not trade supplier stock prior to customer news announcements, thereby providing evidence of public information use for profitable trades in customer-supplier settings.

Fourth, the opposing strands of literature highlight that (i) public information disclosure results in leveling of information across traders, thereby diminishing return predictability and the prospect of abnormal return generation (e.g., Diamond and Verrecchia, 1987; Korajczyk, Lucas, and McDonald, 1991; Tetlock, 2010), or that (ii) differing information processing abilities across investors increase return predictability upon public information revelation (e.g., Harris and Raviv, 1993; Rubinstein, 1993; Kim and Verrecchia, 1994; Kandel and Pearson, 1995). We provide evidence in this debate by offering support to the latter literature strand, as we show that the customer news announcement return is related negatively to supplier short selling in a contemporaneous setting. Public information disclosures allow short sellers an opportunity to undertake profitable trades, and that the magnitude of the effect increases in supplier information asymmetry.

Finally, our study adds to the literature that employs transaction-level short sales data, as opposed to monthly short interest data, thereby increasing the power of our tests that focus on short time frames of customer returns around news announcements versus those of supplier short selling. Also, we advantageously exploit the Factset Revere database of firm-level relationships detailing the information pertinent to the firm's customers, suppliers, and competitors. The benefits of this database, as opposed to Compustat segment database commonly employed in earlier customer-supplier studies, are that (i) it assigns company identifiers, thereby avoiding manual confirmation

of firm names, necessitated with Compustat data, and therefore increases data accuracy; (ii) it provides information of both small and large suppliers' customers, while Compustat contains information of suppliers' major customers; and (iii) the firm's competitors and the associated sectors they overlap.

The remainder of the paper is organized as follows. Section I discusses the motivation of our study and presents a number of testable hypotheses. Section II describes the data sources, the sample, and incorporates descriptive statistics. Section III presents the multivariate tests for the relationship between post-news customer returns and supplier short selling. It also conducts the sensitivity analyses and presents the tests of all the remaining hypotheses. Section IV concludes.

I. Motivation and Hypotheses Development

A. Customer Firm's News Announcements and Short Selling of Supplier Firm's Stock

In this subsection, we first review the role of information in customer-supplier relationships, documented by extant literature. We also draw on prior work pertinent to cross-predictability of returns and then introduce literature that portrays short sellers as informed traders. We then form an expectation pertinent to the relationship between short selling of the supplier firm's stock and the news announcement of its customer firm. We do so by drawing on the connections between information transfers along the supply chain, limited investor attention and stock return predictability, and the role of short sellers in this link.

A.1. Information Transfers Along the Supply Chain

It is conceivable that information transfers in customer-supplier relationships are salient as these relationships are subject to common economic shocks (e.g., Cohen and Frazzini, 2008; Menzly and Ozbas, 2010; Pandit, Wasley, and Zach, 2011). Specifically, one would expect the supplier-customer pair to be affected by a particular shock as long as the customer is an important source of the supplier's current and future sales, and respectively, of its earnings, and cash flows. In addition, both firms could be affected by market prices of their inputs and outputs.

While an early literature examines the effect of a firm's information on its own security return, later work explores the role of a firm's disclosures on the firm within the same industry (e.g., Foster, 1981). Subsequently, Olsen and Dietrich (1985) move beyond these established effects to ascertain information transfers along the supply chain. Specifically, the authors examine the vertical information transfers between retail chain stores and their suppliers. They report that suppliers experience stock price reactions around the time of their customers' announcements (i.e., the retailer's sales announcements), and that these effects are otherwise not observable during the non-announcement periods. In a more recent study, Pandit, Wasley, and Zach (2011) report that suppliers experience an information externality, or a vertical information transfer, around the time of the customer earnings announcements that enhances in the magnitude of news, and especially so of the negative news announcements, as well as the strength of the economic relationship of a customer-supplier pair. Importantly, the authors also show that customer earnings announcement information causes revisions and lower dispersion of analysts' supplier earnings forecasts. In a similar fashion, Guan, Wong, and Zhang (2015) find that analysts who follow a customer provide more accurate earnings forecasts for the supplier than do their counterparts who do not follow a customer. They further report that although both analyst types account for customer earnings news to revise supplier earnings forecasts, analysts who cover a customer-supplier pair improve forecast accuracy more than do supplier analysts. Chu, Tian, and Wang (2014) add to this strand of literature by reporting knowledge spillovers from customers to suppliers and the resulting supplier innovation. Broadly, these studies demonstrate an existence and an important role of information transfers in economically linked customer-supplier relationships.

A.2. Limited Investor Attention and Return Predictability

We have established above that the information transfers across the supply chain affect customer-supplier pairs, and could be incorporated into security prices or a firm's fundamentals. We now review to what extent or how quickly these information externalities are accounted for and are recognized in the arising return predictability across assets.

Extant literature examines the role of information and its transmission in financial markets by

focusing on measures and mechanisms of information flow or transmission and the resulting effects on various aspects of asset pricing and corporate finance (e.g., Tetlock, 2014). Recognition of limited investor attention is an important cornerstone in this literature. Specifically, Hirshleifer and Teoh (2003) model the effect of limited investor attention on reactions to information, presented to investors in alternative manners. In their study, investors tend to pay careful attention to information, presented in an easy-to-follow manner, but ignore implicit information, thus causing asset prices to overreact and underreact in the former and latter instances, respectively. Similarly, in their model, Peng and Xiong (2006) focus on the learning behavior of investors in the context of limited attention. Hong and Stein (1999) develop a model with multiple investor types that underscores gradual diffusion of information in financial markets, as investors may not take advantage of information to revise beliefs about a firm's prospects. This occurrence could be attributed to limited information processing ability or the cost of close evaluation of public information (e.g., Simon, 1955; Hong, Stein, and Yu, 2007). Another literature establishes that investors could be less attentive at particular times such as the end of the week (e.g., DellaVigna and Pollet, 2009; Alldredge and Cicero, 2015). Aligned with the theoretical predictions, a multitude of studies postulate and find that outside investors exhibit limited ability of fully processing the effects of public information (e.g., Hong, Torous, and Valkanov, 2007; Cohen and Frazzini, 2008; and Menzly and Ozbas, 2010).

Return predictability arises as a consequence of limited investor attention. Specifically, previous studies demonstrate that limited information processing leads to return predictability both across firms in various broad contexts and especially in economically linked firms. Lo and MacKinlay (1990) demonstrate that returns of large stocks forecast those of small stocks. Brennan, Jegadeesh, and Swaminathan (1993) find that firms with many analysts lead their counterparts with only few analysts covering the firm. Badrinath, Kale, and Noe (1995) show that firms with high institutional ownership lead those with low institutional ownership. Hong, Torous, and Valkanov (2007) report that returns in retail, services, commercial real estate, metal, and petroleum industries lead the stock market and several key economic activity indicators.

Cohen and Frazzini (2008) and Menzly and Ozbas (2010) report return predictability in supply

chain settings. The former report return predictability in firms that are economically linked via a customer-supplier relationship, while the latter find stocks predicting each other's returns in related customer-supplier industries. Return predictability concept, illustrated above, thus establishes that market players, who pay close attention to information, could take advantage of information revelation and profit from the respective trades (e.g., Demers and Vega, 2008; Engelberg, 2008; Tetlock, Saar-Tsechansky, and Mackassy, 2008).

A.3. Information Intermediary Role of Short Selling

Existing studies have demonstrated that short sellers tend to be more informed than other types of traders (e.g., Drake, Rees, and Swanson, 2011; Reed, 2013). Diamond and Verrecchia (1987) posit that in light of short selling costs, short positions represent informed traders thereby implying that short sellers must exhibit strong views that prices will soon fall and thus engage in respective trades. Two related strands of literature arise in support of this argument. First, a body of work documents that short selling is linked to a firm's various fundamentals. Specifically, firms with low earnings-to-market values or book-to-market values exhibit high levels of short interest (e.g., Dechow, Hutton, Meulbroek, and Sloan, 2001; Geczy, Musto, and Reed, 2002). Second, an extensive literature also shows complementary evidence, underscoring that short selling is related negatively to future returns (e.g., Seneca, 1967; Figlewski, 1981; Senchak and Starks, 1993; Desai et al., 2002; Asquith, Pathak, and Ritter, 2005; Boehme, Danielson, and Sorescu, 2006; Boehmer, Jones, and Zhang, 2008; Diether, Lee, and Werner, 2009). Further, Drake, Rees, and Swanson (2011) report that short sellers facilitate, while analysts hinder price discovery. Prior literature also demonstrates that the prospect of short selling (e.g., Fang, Huang, and Karpoff, 2016) as well as short selling itself (e.g., Desai, Krishnamurthy, and Venkataraman, 2006; Karpoff and Lou, 2010), facilitates public discovery of financial misconduct. Massa et al. (2014) show that short selling increases the speed of information transmission by encouraging insiders to trade faster to prevent competition from short sellers.

Even though the above studies establish the information intermediary role of short sellers, it is *a priori* unclear whether and how short sellers are able to take advantage of information in customer-

supplier relationships. Interestingly, Cohen and Lou (2012) examine how information affects firms that require straightforward information processing to be incorporated into prices, versus how the same information affects its counterparts that entail a complex analysis before information can be reflected in prices. The authors report return predictability from easy-to-analyze firms to complex-to-analyze firms, which enhances in complexity of the latter firm type. It is plausible to view short sellers' information processing in customer-supplier relationships versus outside of customer-supplier links analogously to that of Cohen and Lou's complex firms versus straightforward firms, respectively. In a similar fashion, Cohen and Frazzini (2008) show that mutual funds, which are broadly viewed as a group of informed investors, trade the supplier firm's stock on the customer firm's shock only if they hold both firms in the portfolio, but fail to trade the supplier firm's stock without a substantial lag to a customer shock in the instance of only holding the customer.

Nevertheless, it is certainly conceivable that since short sellers are perceived as traders with the strong information processing ability, they pay attention to market signals about the customer firm and trade the supplier stock when they consider that the market may not fully recognize the effects of the customer's news event. The above discussions, which connect information transmission across the supply chain, investor limited attention resulting in return predictability, as well as the informational role of short sellers, give rise to our first hypothesis:

HYPOTHESIS 1: *Contemporaneous short selling of a supplier firm's stock is negatively related to a customer firm's post-news announcement return.*

B. Customer Post-News Announcement Return and Short Selling of Supplier Firm's Stock in the Context of Information Asymmetry

The studies reviewed above establish the role of information in return predictability and therefore in informed traders' chance to recognize profitable trades. Specifically, gradual information dissemination due to limited investor attention results in return predictability which enhances in slow speed of information transmission, and could be exploited by informed traders. A natural inference from existing findings is that information asymmetry could help short sellers to take advantage of the market's slow information incorporation into prices. A strand of literature in support of this

interpretation suggests the role of information asymmetry in trader's ability to generate superior returns. For instance, employing analyst coverage or institutional ownership as metrics for a firm's information environment, Brennan, Jegadeesh, and Swaminathan (1993) and Badrinath, Kale, and Noe (1995) find that firms with many analysts or those with high institutional ownership lead their counterparts with only few analysts or firms with low institutional ownership, respectively. Further, Menzly and Ozbas (2010) show that when stocks in related customer and supplier industries cross-predict each other's returns, the magnitude of return predictability decreases in institutional ownership. They also underscore that the trading behavior of institutional investors resembles that of informed traders who profit from return predictability. Alldredge and Cicero (2015) report that when insiders sell their firm's stock profitably based on the news about their firm's customer, the effect is more pronounced if fewer analysts cover the supplier.

Building upon these studies, we argue that high information asymmetry of supplier firms increases short selling of their shares upon their customer firms' negative news announcements as strong information processing ability of short sellers allows them to recognize the chance to capture benefits of slow information transmission into prices. This expectation leads to our second hypothesis, as follows:

HYPOTHESIS 2: *The negative relationship between contemporaneous short selling of a supplier firm's stock and customer post-news announcement returns is more pronounced in supplier firms with greater information asymmetry.*

C. Customer Post-News Announcement Returns and Short Selling of Supplier Rival Firm's Stock

Prior literature reports the spillover effects of news announcements or of common shocks in a customer-supplier link to supplier rivals in various settings. For instance, Shahrur (2005) focuses on the wealth effects of horizontal mergers in customer and supplier industries, and reports positive abnormal returns of rivals of the merged firms. Fee and Thomas (2004) examine upstream and downstream effects of the horizontal mergers and offer similar evidence. They find that rivals of the merged firms experience positive abnormal returns at horizontal merger announcements, but show no negative abnormal returns in mergers facing antitrust concerns. The authors interpret that

the rival's shares could increase in value on a merger announcement as either the financial markets perceive that the firms within the industry are undervalued, or they could rise on the prospect of the benefits from their own subsequent mergers. Focusing on firm-level shock propagation in production networks, Barrot and Sauvagnat (2016) show that the adverse effects on sales growth are more pronounced when the affected supplier is more difficult to replace, and also find evidence of spillover of these effects to supplier rivals.

We are thus interested in assessing whether customer news announcements form the views of short sellers not only regarding the supplier firm but also those pertinent to supplier rivals. The pursuit of this issue addresses the call for such inquiry by Dietrich (2011) who asserts that it is important to provide evidence "whether information externalities extend beyond supplier-customer relationships to other firms in the supplier's industry" as such findings could deepen the understanding of cross-sectional correlation among firms. Specifically, we expect the information externality of the customer-supplier link to exhibit an effect on the supplier rival, especially if the supplier and rival firms operate in a larger number of common sectors as such an occurrence manifests a stronger interconnectedness of their business operations and the resulting financial success. Alternatively, supplier rival firms could be unaffected by customer firm news announcements, provided the supplier's and supplier rival's business lines do not overlap substantially. The implications above lead to our third hypothesis:

HYPOTHESIS 3: *Contemporaneous short selling of a supplier rival firm's stock is negatively related to customer post-news announcement return, especially when the supplier firm and rival firm overlap substantially in the industries they operate.*

D. 3-Party Economic Links and Short Selling

While finance research on supply chain relationships predominantly examines customer-supplier pairs (i.e., 2-party links), a few studies explore the various effects across the supply chain; that is, they concentrate on upstream supplier-midstream firm-downstream customer relationships (3-party links).

For instance, Fee and Thomas (2004) examine the effects of horizontal mergers on the merged

firms, its upstream suppliers, or downstream customers. The authors report (i) merger gains as well as positive abnormal returns for the merged firms at merger announcements; (ii) insignificant stock price reactions and little effects on subsequent operating performance of customers in upstream mergers; and (iii) negative announcement returns and reductions in cash flows to sales of suppliers in downstream mergers, which are more pronounced in supplier dependence on the merged firms for revenues. Shahrur (2005) employs input-output accounts to identify downstream and upstream industries, and examines the wealth effects of horizontal mergers on firms in these industries. The author reports positive abnormal returns to firms in both customer and supplier industries for a subsample of takeovers with positive combined wealth effects for both bidder and target shareholders, while negative abnormal returns to firms in supplier industries outside of this subsample.

The strength of the economic relationship in 2-party links is more apparent as long as, for instance, the customer comprises a meaningful proportion of supplier's sales revenue, and thus of its earnings and cash flows. However, the strength of the relationship between the downstream customer and upstream supplier as well as their mutual dependence, is less clear. Likewise, the common economic shocks could either exhibit no impact on the downstream customer-upstream supplier relationship, or affect the 3-party link in a manner different from that prevailing in 2-party links.

We build on the assumption that the effects of the well-documented relationship between customers and suppliers in 2-partly links could extend to a 3-party link, where the downstream customer's financial health is correlated not only with its supplier's (midstream firm's) financial condition, but also with its supplier's supplier (i.e., upstream supplier) financial standing. In this setting, one could expect that short sellers not only interpret the role of the customer's news event for its supplier's future returns, but also do so for the upstream supplier's subsequent performance. Such a prediction leads to our fourth hypothesis:

HYPOTHESIS 4: *Contemporaneous short selling of an upstream supplier firm's stock is negatively related to a downstream customer firm's post-news announcement returns.*

E. Public versus Private Information of Supplier Short Selling

Recent literature uncovers the use of both private and public information by short sellers to generate superior returns. For instance, Christophe, Ferri, and Angel (2004) and Christophe, Ferri, and Hsieh (2010) report evidence of increased short selling *prior* to earnings announcements and to analyst downgrades, respectively, thereby inferring that short sellers are informed investors with private information. Similarly, Karpoff and Lou (2010) report increased levels of short selling *prior* to public news about a firm's financial misconduct. In contrast, focusing on a large database of all corporate news events, Engelberg, Reed, and Ringgenberg (2012) report evidence of profitable short selling on news days, suggesting that short sellers exploit public rather than private information to undertake profitable trades. They further interpret that the superior information processing ability of short sellers provides an opportunity for profit generation based on public news announcements.

Two opposing strands of extant literature help explain the above conflicting findings. On the one hand, Diamond and Verrecchia (1987) and Korajczyk, Lucas, and McDonald (1991) report that news reduces information asymmetry. In line with the above studies, Tetlock (2010) finds that public information revelation aligns available information for investors with access to private information with those without such an access, and also shows no evidence that news interpretation varies by trader type. Such studies suggest that to generate superior returns, one must likely take advantage of private information as with public information revelation, an opportunity for profitable trades dissipates.

On the other hand, Harris and Raviv (1993) and Kim and Verrecchia (1994) develop information asymmetry models, with traders who receive common signals but differ in their abilities to interpret these signals. In a similar fashion, Rubinstein (1993) and Kandel and Pearson (1995) suggest that public news could provide an opportunity for profitable trades for investors with superior information processing ability since different traders could interpret the same news story differently. This line of work thus proposes that public information may allow carrying out profitable trades as long as the trader possesses a superior ability to process this publicly available information.

We therefore conjecture that short sellers exploit public information to make profitable trades of

supplier firms based on their customer firms' news events as information processing in a customer-supplier link could be more complex than outside of the supply chain relationship (i.e., the interpretation of a firm's own information for short selling of its own shares) (e.g., Cohen and Lou, 2012). Interestingly, Alldredge and Cicero (2015) report that even company insiders, usually expected to exploit private information, take advantage of public information pertinent to customer-supplier links, to undertake profitable trades. It is important to emphasize that the scope of this study is not to rule out the use of private information by short sellers. Instead, we are interested in ascertaining whether short sellers mainly employ public information when they trade by exploiting information transfers across the supply chain. Our arguments give rise to the following hypothesis:

HYPOTHESIS 5: *Short sellers rely on public information when they trade a supplier firm's stock based on its customer firm's corporate news announcements.*

II. Data and Sample Construction

We construct our sample from different data sources: (i) economic links from Factset Revere, which is made available via the Wharton Research Data Services (WRDS); (ii) customer non-earnings news from Ravenpack and customer earnings announcement dates from Compustat, both available via WRDS; (iii) short-selling information from NYSE Trade and Quote (TAQ) data, various stock exchanges' websites, and Regulation SHO (Reg SHO) database; (iv) control variables from Compustat and CRSP. The definitions of all the key variables are depicted in Appendix A.

A. Economic links

Factset Revere offers a unique database of company-level relationship information and specializes in collecting publicly disclosed information about a firm's network of customers, suppliers, competitors, and geographic exposures, starting 2003. Its public sources include corporate quarter and annual filings (e.g., 8-K, 10-Q, and 10-K), investor presentations, websites, and press releases. One advantage of the Revere data is that they contain information of both major and minor private and

publicly-listed customers, as well as their identities.[7] Under Regulation SFAS No. 131, firms are required to disclose the identity of any major customer that represents at least 10% of the firms' total reported sales. Unlike Factset Revere, the Compustat segment data, which are commonly employed in previous studies, obtain the supply chain relationship information only from companies' annual 10-K fillings and hence, contain a revenue distribution of firms' major customers. A critical shortcoming of Compustat is that it does not assign company identities (GVKEYs) to publicly-listed customer firms, whose names are as reported in the original filing and are abbreviations or even subsidiary names. To circumvent these data issues, one needs to manually check and identify each customer firm before she could merge the Compustat information with other databases.

To illustrate the information contained in the Factset Revere database, Figure 1 shows a 2007 snapshot of Google with some of its customers, suppliers, rivals, and partners listed. Google has 11 downstream customers, 32 upstream suppliers, 72 rival firms, and 45 partners. In 2007, Google represented 14.5% of Conversant's sales, and Time Warner made up 7% of Google's sales. Based on the Factset Revere data, Yahoo and Answers.com are the closest rivals to Google in that these rivals and Google overlap substantially in the number of sectors they operate in.

We then merge the Factset Revere information with other databases, as described below. Even though our Factset Revere data span from 2003 to 2015, our sample period is constrained by the availability of Reg SHO's short-selling data, which is only available from January 3, 2005 to July 6, 2007. We also form two samples of customer-supplier links based on the types of customer news; one sample is based on customer non-earnings news from the Ravenpack database and the other uses earnings announcement dates from Compustat. By analyzing separate samples of customer news, we are able to determine the relative impact of earnings news, one of the most important corporate news, to that of customer non-earnings news. Table 1 shows the summary statistics of our samples formed using Ravenpack non-earnings news and Compustat earnings releases. Our final sample of customer non-earnings news consists of 2,402 supplier firms, 2,061 customer firms, and 11,477 customer-supplier links with non-earnings news. On the other hand, the earnings news

[7]For publicly-listed customers, the identities are unique Compustat's GVKEYs that allow us to link the Factset Revere data to Compustat and CRSP databases.

sample contains 2,680 supplier firms, 2,898 customer firms, and 19,576 customer-supplier links with corporate earnings news. The mean (median) number of suppliers per customer is 5.566 (2) for the non-earnings sample, compared with 6.753 (2) for the earnings news sample. The corresponding mean (median) numbers of customers per supplier are 4.776 (3) and 7.303 (4).

B. Customer News

Ravenpack is a major news analytics provider that provides real-time structured sentiment, relevance, and novelty data for entities and events detected in unstructured text published by reputable sources, including newswire contents from Dow Jones and the Wall Street Journal and web content from thousands of online sources. Ravenpack analyzes and processes entity-specific news releases and generates entity-specific relevance, novelty, and sentiment numerical scores to all events in news articles. A relevance score ranging from 0 to 100 is assigned to capture the relevance of an entity-specific news, with 100 (0) signifying most (least) relevance. Even though Ravenpack contains earnings announcement dates of firms, such information is obtained from Compustat, consistent with existing studies.

To ensure that our results are not driven by potential confounding events, we mitigate this possibility by undertaking the following filters in our customer non-earnings news sample and earnings news sample throughout the study. Specifically, we remove observations with overlapping or multi-firm news as follows: (i) the news must not have any counterparts in the previous day and the following two days around the announcement date; (ii) the supplier's earnings announcement must not take place during the two trading days around the customer's earnings announcement; (iii) the news is the only fresh news of a particular kind in the 24-hour time frame; (iv) customer firm is the only relevant company in the news (Ravenpack score of 100 for both relevance and event novelty); (v) customer firm must have no more than one news in a given day (e.g., days which include 1 positive news and 2 negative news are removed). Such filters help increase the power of our tests by ensuring a more accurate measurement of short selling in response to specific news as certain investors may not recognize the degree to which other traders have already employed particular information when making decisions about their trades, causing these investors to confuse

stale and fresh news (Tetlock, 2011).

The summary statistics are shown in Table I. On average, each customer-supplier link has 5.649 non-earnings news articles provided by Ravenpack and 7.594 earnings news releases from Compustat. Their medians are 6 and 5, respectively. In total, we have 52,451 customer-supplier pair year observations in the non-earnings news sample, and 89,328 in the earnings news sample. The smaller number of economic links with customer non-earnings news in the former is due to our above-mentioned stricter selection criteria employed in constructing the sample.

C. Short-Selling Data

In June 2004, the SEC implemented Reg SHO under the Securities Exchange Act of 1934 to assess short sale practices. Under Reg SHO, all transaction-level short sales data were made available to the public from January 3, 2005 to July 6, 2007, but were eliminated thereafter. We collect the short-sale information on stocks traded on nine different exchanges, namely the NYSE Trade and Quote (TAQ) database and from the websites of the American Stock Exchange, National Association of Securities Dealers Automated Quotations, National Stock Exchange, Archipelago, Boston Stock Exchange, Chicago Stock Exchange, National Association of Securities Dealers, and Philadelphia Stock Exchange.[8] The short-sale information includes the stock ticker, the number of shares shorted, the transaction date and time, and short-sale price. We aggregate the short-sales transaction data to the daily level by ticker symbol, trading date, and the stock exchange on which the stock is traded, and then merge the daily data with CRSP daily data by ticker and date.

We define a customer firm's news release date as the date that Ravenpack first reports the news, or that Compustat reports the earnings announcement. Throughout our study, we set the customer news release date to day 0. Following Christophe, Ferri, and Angel (2004) and Henry and Koski (2010), we compute abnormal short-selling around customer news release dates, AbSS(0,T), which is the difference between the average daily number of a supplier firm's shares sold short during the days following customer news release day 0 to day T and the average daily number of the firm's shares sold short during the non-announcement period, and the difference is then normalized by the

[8]See Massoud , Saunders, and Keke (2011) for more details of the data.

the average daily number of the firm's shares sold short during the non-announcement period. The non-announcement period is the period within the quarter that the news is released, but excluding the days from day 0 to day T. In the case of earnings announcements, the non-announcement period is measured between day -57 and day -T (T=2, 5) from the announcement date set at day 0.[9] In the case of Ravenpack news, the non-announcement period is measured within each quarter but excluding day -5 to day +5, where day 0 is the news release day.[10] Our analyses focus on AbSS(0,2) and AbSS(0,5).

Table I shows a negative mean AbSS(0,2) for the Ravenpack news sample, but a positive AbSS(0,2) for the earnings news sample and positive AbSS(0,5) for the two samples. But their median values are all negative during our sample period. Judging from their large standard deviation values from 64.07% to 74.16%, there is a substantial cross-sectional variation in AbSS(0,2) and AbSS(0,5).

D. Control Variables

Throughout our analysis, we control for several variables that can potentially influence abnormal short selling of a supplier's stock. Their statistics are also shown in Table I. Our analysis includes abnormal volume of supplier shares traded (AbVol^S) during the days that correspond to the period of abnormal short selling (AbSS), our key dependent variable. Similar to that of the AbSS, the standard deviations of both measures of $\text{AbVol}^S(0,2)$ and $\text{AbVol}^S(0,5)$ are substantially larger than their mean and median values. To ensure that the abnormal supplier short selling is not triggered by the supplier's own return performance or by the market performance, we include both these variables (Ret^S and Ret^M) in all our regressions. Finally, we control for the supplier's firm size and book-to-market equity ratio.

Table II reports the Pearson cross-correlation matrix of the customer non-earnings news sample as its correlation matrix is qualitatively similar to that of the earnings sample. The correlation coef-

[9]We also defined the non-announcement period to be from T (T=2, 5) of the previous quarter (announcement date) to -1 from the current quarter (announcement date) and found the results to be qualitatively similar

[10]The results remain materially unchanged even if the average daily number of a firm's shares sold is computed throughout the sample period, but excluding those days used to compute AbSS(0,2) and AbSS(0,5).

ficients between customer return $\text{Ret}^C(0,2)$ and supplier short selling measures (i.e., AbSS(0,2) and AbSS(0,5)) are negative and highly statistically significant. While these correlations are consistent with our prediction, they are based on univariate analyses and hence do not take into consideration other variables that may possibly drive their correlations. Therefore, in subsequent sections our multivariate analysis will control for such variables. We find that the abnormal volume of supplier shares is an important determinant of supplier short selling; its correlation with abnormal short selling is between 0.633 and 0.737 for $\text{AbVol}^S(0,2)$ and from 0.608 and 0.765 for $\text{AbVol}^S(0,5)$. The coefficients are all highly statistically significant at the 1% level. Except for own correlation with different window specifications (for example, $\text{Ret}^M(0,2)$ and $\text{Ret}^M(0,5)$), the correlation coefficients of all control variables are less than 0.5, suggesting no multicollinearity problem in our regression models.

III. Empirical Results

A. Baseline Results

In this subsection, we test our first hypothesis of the relationship between customer news announcements and supplier abnormal short selling. Specifically, we regress the supplier firm's abnormal short selling measure, $AbSS^S(0,T)$, on the key explanatory variable – its customer firm's 2-day announcement return, $Ret^C(0,2)$, while controlling for firm-specific measures that have been shown by the extant literature to relate to short selling, as shown in the model below.

$$\begin{aligned} AbSS^S(0,T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{AbVol}^S(0,T) + a_3\text{Ret}^S(0,T) + a_4\text{Ret}^M(0,T) \\ &\quad + a_5\text{Size}^S + a_6\text{BM}^S + \epsilon(0,T) \end{aligned} \tag{1}$$

We follow Christophe, Ferri, and Angel (2004) and Henry and Koski (2010) to construct the abnormal short selling metric, $AbSS^S(0,T)$, which has been described in greater detail in the previous subsection. We employ the key explanatory variable, $Ret^C(0,2)$, to convey earnings surprise since a positive (negative) return implies that the market perceives a particular news announcement in a favorable (an unfavorable) manner. Equation (1) is the baseline regression, and if Hypothesis 1 is correct, the a_1 coefficient should be negatively significant, thus underscoring higher short selling

of a supplier firm's shares upon negative market's perception of the customer news announcement.

Based on the extant literature, we control for the market return ($Ret^M(0,T)$), supplier size ($Size^S$), supplier book-to-market equity ratio (BM^S) (e.g., Desai et al., 2002; Christophe, Ferri, and Angel, 2004; Alldredge and Cicero, 2015). We also account for the average share turnover during day 0 to day T of the supplier firm as a proportion of traded shares during the non-announcement period ($AbVol^S(0,T)$) to incorporate the possibility that firms exhibiting sudden volume increases could be easier to short as well as for the prospect of the relation between abnormal short sales and volume surges. Finally, we control for the supplier return ($Ret^S(0,T)$) to corroborate that the link between $AbSS^S(0,T)$ and $Ret^C(0,0)$ does not merely capture the role of supplier's own return in supplier short selling as sudden supplier stock price changes could affect short sellers' decisions pertinent to supplier firms (e.g., Christophe, Ferri, and Angel, 2004; Cohen and Frazzini, 2008). Throughout the study, all our multivariate analyses account for supplier firm-year fixed effects (as applicable) and all associated t-statistics are computed based on standard errors adjusted for the supplier firm clustering. In unreported tests, we account for industry-year effects and also for firm-month fixed effects in lieu of the market return, and obtain unaltered results.

Estimates of (1) are contained in Table III. Models 1-4 of Panel A focus on all corporate non-earnings news announcements as it offers a broad platform to ascertain whether and how customer post-news announcement returns relate to supplier contemporaneous short selling across all corporate news types. Such an approach allows drawing strong inferences about the short sellers' actions pertinent to information externalities associated with customer-supplier links. To provide further robustness of our tests, we also separately examine earnings announcements in Models 5-8 of Panel A as earnings news is recognized as one of the most important corporate news and is a large news category. For example, Tetlock (2014) reports that earnings announcements comprise 33% of newswires. To examine whether the observed effects vary with the length of time window around the customer news announcement date, we focus on two time periods. Specifically, we examine the time period from the announcement date (day 0) through the second day after the announcement (day 2), and present the results in Models 1-2 and 5-6 of Panel A for the customer non-earnings news and customer earnings news, respectively. We also report the results from the

announcement day through the fifth day after the announcement, or time period (0,5) in Models 3-4 (non-earnings news) and 7-8 (earnings news) of Panel A. For each time period and each news sample, we perform two regressions, without (i.e., Models 1, 3, 5, and 7) and with the inclusion of the key explanatory variable, $AbSS^S(0,T)$ (i.e., Models 2, 4, 6, and 8).

To verify that our results are not driven by the choice of the abnormal short selling measure, $AbSS^S(0,T)$, we follow Christophe, Ferri, and Angel (2004) and Henry and Koski (2010) and also perform the same tests on an alternative short selling metric, the relative short selling ($ReSS^S(0,T)$), and present the results in Table III, Panel B across eight models. These models are constructed analogously to those in Panel A. $ReSS^S(0,T)$ measures relative short selling, computed as the ratio of supplier's shorted shares to traded shares for the customer's announcement time period (0,T). To control for volume associated with $ReSS^S(0,T)$, we replace $AbVol^S(0,T)$ with $NReSS^S(0,T)$, which is the relative abnormal short selling, constructed as the ratio of shorted to traded shares during the non-announcement period. In all subsequent tests, we employ both short selling measures, $AbSS^S(0,T)$ and $ReSS^S(0,T)$, but only report the results with the former metric as employing the latter measure renders virtually no impact on our findings.

The results in Table III are consistent with Hypothesis 1 as the coefficients of $Ret^C(0,2)$ are strongly negatively significant across all models in both Panels A and B. For example, the coefficient of $AbSS^S(0,T)$ in Model 2 of Panel A is -0.652 and is significant at the 1% level, thus highlighting close to 0.7% increase in supplier abnormal short selling upon customer's negative announcement return. In terms of economic significance, a one-standard deviation decrease in $Ret^C(0,2)$ is associated with a 2.065% increase in abnormal short selling. It is important to stress that although the regression coefficients of $AbSS^S(0,T)$ and of $ReSS^S(0,T)$ are strongly significant in all models at the 1% level, the magnitudes of the coefficients in (0,2) windows are larger than those in (0,5) windows. Such findings imply a stronger link immediately at and around the news release, thus confirming that short sellers exhibit high information processing skills that allow them to quickly incorporate the new information into the revision of their beliefs about a supplier firm's prospects.

The results on the control characteristics are broadly consistent with those of prior studies.

Specifically, higher supplier abnormal volume and market return relate positively and negatively to supplier abnormal short selling, respectively. Interestingly, higher supplier return exhibits a positive link to supplier abnormal short selling. Such results are consistent with Diether, Lee, and Werner (2008) who report increased short selling after price run-ups. The regression coefficient of supplier size is positively significant only in Panel B, and that of the book-to-market equity ratio is insignificant.

In sum, we have found a strong negatively significant relation between post-news customer returns and supplier short selling, while accounting for characteristics shown to affect short selling as well as for firm-year and industry-year fixed effects. Such evidence is important especially in the context of short sellers playing a key role in financial markets. For instance, Diether, Lee, and Werner (2009) report that daily shorting comprises 24% of the NYSE and 31% of the NASDAQ share volume. Further, this negative link persists across all news types and for earnings news in particular, as well as for the alternative short selling metric and time periods around the customer announcements. Such robust results are consistent with our conjecture that short sellers take advantage of return predictability arising due to limited investor attention in customer-supplier relationships and exhibit a high information processing ability to undertake profitable supplier trades in the context of customer news announcements.

B. Robustness Tests

To further establish that the link between post-news customer returns and supplier short selling is not spurious, we conduct two additional tests. In the first test, we construct a subsample of customer-supplier pairs that are either linked and become de-linked or vice versa, during our sample period between January 3, 2005 and July 6, 2007. This subsample construction is illustrated by the following example. Marvel Entertainment Inc. and Hasbro Inc. exhibit a customer-supplier link in years 2003-2004, no relationship in 2005-2006, and are re-linked in 2007-2008. In 2009, the firms become de-linked again as Walt Disney Company acquires Marvel Entertainment for $4 billion. Therefore, during our sample period, this relationship exhibits a change from the de-linked status in years 2005 and 2006 to the linked status in 2007. It is important to highlight that customer-

supplier pairs that do not experience a change in the relationship during our sample period (i.e., always linked or never linked firms) do not enter the subsample. The goal of employing the change-status subsample is to verify that short sellers' decisions to short supplier's stock are indeed driven by their knowledge of the newly (re)established customer-supplier link rather than by alternative causes.

Consistent with this expectation, prior studies report no evidence of studied effects during non-relationship years in customer-supplier pairs. For example, Cohen and Frazzini (2008) examine real activities, measured by sales and operating income, in supply chain relationships and find that they are correlated in customer-supplier pairs during linked years as well as predict supplier's real activities during those years, but are uncorrelated and exhibit no predictive power over real activities in delinked years. Similarly, Barrot and Sauvagnat (2016) show that idiosyncratic shocks in customer-supplier networks propagate only during the years of active customer-supplier relationships, while not in the delinked years.

We perform the regression analyses similar to those in our baseline model, but the key explanatory variables are Linked $\text{Ret}^C(0,2)$ and Delinked $\text{Ret}^C(0,2)$, as follows.

$$\begin{aligned} \text{AbSS}^S(0,T) &= a_0 + a_1 \text{Linked Ret}^C(0,2) + a_2 \text{Delinked Ret}^C(0,2) + a_3 \text{AbVol}^S(0,T) \\ &\quad + a_4 \text{Ret}^S(0,T) + a_5 \text{Ret}^M(0,T) + a_6 \text{Size}^S + a_7 \text{BM}^S + \epsilon(0,T). \end{aligned} \tag{2}$$

In model (2), Linked $\text{Ret}^C(0,2)$ equals customer's announcement return during the (0,2) window if the customer is linked to the supplier and equals zero if otherwise, whereas Delinked $\text{Ret}^C(0,2)$ equals customer's announcement return during the (0,2) window if the customer is delinked from the supplier and zero if otherwise. The control characteristics are the same as those in Table III.

The results are contained in Table IV. Models 1-2 focus on the customer non-earnings news, and Models 3-4 employ the customer earnings news sample. The results are consistent with our prediction. Specifically, the regression coefficients of Linked $\text{Ret}^C(0,2)$ are negatively significant and are stronger in the (0,2) window, whereas they are weaker in the (0,5) window. Such differential effects are consistent with those reported in the main results of Table III. In turn, the regression coefficients of Delinked $\text{Ret}^C(0,2)$ are insignificant across all four models. The results on control

characteristics are broadly similar to those of Table III.

Such findings suggest that short sellers take advantage of unfavorable customer news to short the supplier's stock in an active customer-supplier relationship, even if the relationship was not active in the preceding year. They further show that short sellers make no such trades during the time period when the customer exhibits no relationship with the supplier even if such a relationship existed in the prior year. This result provides further support to our conjecture that short sellers trade based on the information externality in a customer-supplier pair, and that short sellers are attentive to the existence of customer-supplier links.

In the second test, we adopt an alternative approach to establish that the customer-supplier relationship is indeed driving short sellers' decisions to short supplier's stock based on its customer's news announcement. We designate pseudo suppliers, $S*$, and pseudo customers, $C*$, by matching the true suppliers or customers to the artificial suppliers or customers by industry, closest size, and book-to-market characteristics. If short sellers are indeed carrying out their trades based on the customer news announcement pertinent to a customer-supplier relationship, the effect must only exist in a true customer-supplier pair and no effect should be observed in a pseudo customer-supplier link. Such a prediction is consistent with findings of Chu, Tian, and Wang (2014), who show no relationship between knowledge spillovers and innovation across the supply chain in false customer-supplier links.

Our analysis replaces true suppliers with the matched pseudo suppliers, or true customers with the matched pseudo customers, and employ the following two pseudo specifications. We assign firms to *pseudo supplier-customer* links and *supplier-pseudo customer* links.

$$\begin{aligned}\text{AbSS}^{S*}(0,T) &= a_0 + a_1\text{Ret}^{C}(0,2) + a_2\text{AbVol}^{S*}(0,T) + a_3\text{Ret}^{S*}(0,T) + a_4\text{Ret}^{M}(0,T) \\ &= +a_5\text{Size}^{S*} + a_6\text{BM}^{S*} + \epsilon(0,T). \qquad (3)\\ \text{AbSS}^{S}(0,T) &= a_0 + a_1\text{Ret}^{C*}(0,2) + a_2\text{AbVol}^{S}(0,T) + a_3\text{Ret}^{S}(0,T) + a_4\text{Ret}^{M}(0,T) \\ &= a_5\text{Size}^{S} + a_6\text{BM}^{S} + \epsilon(0,T). \qquad (4)\end{aligned}$$

$AbSS^{S*}(0,T)$ in (3) denotes the abnormal short selling of a pseudo supplier's stock and $Ret^{C*}(0,2)$

in (4) represents a pseudo customer's announcement return.

The results are reported in Table V. Models 1-2 and 5-6 pertain to pseudo suppliers linked to true customers, and Models 3-4 and 7-8 focus on pseudo customers linked to true suppliers. The results are aligned with our prediction as none of the $Ret^C(0,2)$ coefficients is statistically significant across all models. Since the above tests are carried out on artificial links of customers and suppliers, such evidence offers further support to the expectation that short sellers respond to customer news announcements to short supplier stock in true customer-supplier links.

In summary, the results reported in Tables IV and V provide corroborating evidence that the established link between post-news customer returns and abnormal supplier short selling is distinct and persists in various sensitivity tests, rather than spuriously displays a relationship when none exists.

C. The Role of Information Asymmetry

In this subsection, we test our second hypothesis whether the relationship between post-news customer return and supplier short selling varies in supplier information asymmetry. We expect our established relationship to strengthen in supplier firm's information asymmetry. The reason is that one would perceive a weaker information environment be associated with more gradual information dissemination and thus stronger return predictability, of which short sellers could take advantage. We implement several tests to verify our conjecture, and report the results in Tables VI and VII.

In Table VI, we perform the expanded baseline model that incorporates a metric of the information asymmetry, InfoAsym, and its interaction with $\text{Ret}^C(0,2)$, as given by

$$\begin{aligned}\text{AbSS}^S(0,T) = a_0 + a_1\text{Ret}^C(0,2) + a_2\text{InfoAsym} \times \text{Ret}^C(0,2) + a_3\text{InfoAsym} + a_4\text{AbVol}^S(0,T) \\ + a_5\text{Ret}^S(0,T) + a_6\text{Ret}^M(0,T) + a_7\text{Size}^S + a_8\text{BM}^S + \epsilon(0,T). \qquad (5)\end{aligned}$$

To conduct the tests, we employ four different binary variables to measure InfoAsym. We include (i) News, which takes the value of 1 if the supplier falls into the top quartile-ranked supplier firms with the largest number of news articles; (ii) SP500, which equals 1 if the supplier is an S&P 500

index member; (iii) InstOwn, which equals 1 if the supplier is in the top quartile-ranked supplier firms with the highest concentration of institutional ownership; and (iv) Analysts, which takes the value of 1 if the supplier is in the top quartile-ranked supplier firms with the most number of analysts following the firm. Accordingly, InfoAsym measures take the value of 1 in the instance of lower information asymmetry or greater transparency, and 0 if the information asymmetry is higher. Taken together, these measures provide a broad spectrum of metrics capturing a firm's information environment.

The results in Table VI highlight the regression coefficients of $Ret^C(0,2)$, those of its interaction terms with News, SP500, InstOwn, or Analysts, as well as of InfoAsym measures, presented separately across 16 models, which focus on customer non-earnings news versus customer earnings news, as well as on (0,2) versus (0,5) windows around the announcement date. The coefficients of the control characteristics are not tabulated given space considerations.

The evidence is consistent with Hypothesis 2. The regression coefficients of post-news customer return remain negative and strongly significant in all models. Importantly, the coefficients of the interaction terms between $Ret^C(0,2)$ and each of the InfoAsym metrics are positive and statistically significant in most models. Consistent with the results in earlier tables, the magnitudes of the coefficients of the interaction terms are all higher in (0,2) than in (0,5) windows around the announcement date. Some exceptions are the interaction terms of $Ret^C(0,2)$ with Analysts in Models 7-8, which are insignificant, while their counterparts in Models 15-16 are highly significant. Broadly, the interactions terms of $Ret^C(0,2)$ with each of the four information asymmetry measures – News, SP500, InstOwn, and Analysts – are positive and significant. As each of these information environment metrics takes the value of 1 in the instance of lower information asymmetry, positive interaction terms bear the predicted signs and imply that the negative link between customer announcement returns and supplier short selling is more (less) pronounced in high (low) supplier information asymmetry.

For more robustness tests, we also take an alternative approach to measuring information asymmetry and report the associated results in Table VII. We employ two variants of distance: (i) the

distance between supplier and customer and (ii) the supplier distance to Wall Street, both measured as the straight line distance based on historical headquarter zip codes and the zip code of Wall Street, and available from Compustat Snapshot data.[11] In our tests, the longer distance between supplier and customer or between supplier and the Wall Street, measures the possibility of a slower information dissemination. The choice of such metrics is motivated by several studies. For example, Coval and Moskowitz (2001) show that mutual funds are able to earn large abnormal returns in local investments, where the local stocks are those with the closest distance. Chu, Tian, and Wang (2014) explore the effects of customer-supplier links on supplier innovation employing distance between the supplier's and the customer's headquarters as a measure of knowledge spillover.

Table VII is based on the tests similar to those of Table VI, except it incorporates a measure of distance, $Distance^{CS}$ or $Distance^{WS}$, in place of InfoAsym, as well as the interaction of distance with $Ret^{C}(0,2)$ to assess the differential effects. $Distance^{CS}$ is defined as a binary variable that takes the value of 1 if the customer-supplier distance is in the top quartile-ranked of the customer-supplier pairs with the shortest distance or zero. Similarly, $Distance^{WS}$ takes the value of 1 if the supplier-Wall Street distance is in the top quartile-ranked of suppliers with the shortest distance from Wall Street. As previously discussed, $Distance^{CS}$ and $Distance^{WS}$ reflect the shortest distance and thus proxy for the fastest information dissemination.

The results show that the coefficients of $Ret^{C}(0,2)$ are all negative and statistically significant, thus reinforcing the earlier established link between post-news customer returns and supplier short selling, while accounting for distance measures. The interaction terms of $Ret^{C}(0,2)$ with $Distance^{CS}$ and $Distance^{WS}$ are, however, insignificant. Such findings suggest that the effect of information asymmetry is not observed when distance measures are employed to capture information dissemination.

In summary, the results strongly suggest the role of supplier information asymmetry in the relationship between post-news customer returns and supplier short selling. We thus offer evidence that supplier short selling upon customer unfavorable news announcements strengthens in supplier

[11] Compustat Snapshot contains historical information of a firm's headquarter location. Such information is important if the company has moved the location of its headquarters.

information asymmetry.

D. Short Selling of Supplier Rivals' Stock and Upstream-Downstream Relationships

D.1. Supplier Rivals

Existing empirical evidence suggests spillover effects of information externalities in the customer-supplier relationship to the supplier industry. Thus, in this subsection, we examine whether short sellers respond to customer news announcements to engage in trades that pertain to supplier rivals. As suppliers and certain rivals may not have correlated fundamentals, we particularly expect the link to depend on the degree of overlapped business operations between the supplier and supplier rival.

To carry out the tests, we employ Factset Revere's relationship data to locate all competitors of the supplier in each customer-supplier pair. We remove rivals that share the same customer with the supplier to ensure any observed effects are not driven by the customer-supplier rival links. We further take advantage of the Revere's "overlap" variable, which reports the number of overlapping industry sectors in each rival pair, with the sectors based on Revere's proprietary industry classification, designed to exhibit a hierarchical structure.[12] We then identify the closest and most distant rivals based on the largest and smallest numbers of overlapped sectors, respectively. We expect the link between post-news customer returns and supplier rival short selling to persist especially in the closest rival, but be weaker or dissipate in the case of the distant rival. Our expectation is grounded in the idea that the supplier and rivals with stronger business interconnectedness due to many overlapping business operations could exhibit more correlated fundamentals compared to those of competitors with few or no overlapped industry sectors.

The results are displayed in Table VIII. We replicate the baseline regression (1) using the subsamples of closest and most distant rivals, and present the analyses separately by rival type. The findings indicate that the $Ret^{C}(0,2)$ coefficients are consistently negative across all model specifications, suggesting that in general unfavorable customer news increases the short sale of not

[12]Revere has about 1400 industry classifications.

only the supplier's stock, as shown in the preceding sections, but also the supplier's rival firm's stock. However, the news-related customer-return has no significant effect on the distant supplier short selling; it has a significant but not robust effect on the close rival short selling. The effect becomes slightly weaker after we control for the customer's supplier's return in the regression models, an indication that the abnormal rival short selling of supplier is not driven entirely by the supplier's return. To compare the economic significance of $Ret^C(0,2)$ coefficient in the baseline regression of Table III versus that in the current table, we calculate the changes in abnormal short selling in response to a one-standard deviation change in $Ret^C(0,2)$. Ceteris paribus, short selling increases by 0.541% (2.065%) in the customer non-earnings news sample in column (1) of Table VIII (column (2) of Table III) per one-standard deviation decrease in $Ret^C(0,2)$, suggesting that the effect of customer news is 3.82 times greater on immediate supplier than that on the supplier's closest rival. Such an outcome is consistent with Hypothesis 3 that the impact on the direct supplier ought to be greater than that on the supplier's closest rival.

Overall, our findings suggest that short sellers respond to customer news announcements to short supplier rival's stock if the rival shares several industry sectors with the supplier. It is noteworthy that such results are important especially in the context of the design of the closest rival sample, where the rival is not a direct supplier of the customer. Such sample construction results in an expectation of a weaker or no relationship compared to that with the true supplier. Instead, it appears that the relationship between the post-news customer returns and supplier rival's short selling persists even if the supplier rival is not itself the customer's supplier. The above finding deepens our understanding of information spillovers through short selling across the supply chain to the supplier industry.

D.2. Upstream-Downstream Relationships

We now examine whether there is any link between post-news downstream customer announcement returns and upstream supplier short selling. While several studies focus on relationships across the entire supply chain, rather than only on customer-supplier pairs (2-party links), in M&A settings (e.g., Fee and Thomas, 2004; Shahrur, 2005), the research in this area is overall

limited. Furthermore, extant studies do not examine the effects between downstream customer and upstream supplier. Instead, their focus is on the merger of the midstream company with its downstream customer (upstream supplier) and the effects of the combined firm on the upstream supplier (downstream customer). As such, this research pursuit is different from our study as it does not directly examine the most distant two parties in the 3-party link comprised of the upstream supplier, the midstream firm, and the downstream customer.

It is plausible that the information flow in a customer-supplier relationship (where the supplier is the midstream firm) also affects the upstream supplier as the financial health of all three involved parties could be mutually determined due to interdependence of revenues, earnings, and cash flows. On the other hand, the role of the customer-supplier link may be too remote to exhibit any impact on the upstream supplier.

We identify 3-party links of upstream supplier-midstream firm-downstream customer, and remove S&P 500 firms in the midstream node. We do so for two main reasons. First, S&P 500 firms tend to have a well diversified supplier base, thus potentially rendering no crucial role of any one supplier. Second, as information asymmetry is the driving factor of return predictability, we expect high information transparency in customer-S&P 500 supplier links to make an opportunity of short sellers' profit generation pertinent to the upstream supplier less likely. The above sample construction is more likely to reveal information flow effects, if any, in the upstream supplier-downstream customer links.

We replicate the baseline regression (1) with the abnormal short selling of the supplier's supplier as the dependent variable and the upstream supplier's controls in place. The results are contained in Table IX. While the control characteristics resemble those of the main tests in Table III, the regression coefficients of the key explanatory variable, $Ret^C(0,2)$, are insignificant across all four models. Such an occurrence suggests that short sellers do not short upstream supplier's stock based on news announcement of the downstream customer. Perhaps the complexity of the multitude of midstream and upstream suppliers, all with different degrees of the strength of the direct relationships in paired links (i.e., 2-party links) renders no strong information flow effects between the two

most distant participants in the supply chain – upstream suppliers and downstream customers. The lack of information transfers, possibly caused by the lack of economic interdependence, results in no observed relationship between downstream customer announcement returns and upstream supplier short selling.

E. The Role of Public versus Private Information

Thus far, we postulate the use of public information by short sellers in customer-supplier links. Accordingly, the research design of our multivariate tests reflects contemporaneous settings. However, earlier literature proposes and finds the results consistent with short sellers acting prior to the news announcements, thereby suggesting that short sellers rely on private information for profitable trades (e.g., Christophe et al., 2004; Christophe et al., 2010). In contrast, Engelberg, Reed, and Ringgenberg (2012) report profitable short selling based on public rather than private information.

We have established in all tests that suppliers act at or shortly after the customer news announcements. To verify whether short sellers also initiate supplier trades prior to the announcements, we adjust our baseline regression model to allow for testing the use of private information. Specifically, the dependent variable of the abnormal short selling now focuses on the time period (-t,T) with (-2,-1) and (-5,-1) time frames, and so do the control characteristics, while the key independent variable $Ret^C(0,2)$ remains in the (0,2) and (0,5) time periods around the announcement date, as follows.

$$\begin{aligned}\text{AbSS}^S(-t,-T) = a_0 + a_1\text{Ret}^C(0,2) + a_2\text{AbVol}^S(-t,-T) + a_3\text{Ret}^S(-t,-T) + a_4\text{Ret}^M(-t,-T) \\ + a_5\text{Size}^S + a_6\text{BM}^S + \epsilon(0,T). \qquad (6)\end{aligned}$$

Results are shown in Table X.

The table shows no significant coefficient of customer announcement return, $Ret^C(0,2)$, across all model specifications. Such results imply that short sellers do not trade supplier stock prior to customer news announcements. While the goal of this study is not to rule out the use of private information by short sellers, the current evidence suggests that short sellers rely on public information for profitable sales of supplier stock based on customer news announcements. Our

findings provide no evidence that short sellers make use of private information when making trades based on information flows in customer-supplier links.

IV. Conclusion

Prior studies document that short sellers exhibit superior information processing ability, which gives rise to relations of short selling to future firm's fundamentals and subsequent stock returns. Another body of work provides evidence of an important role of information transfers across the supply chain, which results in incorporation of this information into security prices. While extant research examines short selling based on processing of information about the firm, we fill the gap in the literature by examining whether short sellers take advantage of information of related firms to undertake profitable trades. Specifically, we employ daily short sales data for the period January 3, 2005 to July 6, 2007 and Factset Revere's firm-level relations (Compustat) data with 2,402 (2,680) supplier firms and 2,061 (2,898) customer firms in non-earnings news (earnings news) sample which captures all corporate non-earnings (earnings) news types to examine whether short sellers exploit information pertinent to customer-supplier links when making their trade decisions. Examining such a wide sample of customer-supplier relationships provides an excellent platform to assess whether and how short sellers take advantage of information transfers across the supply chain.

Our study is the first to provide strong evidence that post-news customer returns are significantly negatively associated with supplier short selling in a contemporaneous setting. This finding implies that supplier short selling increases upon customer's negative announcement returns. The established relationship is robust to various sub-samples; time periods around news announcement dates; alternative measures of short selling; and numerous filters intended to mitigate the possibility that the link is affected by the confounding events, especially the supplier rather than the customer news. In further sensitivity analyses, we find no significant relationship between customer announcement returns and supplier short selling during the time periods when customer-supplier pairs change from linked to delinked status, while the relationship persists when they change from delinked to linked status. We find no significant relationship when we assign customers and sup-

pliers to pseudo relationships. Such findings provide further support to our main hypothesis that the relation between post-news customer return and supplier short selling is distinct rather than reflects other effects.

Our further results uncover evidence that information transfers in customer-supplier relationships propagate across the supply chain. Specifically, we document increased short selling of supplier's closest rival upon negative customer announcement return. Finally, no increased short selling is observed prior to unfavorable customer news, suggesting that short sellers exploit public information revelation to undertake profitable trades.

In sum, our findings indicate an information intermediary role of short sellers in customer-supplier relationships, and more broadly, along the supply chain. Such results present a channel through which short sellers undertake an important function in the financial markets to increase price efficiency.

Figure 1
A Snapshot of the Factset Revere Information on Google in Year 2007

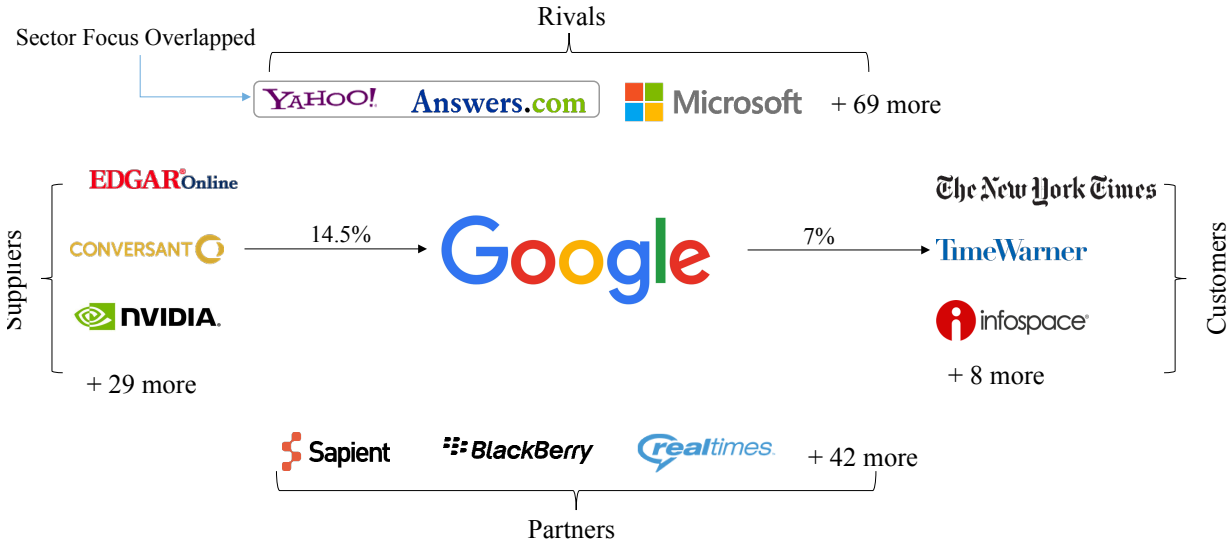

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Table I

Summary Statistics

This table reports the annual number of observations (NObs) for supplier firms, customer firms, and customer-supplier pairs, the average number of suppliers per customer, the average number of customers per supplier, and the average number of Ravenpack customer non-earnings news articles per customer. It also reports the mean, median, and standard deviation of our key variables and various control variables. Our short-sale variables are the supplier absolute short selling ($\text{AbSS}^S(0,T)$), where it is measured over the period from the customer non-earnings news release date, or earnings announcement date at t=0 to T (where T=2 or 5 days after the announcement). Control variables include supplier abnormal volume ($\text{AbVol}^S(0,T)$) during t=0,T relative to traded shares during the non-announcement period, supplier and market returns around customer-news announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). Construction of the variables is defined in Appendix A. Sample period is from July 2005 to July 2007.

	Customer Non-Earnings News				**Customer Earnings News**			
Variable	NObs	Mean	Median	Std Dev	NObs	Mean	Median	Std Dev
Panel A: Supplier Firms and Customer Firms								
Number of suppliers per customer		5.566	2	10.589		6.753	2	15.491
Number of customers per supplier		4.776	3	5.502		7.303	4	10.514
Supplier firms	2,402				2,680			
Customer firms	2,061				2,898			
Customer-supplier pairs	11,477				19,576			
Panel B: Customer News								
Number of news articles per customer-supplier pair		5.649	6	2.897		7.594	5	6.967
Customer-supplier pair year observations	52,451				89,328			
Panel C: Abnormal Short Selling								
AbSS(0,2)		-2.245%	-19.38%	67.47%		8.425%	-11.27%	74.16%
AbSS(0,5)		1.658%	-13.82%	64.07%		9.563%	-6.436%	66.10%
Panel D: Control Variables								
$\text{AbVol}^S(0,2)$		-3.502%	-17.78%	62.62%		8.947%	-9.379%	73.28%
$\text{Ret}^S(0,2)$		0.153%	0.062%	3.746%		0.272%	0.176%	4.168%
$\text{Ret}^M(0,2)$		0.108%	0.174%	0.903%		0.167%	0.284%	0.879%
$\text{AbVol}^S(0,5)$		-0.084%	-13.99%	60.35%		9.553%	-5.962%	64.95%
$\text{Ret}^S(0,5)$		0.403%	0.306%	5.485%		0.536%	0.436%	5.807%
$\text{Ret}^M(0,5)$		0.326%	0.449%	1.451%		0.416%	0.536%	1.348%
Size^S		6.128	6.037	2.013		6.727	6.507	2.208
BM^S		48.23%	41.77%	30.71%		45.77%	38.53%	29.69%

Table II

Pearson Correlation Matrix

This table reports the cross-correlation coefficients between the independent variables employed in our baseline analysis with p-values reported in parentheses. Our key variable is post-news customer return ($\text{Ret}^C(0,2)$) measured from the release of customer news at t=0 to day 2. Control variables include the supplier absolute short selling ($\text{AbSS}^S(0,T)$), supplier abnormal volume ($\text{AbVol}^S(0,T)$), supplier and market returns around customer-news announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). Definition and construction of the variables are shown in Appendix A.

	AbSS(0,5)	$\text{Ret}^C(0,2)$	$\text{AbVol}^S(0,2)$	$\text{Ret}^S(0,2)$	$\text{Ret}^M(0,2)$	$\text{AbVol}^S(0,5)$	$\text{Ret}^S(0,5)$	$\text{Ret}^M(0,5)$	Size^S	BM^S
AbSS(0,2)	0.821	-0.011	0.737	0.165	-0.022	0.608	0.123	-0.023	0.030	-0.001
	(<.001)	(0.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(0.716)
AbSS(0,5)		-0.009	0.633	0.139	-0.021	0.765	0.168	-0.026	0.019	-0.005
		(0.007)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(0.161)
$\text{Ret}^C(0,2)$			-0.006	0.203	0.371	-0.006	0.138	0.231	-0.002	0.003
			(0.055)	(<.001)	(<.001)	(0.056)	(<.001)	(<.001)	(0.646)	(0.425)
$\text{AbVol}^S(0,2)$				0.106	-0.010	0.810	0.089	-0.018	0.027	0.003
				(<.001)	(0.005)	(<.001)	(<.001)	(<.001)	(<.001)	(0.344)
$\text{Ret}^S(0,2)$					0.324	0.084	0.664	0.206	0.007	-0.012
					(<.001)	(<.001)	(<.001)	(<.001)	(0.046)	(<.001)
$\text{Ret}^M(0,2)$						-0.006	0.219	0.642	0.001	0.007
						(0.058)	(<.001)	(<.001)	(0.68)	(0.040)
$\text{AbVol}^S(0,5)$							0.107	-0.014	0.015	0.000
							(<.001)	(<.001)	(<.001)	(0.896)
$\text{Ret}^S(0,5)$								0.334	0.009	-0.011
								(<.001)	(0.007)	(0.002)
$\text{Ret}^M(0,5)$									0.000	0.003
									(0.927)	(0.356)
Size^S										0.105
										(<.001)

Table III

Post-News Customer Returns and Supplier Abnormal Short Sales

This table reports results from the regression of supplier abnormal short selling (Panel A) or supplier relative short selling (Panel B) on the post-news customer announcement return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date, or earnings announcement date at t=0 to day 2.

$$\begin{aligned}\text{AbSS}^S(0,T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{AbVol}^S(0,T) + a_3\text{Ret}^S(0,T) + a_4\text{Ret}^M(0,T) + a_5\text{Size}^S + a_6\text{BM}^S + \epsilon(0,T).\\ \text{ReSS}^S(0,T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{NReSS}^S(0,T) + a_3\text{Ret}^S(0,T) + a_4\text{Ret}^M(0,T) + a_5\text{Size}^S + a_6\text{BM}^S + \epsilon(0,T).\end{aligned}$$

The dependent variable is either the supplier abnormal short selling ($\text{AbSS}^S(0,T)$) or supplier relative short selling ($\text{ReSS}^S(0,T)$). Control variables include supplier abnormal volume ($\text{AbVol}^S(0,T)$) or shorted shares during t=0,T relative to traded shares during the non-announcement period ($\text{NReSS}^S(0,T)$), supplier and market returns around customer-news announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

Panel A: Abnormal Short Sales, $\text{AbSS}^S(t,T)$

	Customer Non-Earnings News				**Customer Earnings News**			
	$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$		$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Ret}^C(0,2)$		-0.652***		-0.293***		-0.113***		-0.075**
		(-2.983)		(-2.905)		(-3.176)		(-2.359)
$\text{AbVol}^S(0,2)$	1.378***	1.390***			1.060***	1.060***		
	(5.236)	(5.293)			(14.361)	(14.363)		
$\text{Ret}^S(0,2)$	2.633***	2.589***			3.094***	3.104***		
	(4.994)	(4.749)			(6.664)	(6.671)		
$\text{Ret}^M(0,2)$	-2.018**	-3.472***			-3.929***	-3.830***		
	(-2.196)	(-3.611)			(-6.403)	(-6.342)		
$\text{AbVol}^S(0,5)$			0.388***	0.392***			1.207***	1.207***
			(4.036)	(3.996)			(9.139)	(9.139)
$\text{Ret}^S(0,5)$			1.989***	2.004***			1.441***	1.444***
			(8.205)	(7.950)			(5.780)	(5.791)
$\text{Ret}^M(0,5)$			-1.186***	-3.269***			-1.523***	-1.505***
			(-2.704)	(-7.785)			(-4.818)	(-4.767)
Size^S	0.002	0.006	-0.022	-0.013	0.019	0.018	0.037	0.037
	(0.070)	(0.166)	(-0.807)	(-0.504)	(0.669)	(0.662)	(1.153)	(1.150)
BM^S	0.013	-0.016	-0.014	-0.025	0.027	0.027	0.047	0.047
	(0.203)	(-0.247)	(-0.327)	(-0.548)	(0.573)	(0.574)	(0.997)	(0.998)
NObs	52,451	52,451	52,451	52,451	89,328	89,328	89,328	89,328
$\bar{R}^2$	0.724	0.731	0.369	0.379	0.687	0.687	0.790	0.790
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table III – Continued

Post-News Customer Returns and Supplier Abnormal Short Sales

	Panel B: Relative Short Sales, ReSS$^S(t,T)$							
	Customer Non-Earnings News				**Customer Earnings News**			
	ReSS$^S(0,2)$		ReSS$^S(0,5)$		ReSS$^S(0,2)$		ReSS$^S(0,5)$	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ret$^C(0,2)$		-0.040***		-0.037***		-0.016***		-0.009**
		(-2.622)		(-2.948)		(-3.414)		(-2.300)
NReSS$^S(0,2)$	0.355***	0.346***			0.368***	0.368***		
	(19.982)	(20.414)			(23.099)	(23.090)		
Ret$^S(0,2)$	0.360***	0.355***			0.381***	0.382***		
	(22.425)	(22.414)			(23.702)	(23.780)		
Ret$^M(0,2)$	-0.063	-0.529***			-0.446***	-0.432***		
	(-1.047)	(-8.772)			(-8.653)	(-8.335)		
NReSS$^S(0,5)$			0.333***	0.327***			0.346***	0.346***
			(19.438)	(20.231)			(21.946)	(21.940)
Ret$^S(0,5)$			0.231***	0.230***			0.219***	0.220***
			(21.724)	(22.829)			(21.634)	(21.663)
Ret$^M(0,5)$			0.243***	-0.271***			-0.168***	-0.165***
			(6.426)	(-8.282)			(-5.079)	(-5.008)
Size^S	0.008*	0.012**	0.015***	0.019***	0.015***	0.015***	0.018***	0.018***
	(1.655)	(2.409)	(3.392)	(4.267)	(3.485)	(3.479)	(4.038)	(4.039)
BM^S	0.000	-0.002	-0.007	-0.009	0.003	0.003	-0.001	-0.001
	(0.029)	(-0.328)	(-1.010)	(-1.547)	(0.417)	(0.418)	(-0.130)	(-0.131)
NObs	52,451	52,451	52,451	52,451	89,328	89,328	89,328	89,328
$\bar{R}^2$	0.373	0.394	0.438	0.463	0.435	0.435	0.499	0.499
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table IV

Linked vs. Delinked Customer-Supplier Relations, Post-News Customer Returns, and Supplier Abnormal Short Sales

This table reports results from the regression of supplier abnormal short selling on the linked vs delinked post-news customer return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2. Specifically, the analysis focuses on a sample of supplier-customer pairs, where the customers are once linked and then become delinked, or are not linked but then become linked with their respective suppliers during the sample period from January 3, 2005 to July 6, 2007.

$$\begin{aligned}\text{AbSS}^S(0,T) \quad = \quad & a_0 + a_1 \text{Linked Ret}^C(0,2) + a_2 \text{Delinked Ret}^C(0,2) + a_3 \text{AbVol}^S(0,T) \\ & + a_4 \text{Ret}^S(0,T) + a_5 \text{Ret}^M(0,T) + a_6 \text{Size}^S + a_7 \text{BM}^S + \epsilon(0,T).\end{aligned}$$

The dependent variable is the supplier abnormal short selling ($\text{AbSS}^S(0,T)$). Linked $\text{Ret}^C(0,2)$ is a variable that equals the customer return over the announcement date at t=0 to day 2 if the customer is linked to the supplier, and 0 if otherwise. Delinked $\text{Ret}^C(0,2)$ is a variable that equals the customer return over the announcement date at t=0 to day 2 if the customer is delinked from the supplier, and 0 if they become linked. Control variables include supplier abnormal volume ($\text{AbVol}^S(0,T)$) during post-news customer announcements, supplier and market returns during post-news customer announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News		**Customer Earnings News**	
	AbSS(0,2)	AbSS(0,5)	AbSS(0,2)	AbSS(0,5)
Variables	(1)	(2)	(3)	(4)
Linked $\text{Ret}^C(0,2)$	-0.553**	0.245	-0.170***	-0.083*
	(-2.393)	(0.764)	(-3.085)	(-1.679)
Delinked $\text{Ret}^C(0,2)$	-0.456	-0.061	0.041	0.015
	(-1.303)	(-0.243)	(0.121)	(0.081)
$\text{AbVol}^S(0,2)$	1.506***		1.325***	
	(9.867)		(10.648)	
$\text{Ret}^S(0,2)$	2.231*		2.450***	
	(1.872)		(3.927)	
$\text{Ret}^M(0,2)$	-2.651		-2.908***	
	(-1.455)		(-3.833)	
$\text{AbVol}^S(0,5)$		1.438***		1.433***
		(10.699)		(9.648)
$\text{Ret}^S(0,5)$		1.329***		0.821**
		(3.000)		(2.286)
$\text{Ret}^M(0,5)$		-1.849***		-0.764
		(-2.949)		(-1.560)
Size^S	0.043	0.026	-0.020	0.009
	(1.200)	(0.912)	(-0.408)	(0.189)
BM^S	0.020	0.033	0.018	0.019
	(0.426)	(0.822)	(0.497)	(0.407)
NObs	38,734	38,734	82,140	82,140
$\bar{R}^2$	0.870	0.856	0.813	0.860
Firm-Year	Yes	Yes	Yes	Yes

Table V

Placebo Tests: Post-News Customer Returns and Supplier Abnormal Short Sales

This table reports results from the regression of supplier abnormal short selling on the post-news customer return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2.

$$\begin{aligned}
\text{Pseudo Supplier:}\quad \text{AbSS}^{S*}(0,T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{AbVol}^{S*}(0,T) + a_3\text{Ret}^{S*}(0,T) + a_4\text{Ret}^M(0,T) \\
&\quad + a_5\text{Size}^{S*} + a_6\text{BM}^{S*} + \epsilon(0,T). \\
\text{Pseudo Customer:}\quad \text{AbSS}^{S}(0,T) &= a_0 + a_1\text{Ret}^{C*}(0,2) + a_2\text{AbVol}^{S}(0,T) + a_3\text{Ret}^{S}(0,T) + a_4\text{Ret}^M(0,T) \\
&\quad + a_5\text{Size}^{S} + a_6\text{BM}^{S} + \epsilon(0,T).
\end{aligned}$$

The dependent variable is the supplier abnormal short selling ($\text{AbSS}^S(0,T)$). $S*$ denotes a supplier matched to the linked supplier by industry and closest size and BM; $C*$ denotes a customer matched to the linked customer by industry and by closest size and BM. Control variables include supplier abnormal volume ($\text{AbVol}^S(0,T)$), supplier and market returns around post-news customer dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the pseudo supplier firm level or pseudo customer firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News				**Customer Earnings News**			
	Pseudo Suppliers		**Pseudo Customers**		**Pseudo Suppliers**		**Pseudo Customers**	
	$\text{AbSS}^{S*}(0,2)$	$\text{AbSS}^{S*}(0,5)$	$\text{AbSS}^{C*}(0,2)$	$\text{AbSS}^{C*}(0,5)$	$\text{AbSS}^{S*}(0,2)$	$\text{AbSS}^{S*}(0,5)$	$\text{AbSS}^{C*}(0,2)$	$\text{AbSS}^{C*}(0,5)$
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Ret}^C(0,2)$	-0.057	-0.013			-0.003	-0.012		
	(-0.120)	(-0.049)			(-0.089)	(-0.377)		
$\text{Ret}^{C*}(0,2)$			0.167	0.060			-0.038	-0.036
			(0.946)	(0.648)			(-0.849)	(-0.961)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NObs	38,593	38,593	48,238	48,238	83,889	83,889	59,986	59,986
$\bar{R}^2$	0.653	0.693	0.805	0.540	0.815	0.800	0.878	0.877
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VI
Post-News Customer Returns, Supplier Abnormal Short Sales, and Supplier Information Asymmetry

This table reports results from the regression of supplier abnormal short selling on the post-news customer announcement return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2, and a measure of supplier information asymmetry (InfoAsym).

$$\text{AbSS}^S(0,T) \quad = \quad a_0 + a_1\text{Ret}^C(0,2) + a_2\text{InfoAsym} \times \text{Ret}^C(0,2) + a_3\text{InfoAsym} + a_4\text{AbVol}^S(0,T) + a_5\text{Ret}^S(0,T) + a_6\text{Ret}^M(0,T) + a_7\text{Size}^S + a_8\text{BM}^S + \epsilon(0,T).$$

The dependent variable is the supplier abnormal short selling ($\text{AbSS}^S(0,T)$). The regression employs five different measures of the supplier information asymmetry binary indicators (InfoAsym), namely top quartile-ranked number of news articles (News), SP500 index member (SP500), top quartile-ranked institutional ownership (InstOwn), and top-quartile ranked number of analysts following (Analysts). InfoAsym equals 1 if the supplier firm is ranked among the 25% of firms with the lowest level of information asymmetry and 0 if otherwise. Unreported coefficients of the control variables include those of supplier abnormal volume ($\text{AbVol}^S(0,T)$), supplier and market returns around customer earnings announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News								**Customer Earnings News**							
	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)	$\text{AbSS}^S(0,T)$ (0,2)	(0,5)
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
$\text{Ret}^C(0,2)$	-0.179***	-0.122***	-0.188***	-0.127***	-0.831**	-0.263*	-0.779***	-0.286**	-0.845***	-0.277**	-0.809***	-0.313***	-0.208***	-0.120***	-0.154***	-0.113***
	(-3.606)	(-2.656)	(-3.767)	(-2.761)	(-2.423)	(-1.846)	(-2.679)	(-2.289)	(-2.672)	(-2.198)	(-3.007)	(-2.744)	(-3.894)	(-2.688)	(-3.482)	(-2.748)
News×	0.193***	0.137***							0.668*	-0.059						
$\text{Ret}^C(0,2)$	(3.546)	(2.599)							(1.688)	(-0.342)						
News	0.026	0.023							0.015	0.007						
	(1.037)	(1.218)							(0.702)	(0.340)						
SP500×			0.219***	0.152***							0.890**	0.112				
$\text{Ret}^C(0,2)$			(3.954)	(2.856)							(2.535)	(0.608)				
SP500			0.037	0.041							0.044	-0.031				
			(0.879)	(1.050)							(0.918)	(-0.669)				
InstOwn×					0.717*	-0.079							0.230***	0.138***		
$\text{Ret}^C(0,2)$					(1.687)	(-0.447)							(3.963)	(2.651)		
InstOwn					-0.009	0.027							0.024	0.027		
					(-0.418)	(1.478)							(0.568)	(0.607)		
Analysts×							0.490	-0.031							0.166***	0.152***
$\text{Ret}^C(0,2)$							(1.460)	(-0.181)							(3.080)	(2.941)
Analysts							0.000	-0.011							0.018*	0.019*
							(-0.017)	(-0.902)							(1.958)	(1.711)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NObs	89,328	89,328	89,328	89,328	47053	47053	52451	52451	52,451	52,451	52,451	52,451	82,096	82,096	89,328	89,328
$\bar{R}^2$	0.687	0.790	0.687	0.790	0.75	0.382	0.731	0.379	0.731	0.379	0.731	0.379	0.715	0.811	0.687	0.790
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VII

Distance, Post-News Customer Returns, and Supplier Abnormal Short Sales

This table reports results from the regression of supplier abnormal short selling on the post-news customer announcement return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2, and a measure of supplier-customer distance (Distance^{CS}) or the distance of the supplier from the Wall Street (Distance^{WS}).

$$\begin{aligned}\text{AbSS}^S(0,T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{Distance}\times\text{Ret}^C(0,2) + a_3\text{Distance} + a_4\text{AbVol}^S(0,T) + a_5\text{Ret}^S(0,T)\\ &\quad + a_6\text{Ret}^M(0,T) + a_7\text{Size}^S + a_8\text{BM}^S + \epsilon(0,T).\end{aligned}$$

The dependent variable is the supplier abnormal short selling ($\text{AbSS}^S(0,T)$). Distance represents a binary variable that takes the value of 1 if the customer-supplier distance is ranked among the 25% of the customer-supplier pairs with the shortest distance, or if the distance between the supplier firm and Wall Street is ranked among the 25% of suppliers with the shortest distance from the Wall Street. Unreported coefficients of the control variables include those of supplier abnormal volume ($\text{AbVol}^S(0,T)$), supplier and market returns around customer news announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News				**Customer Earnings News**			
	$\text{AbSS}^S(0,2)$	$\text{AbSS}^S(0,5)$	$\text{AbSS}^S(0,2)$	$\text{AbSS}^S(0,5)$	$\text{AbSS}^S(0,2)$	$\text{AbSS}^S(0,5)$	$\text{AbSS}^S(0,2)$	$\text{AbSS}^S(0,5)$
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Ret}^C(0,2)$	-0.814***	-0.233*	-0.626***	-0.396***	-0.096**	-0.080*	-0.131***	-0.120***
	(-3.283)	(-1.807)	(-2.642)	(-3.139)	(-2.041)	(-1.841)	(-3.126)	(-2.950)
$\text{Distance}^{CS}\times$	0.406	0.057			-0.017	-0.011		
$\text{Ret}^C(0,2)$	(1.047)	(0.256)			(-0.230)	(-0.153)		
Distance^{CS}	0.006	0.010			0.000	0.000		
	(0.403)	(1.022)			(0.015)	(0.045)		
$\text{Distance}^{WS}\times$			-0.106	0.396*			0.057	0.144**
$\text{Ret}^C(0,2)$			(-0.312)	(1.908)			(0.763)	(2.286)
Distance^{WS}			-0.123**	-0.043			-0.024	-0.022
			(-2.251)	(-0.962)			(-0.641)	(-0.591)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NObs	43,018	43018	52,406	52,406	74197	74197	89251	89251
$\bar{R}^2$	0.711	0.403	0.731	0.379	0.706	0.811	0.687	0.790
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VIII

Supplier's Rival Abnormal Short Sales and Post-News Customer Returns

This table reports results from the regression of supplier's rival abnormal short selling on the post-news customer announcement return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2.

$$\text{AbSS}^R(0,T) \quad = \quad a_0 + a_1\text{Ret}^C(0,2) + a_2\text{Ret}^S(0,2) + a_3\text{AbVol}^R(0,T) + a_4\text{Ret}^R(0,T) + a_5\text{Ret}^M(0,T) + a_6\text{Size}^R + a_7\text{BM}^R + \epsilon(0,T).$$

The dependent variable is the supplier's closest or distant rival's abnormal short selling ($\text{AbSS}^R(0,T)$). Control variables include supplier return ($\text{Ret}^S(0,2)$), rival abnormal volume ($\text{AbVol}^R(0,T)$), supplier's rival and market returns around customer-news announcement dates ($\text{Ret}^R(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier's rival firm size (Size^R) and book-market equity ratio (BM^R). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier's rival firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier's rival firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News								**Customer Earnings News**							
	Closest Rival				Distant Rival				Closest Rival				Distant Rival			
	$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$		$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$		$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$		$\text{AbSS}^S(0,2)$		$\text{AbSS}^S(0,5)$	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
$\text{Ret}^C(0,2)$	-0.176**	-0.145*	-0.099	-0.061	-0.281	-0.258	-0.105	-0.050	-0.067*	-0.067*	-0.077***	-0.070**	-0.057	-0.049	-0.086	-0.077
	(-2.068)	(-1.702)	(-1.325)	(-0.782)	(-1.607)	(-1.481)	(-0.624)	(-0.280)	(-1.700)	(-1.727)	(-2.618)	(-2.425)	(-0.768)	(-0.670)	(-1.529)	(-1.366)
$\text{Ret}^S(0,2)$		-0.301***				-0.228				0.008				-0.288**		
		(-3.012)				(-1.532)				(0.099)				(-2.086)		
$\text{Ret}^S(0,5)$				-0.199***				-0.294**				-0.141**				-0.217**
				(-2.628)				(-2.206)				(-2.181)				(-2.329)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NObs	45,889	45,886	45,905	45,902	20,473	20,473	20,473	20,473	84,151	84,149	84,151	84,149	41,894	41,894	41,942	41,942
$\bar{R}^2$	0.542	0.542	0.566	0.566	0.608	0.608	0.571	0.571	0.584	0.584	0.552	0.552	0.614	0.614	0.689	0.690
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table IX

Upstream Supplier Abnormal Short Sales and Post-News Customer Returns

This table reports results from the regression of upstream supplier abnormal short selling on the post-news customer announcement return ($\text{Ret}^{C}(0,T)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2.

$$\begin{aligned}\text{AbSS}^{SS}(0,T) &= a_0 + a_1\text{Ret}^{C}(0,2) + a_2\text{AbVol}^{SS}(0,T) + a_3\text{Ret}^{SS}(0,T) + a_4\text{Ret}^{M}(0,T) + a_5\text{Size}^{SS} \\ &\quad + a_6\text{BM}^{SS} + \epsilon(0,T).\end{aligned}$$

The dependent variable is the upstream supplier abnormal short selling ($\text{AbSS}^{SS}(0,T)$). Control variables include those of upstream supplier abnormal volume ($\text{AbVol}^{SS}(0,T)$), upstream supplier and market returns around customer news announcement dates ($\text{Ret}^{SS}(0,T)$ and $\text{Ret}^{M}(0,T)$, respectively), upstream supplier firm size (Size^{SS}), and supplier book-market equity ratio (BM^{SS}). All the variables are defined in Appendix A. NObs is the number of customer-supplier-supplier links, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include upstream supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the upstream supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News		**Customer Earnings News**	
	$\text{AbSS}^{SS}(0,2)$	$\text{AbSS}^{SS}(0,5)$	$\text{AbSS}^{SS}(0,2)$	$\text{AbSS}^{SS}(0,5)$
Variables	(1)	(2)	(3)	(4)
$\text{Ret}^{C}(0,2)$	-0.122	-0.098	0.018	-0.003
	(-1.362)	(-1.274)	(0.474)	(-0.089)
$\text{AbVol}^{SS}(0,2)$	1.019***		0.627***	
	(16.111)		(2.873)	
$\text{Ret}^{SS}(0,2)$	2.080***		2.298***	
	(5.683)		(3.834)	
$\text{Ret}^{M}(0,2)$	-3.047***		-3.025***	
	(-5.087)		(-3.574)	
$\text{AbVol}^{SS}(0,5)$		1.064***		0.847***
		(17.024)		(6.610)
$\text{Ret}^{SS}(0,5)$		1.362***		1.384***
		(6.479)		(4.876)
$\text{Ret}^{M}(0,5)$		-1.937***		-1.443***
		(-5.929)		(-2.665)
Size^{SS}	-0.001	-0.007	0.013	0.020
	(-0.041)	(-0.289)	(0.370)	(0.634)
BM^{SS}	0.012	0.006	0.063	0.073
	(0.190)	(0.111)	(0.726)	(0.743)
NObs	51,588	51,678	82,350	82,350
$\bar{R}^2$	0.605	0.640	0.414	0.533
Firm-Year	Yes	Yes	Yes	Yes

Table X

Post-News Customer Returns and Pre-News Supplier Abnormal Short Sales

This table reports results from the regression of supplier abnormal short selling prior to customer-news releases on the post-news customer announcement return ($\text{Ret}^C(0,2)$), where the return is measured over the period from the customer non-earnings news release date or earnings announcement date at t=0 to day 2.

$$\begin{aligned}\text{AbSS}^S(-t,-T) &= a_0 + a_1\text{Ret}^C(0,2) + a_2\text{AbVol}^S(-t,-T) + a_3\text{Ret}^S(-t,-T) + a_4\text{Ret}^M(-t,-T) + a_5\text{Size}^S \\ &\quad + a_6\text{BM}^S + \epsilon.\end{aligned}$$

The dependent variable is the supplier abnormal short selling ($\text{AbSS}^S(-t,-T)$). Control variables include supplier abnormal volume ($\text{AbVol}^S(0,T)$), supplier and market returns around customer-news announcement dates ($\text{Ret}^S(0,T)$ and $\text{Ret}^M(0,T)$, respectively), supplier firm size (Size^S), and supplier book-market equity ratio (BM^S). All the variables are defined in Appendix A. NObs is the number of customer-supplier pairs, and $\bar{R}^2$ is the adjusted R-squared value. All regressions also include supplier firm-year fixed effects (FE), and all $t-$statistics reported in parentheses are computed based on adjusted standard errors clustered at the supplier firm level. *, **, *** are significance levels denoted at the 10%, 5% and 1%, levels, respectively.

	Customer Non-Earnings News		**Customer Earnings News**	
	$\text{AbSS}^S(-2,-1)$	$\text{AbSS}^S(-5,-1)$	$\text{AbSS}^S(-2,-1)$	$\text{AbSS}^S(-5,-1)$
Variables	(1)	(2)	(3)	(4)
$\text{Ret}^C(0,2)$	0.120	0.100	0.008	0.044
	(0.946)	(0.950)	(0.188)	(1.260)
$\text{AbVol}^S(-2,-1)$	0.197		1.002***	
	(1.572)		(7.166)	
$\text{Ret}^S(-2,-1)$	1.129**		2.624***	
	(2.325)		(3.760)	
$\text{Ret}^M(-2,-1)$	-1.848***		-1.140	
	(-3.587)		(-1.491)	
$\text{AbVol}^S(-5,-1)$		0.356***		1.298***
		(3.690)		(7.638)
$\text{Ret}^S(-5,-1)$		1.195***		1.074***
		(2.820)		(3.111)
$\text{Ret}^M(-5,-1)$		-1.809***		-1.251***
		(-3.570)		(-3.328)
Size^S	-0.024	0.009	-0.001	0.024
	(-0.812)	(0.357)	(-0.024)	(0.790)
BM^S	0.025	-0.013	0.018	0.032
	(0.693)	(-0.419)	(0.308)	(0.590)
NObs	52,451	52,451	89,327	89,328
$\bar{R}^2$	0.209	0.340	0.685	0.818
Firm-Year	Yes	Yes	Yes	Yes

Appendix A
Variable Definition and Data Source

Variable	Definition	Data Source
AbSS(0,T)	The average daily number of a supplier firm's shares sold short from its customer's news release date at day 0 to day T (T=2, 5) divided by the average daily number of the supplier firm's shares sold short during the non-announcement period, and then normalize the difference by the latter. The non-announcement period is the period within the quarter that the Ravenpack news is released, but excluding the days from day 0 to day T. In the case of earnings announcements, the non-announcement period is measured between day -57 and day -T (T=2, 5) from the announcement date set at day 0.	Manual collection from various stock exchanges' websites, including NYSE TAQ database.
$\text{Ret}^C(0,2)$	Customer firm's cumulative return associated with own non-earnings news release date or earnings announcement date at day 0 to day 2.	CRSP
$\text{AbVol}^S(t,T)$	The difference between the average daily stock turnover of a supplier firm for day t to day T (T=2, 5) and the average daily number of stock turnover during the non-announcement period and then divide the difference by the latter.	CRSP
$\text{Ret}^S(t,T)$	Supplier firm's cumulative return associated with customer news or earnings announcement from day t to day T.	CRSP
$\text{Ret}^M(t,T)$	Market's cumulative return associated with customer news or earnings announcement from day t to day T.	CRSP
$\text{ReSS}^S(0,T)$	The number of shorted shares relative to traded shares of a supplier firm during the period from the customer news release or earnings announcement day 0 to day T.	Manual collection from various stock exchanges' websites, including NYSE TAQ database; CRSP
$\text{NReSS}^S(0,T)$	The number of shorted shares relative to traded shares of a supplier firm during the non-announcement period, which is between day -57 and day -T, (T=2, 5).	Manual collection from various stock exchanges' websites, including NYSE TAQ database; CRSP
Size^S	Log of total assets of supplier firm in year $t-1$.	Compustat
BM^S	Book to market equity ratio of supplier firm in year $t-1$.	Compustat
Linked $\text{Ret}^C(0,2)$	A variable that equals the customer firm's cumulative return associated with own news release or earnings announcement date at day 0 to day 2 if the customer is linked to the supplier, and 0 if otherwise.	CRSP
Delinked $\text{Ret}^C(0,2)$	A variable that equals the customer firm's cumulative return associated with own news release or earnings announcement date at day 0 to day 2 if the customer is delinked from the supplier, and 0 if they become linked.	CRSP
Distance^{CS}	A binary variable that equals 1 if the customer-supplier distance is ranked among the 25% of the customer-supplier pairs with the shortest distance.	Compustat Snapshot Data
Distance^{WS}	A binary variable that equals 1 if the distance between the supplier firm and the Wall Street is ranked among the 25% of suppliers with the shortest distance from the Wall Street.	Compustat Snapshot Data
News	A binary variable that equals 1 if the supplier firm is ranked among the 25% of supplier firms with most number of news articles.	Ravenpack
SP500	A binary variable that equals 1 if the supplier firm is an S&P500 index member	CRSP
InstOwn	A binary variable that equals 1 if the supplier firm is among the top 25% of supplier firms with the largest institutional ownership.	Thomson Reuters
Analysts	A binary variable that equals 1 if the supplier firm is among the top 25% of supplier firms with the largest number of analyst coverage.	IBES