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Essays on overlapping institutional investors along a supplier: customer relationship

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Essays on Overlapping Institutional Investors along a Supplier–Customer Relationship

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DECLARATION

I hereby declare that this thesis represents my own work which has been done after registration for the degree of PhD at Hong Kong Baptist University, and has not been previously included in a thesis or dissertation submitted to this or any other institution for a degree, diploma or other qualifications.

Signature: _____

Date: August 2014

ABSTRACT

This study consists of two essays. In the first essay, I examine whether the overlap in institutional investors between the supplier and its customer can be an efficient monitoring mechanism in the product market. Using a large sample of supplier–customer relationships for the period 1980–2011, I provide the following evidence. First, a high level of overlapping institutional ownership mitigates the adverse effect of asymmetric interdependence between supplier and customer on their firm performance. Second, relationship-specific investments and partnership duration are identified as underlying channels through which overlapping institutional ownership mitigates the adverse effect of asymmetric interdependence on partners' performance. Third, overlapping institutional ownership is negatively associated with accounts receivable when the supplier is more financially constrained than the customer, suggesting that overlapping institutional ownership improves the efficiency of trade credit allocation. These findings survive out of a series of robustness checks. The findings of this study highlight that the overlap in institutional investors between supplier and customer plays as an efficient monitoring mechanism in the product market.

In the second essay, I examine the informational role of overlapping transient institutional investors who hold stocks of both the firm and its customers in disseminating customer information to the firm's bond market and document four findings. First, I find that overlapping transient institutional ownership significantly alleviates the prediction of lagged customer-portfolio bond returns to supplier bond returns even after controlling for the interaction effect between stock market and bond market. This finding survives out of a series of robustness checks. The alleviation effect is more pronounced for firms with high customer concentration and low customer industry competition, or with non-investment grade. Second, I find that overlapping transient institutional ownership represents more than a mere proxy for investor attention and leads to information advantage over overlapping institutional bondholders. Third, I find that current customer-portfolio return is significantly associated with the trading volume of overlapping transient institutional investors in the bond market, suggesting that overlapping transient institutional investors indeed take customer information into account when they trade bonds of suppliers. Fourth, I examine the real effect of customer information on bondholders and find that customer bond return is significantly related to the supplier's future operating performance, which is an important predictor of credit risk. Overall, my results show that overlapping transient institutional shareholders take economically linked information into account when they trade in the bond market and improve the informativeness of bond price.

Keywords: supplier–customer relationships, overlapping institutional investors, monitoring mechanism, bond price informativeness

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Chapter 1: The Monitoring Role of Overlapping Institutional Investors along a Supplier–Customer Relationship

1.1 Introduction

Transaction cost economics (TCE) maintains that contracts in the product market are incomplete due to bounded rationality and that this incompleteness facilitates opportunism (Williamson, 1996). Thus, suitable governance mechanisms should be explored to alleviate such opportunism and adapt the contracts. Market, vertical integration and some hybrid mechanisms in between, such as long-term contracting, are the basic governance mechanisms examined in TCE. Recent studies extend hybrid mechanisms to equity linkage (Fee et al., 2006). Prior studies extensively examine equity linkage on either that the customer takes an equity stake in the supplier or that the supplier takes an equity stake in the customer or that the customer and the supplier jointly hold an entity (e.g., Pisano, 1989; Gulati, 1995; Oxley, 1997; Robinson and Stuart, 2002; Krishnaswami et al., 2002; Allen et al., 2005; Allen and Phillips, 2002; Fee et al., 2006). This study extends the hybrid mechanism related to equity linkage to overlapping institutional investors. It is different from prior studies as this study focuses on a scenario in which an institutional investor takes an equity stake in *both* the supplier and the customer. Thus, the customer and the supplier are linked by the common institutional investor other than the trading contracts.

The related literature shows that institutional investors have both informational role (e.g., Bartov et al., 2000; Balsam et al., 2002; Jiambalvo et al., 2002; Agarwal, 2007) and monitoring role toward firm activities (e.g., Kochhar and David, 1996; Chung et al., 2002; Hartzell and Starks, 2003; Chhaochharia et

al., 2012). For example, Bartov et al. (2000) find that institutional ownership is negatively associated with post-earnings-announcement abnormal returns. Balsam et al. (2002) generate evidence that for firms with relatively high institutional ownership, unexpected discretionary accruals are negatively (not) associated with cumulative abnormal returns over a period ending two days prior to (a 17-day window around) the filing date of 10-Q forms, but for other firms, these associations are not significant. Jiambalvo et al. (2002) show that institutional ownership is positively associated with both the extent to which price leads earnings and the extent to which order backlog is reflected in price. Agarwal (2007) investigates the relationship between institutional ownership and liquidity, and finds a U-shaped relationship as a result of the interaction effect of adverse selection on uninformed investors and information efficiency. Though they focus on different perspectives, all the four papers reveal the information advantage of institutional investors. On the other hand, Kochhar and David (1996) document that ownership of pressure-resistant institutions (public pension funds, mutual funds, and endowments and foundations owning at least 1% of shares) is positively associated with firm innovations, suggesting a monitoring role of certain institutional investors. Chung et al. (2002) show that the presence of large institutional investors inhibits the earnings management incentive of managers. Hartzell and Starks (2003) find a positive (negative) relation between institutional investor concentration (i.e., the share of institutional ownership by the five largest holders or the Herfindahl index of institutional fractional holdings) and pay-for-performance sensitivity (total level) of managerial compensation. Chhaochharia et al. (2012) set forth a comprehensive analysis suggesting that local institutional investors are efficient corporate behavior monitors. Specifically,

they find that firms with local institutional investors are less likely to manage earnings, backdate options or be the targets of class action lawsuits, and more likely to introduce shareholder proposals, increase CEO turnover and decrease excess CEO pay. Managers in such firms are more likely to make efforts to increase firm value rather than build empires or lead the quiet life (fear for changes). Taken together, the monitoring role of institutional investors is well documented in the extant literature.

Another related literature shows the role of diversified shareholders (e.g., Fama, 1978; Easterbrook and Fischel, 1982; Drucker, 1991; Hansen and Lott, 1996; Rubin, 2006; Matvos and Ostrovsky, 2008; Goranova et al., 2010; Harford et al., 2011). Researchers (except Harford et al. (2011)) agree that diversified shareholders maximize portfolio value rather than the value of individual firms. Drucker (1991), Hansen and Lott (1996) and Rubin (2006) show that diversified shareholders help internalize externalities firms have on the other firms within a portfolio. However, Harford et al. (2011) find that diversified shareholders can not affect corporate decisions because of small cross-holdings. My research provides another evidence to show the monitoring role of diversified shareholders. Investor overlap, a natural consequence of investment diversification, as an information transfer channel between two given firms is also examined in existing literature. For example, Cohen and Frazzini (2008) and Jung (2013) show that overlapping institutional investors facilitate information transfer between firms. Cohen and Frazzini (2008) examine return predictability across firms in a supplier–customer relationship and show that only when mutual funds hold both the supplier's and the customer's stocks, they discern the economic link between the two firms and trade in the stock market based on information of the pair rather than one,

suggesting the *informational* role of overlapping institutional investors within a supplier–customer relationship. To my best knowledge, that is the only paper to examine the role of overlapping institutional investors along the supply chain empirically. A recent work by Jung (2013) shows a *monitoring* role of overlapping institutional investors. He finds that firms having an overlap in institutional ownership with the first mover in providing more quantitative information than the requirement of SEC are more likely to increase such information disclosure, suggesting that overlap in institutional investors is a mechanism for diffusion of disclosure practices within an industry. Different from Cohen and Frazzini (2008), I explore the monitoring role of overlapping institutional investors: i.e., whether the overlapping institutional investors mitigate the adverse effects of asymmetric interdependence between a supplier and its customer. I also extend my sample to all institutional investors exclusive of banks, insurance companies and other unclassified institutional investors[1], not just mutual funds. In contrast with Jung (2013), I focus on (i) supplier–customer links rather than industry links and (ii) the effects of overlapping institutional investors on partner performance and its underlying channels (such as relationship-specific investments and partnership duration) rather than the disclosure practices.

From a different context, this paper relates to the literature on dependence theory and bilateral deterrence theory. Dependence theory closely relates to power dependence theory (Emerson, 1962). Dependence theory stresses the importance of balancing interorganizational interdependence to alleviate uncertainty in the flow of needed resources (Pfeffer and Salancik, 1978). Casciaro and Piskorski

[1] Equivalently, I include Type 3 and Type 4 institutional investors in the Thomson Reuters Institutional (13f) Holdings database. Institutions with Type 3 refer to investment companies and their managers, and those with Type 4 refer to independent investment advisors.

(2005) further divide interorganizational interdependence into two distinct theoretical dimensions, power imbalance[2] and mutual dependence.[3] They show that the two dimensions have opposite effects on an organization's ability to absorb external constraints. Specifically, power imbalance inhibits but mutual dependence propels constraint absorption operations. Schloetzer (2012) finds that the asymmetry of interdependence as a proxy for the potential for hold-up is negatively associated with the extent of process integration and information sharing, while the magnitude of interdependence benefits process integration and information sharing between supply chain partners. Bilateral deterrence theory agrees with power dependence theory in terms of the role of mutual dependence, but disagrees that only the higher-power partner inhibits the behavior of the lower-power partner. This theory proposes that both partners in an unequal power relationship employ hostile tactics to the other (Lawler, 1992). Another line of research investigates the monitoring role of the partners within a supplier–customer relationship (Hui et al., 2012). Hui et al. (2012) find that when a firm's customers or suppliers have greater bargaining power, the firm's accounting information is more conservative, suggesting the monitoring role of powerful stakeholders in the product market.

In short, prior research well documents the monitoring role of institutional investors, and Cohen and Frazzini (2008) show the informational role of "overlapping" institutional investors within supplier–customer relationships. However, there is little research on the *monitoring* role of *overlapping* institutional investors within supplier–customer relationships. I fill in this gap by

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[2] This is consistent with the asymmetric interdependence in this paper.

3 Some scholars use another terminology, "magnitude of interdependence" (e.g., Schloetzer, 2012).

examining whether the overlapping institutional investors between supplier and customer efficiently monitor the behaviors of both supplier and customer to maximize total profits of these two firms. Furthermore, both dependence theory and bilateral deterrence theory show that asymmetric interdependence (power imbalance) is adverse to interorganizational relationship. Thus, detecting whether overlapping institutional investors mitigate the adverse effect of asymmetric interdependence naturally becomes a useful approach to examine the monitoring role of overlapping institutional investors. Hui et al. (2012) find the monitoring role of a firm's suppliers and customers with bargaining power on the firm, but don't provide a mechanism for the stakeholders to monitor the firm. I posit that overlapping institutional investors serve as a medium for one partner to monitor the other in a supplier–customer relationship. In specific, I assemble a sample of over 12,000 supplier–customer relationships for the period 1980–2011 and investigate whether a high level of overlapping institutional ownership helps mitigate the adverse effects of asymmetric interdependence between the supplier and the customer on partners' performance.

To detect the monitoring role of overlapping institutional investors, I first examine the overall effect of overlapping institutional ownership on the partners' individual performance. I find that a high level of overlapping institutional ownership mitigates the negative effects of asymmetric interdependence between supplier and customer on their individual performance using a level regression model based on Fama and French (1998). As robustness checks, I conduct five additional analyses. First, I use the excess return regression (Faulkender and Wang, 2006) to detect the change-in-change effect. The results are consistent with my main analysis. The indicator for decrease in mutual dependence and increase in

asymmetric interdependence is negatively associated with excess return only if overlapping institutional ownership decreases. Second, to control for endogeneity and censored data issue regarding overlapping institutional ownership, I first use the Tobit model to predict overlapping institutional ownership after controlling for the self-selection bias (Heckman, 1979), and then use the predicted overlapping institutional ownership as a grouping basis to test my hypotheses. I borrow the model of Ellis et al. (2012) to estimate the self-selection bias (inverse Mills ratio) for firms disclosing principal customer information. Results are generally consistent with the results using the actual overlapping institutional ownership. Third, I use overlapping institutional ownership as an independent variable in the model and examine whether its effect on performance is more significant in the group with higher asymmetric interdependence between the partners. Results are consistent with those of my main analysis. Fourth, I choose the largest customer to which the percentage of sales is greatest for each supplier and the largest supplier from which the percentage of the cost of goods sold is greatest for each customer to check whether the full sample results (where all the principal customers are treated as a portfolio) still hold. Generally, the results are consistent with those of full-sample analyses. Finally, I test my hypotheses for suppliers (customers), the customers (suppliers) of which are in the low competition industries. Suppliers (customers) in this subsample have limited alternative customers (suppliers) and thus my measurement[4] for dependence of supplier (customer) on customer (supplier) is more appropriate. Results are consistent with those of full-sample analyses.

[4] As shown in Section 1.4, I measure the dependence of supplier on customer as the percentage of supplier sales to the customer and the dependence of customer on supplier as the percentage of customer cost of goods sold from the supplier.

To identify the channels through which overlapping institutional ownership affects the partners' performance, I examine the effect of overlapping institutional ownership on relationship-specific investments and partnership duration. The results show that overlap in institutional ownership mitigates the inhibition of asymmetric interdependence on partners' incentive to invest relationship-specific assets. The results are consistent if I control for the endogeneity of overlapping institutional ownership or confine the supplier (customer) sample to suppliers (customers) with high customer (supplier) concentration of which R&D investments are more likely to be relationship specific than those without. To further detect the beneficial role of overlapping institutional investors on the partnership, I examine whether overlapping institutional ownership increases the partnership duration. I find that asymmetric interdependence is positively rather than negatively associated with partnership duration and that overlap in institutional ownership reinforces this positive effect of asymmetric interdependence on partnership duration. The results are robust if I use the predicted overlapping institutional ownership or confine the partnerships to industries with low competition where my measurement of asymmetric interdependence between the partners is more precise than those without.

As a further test, I examine the role of overlapping institutional investors on trade credit allocation. The results show that overlap in institutional ownership improves the efficiency of allocating trade credits between the partners. Specifically, overlapping institutional ownership is negatively associated with trade credits if the supplier is more financially constrained than the customer.

These evidences are consistent with the prediction that overlapping institutional ownership benefits the entire supplier–customer relationship and its

individual partners. Therefore, overlap in institutional investors between supplier and customer can be an efficient monitoring mechanism in the product market.

This paper contributes to the literature in several ways. First, it is the first study to examine the monitoring role of overlapping institutional investors along the supply chain and to provide evidence on their effective governance role in balancing interorganizational dependence, safeguarding relationship-specific investments and achieving a win-win outcome for both supplier and customer. The paper suggests that overlap in institutional investors serves as another hybrid mechanism to monitor partners along a supply chain. Furthermore, this paper extends prior research that finds the monitoring role of a firm's customers and suppliers on the firm behavior (e.g., Hui et al., 2012) to the monitoring role of overlapping institutional investors on the partners. This research suggests that a partner with low bargaining power is still able to monitor the other with relatively high bargaining power through overlapping institutional investors. Finally, this paper extends research on institutional investors by revealing the incremental role of overlapping institutional investors in monitoring their investees.

The remainder of this paper proceeds as follows. Section 1.2 presents a literature review and hypothesis development. Section 1.3 describes the data. Section 1.4 presents the analysis of overlapping institutional ownership and individual performance. Section 1.5 presents the analysis of overlapping institutional ownership and underlying channels of partner performance, Section 1.6 provides further evidence and Section 1.7 concludes.

1.2 Literature review and hypothesis development

From transaction cost economics (TCE), suppliers and customers are linked by relationship-specific investments. Because of low redeployability of the

investments, the exchange partner has the incentive to exploit the quasi-rents. The supplier or customer predicts the exploitation and can be reluctant to make such investments ex ante. So, governance mechanisms should be present to safeguard the investments to maintain a necessary level of relationship-specific investments in a supply chain. Though vertical integration is the basic safeguard mechanism, an increasing number of researchers explore various hybrid mechanisms (e.g., Stinchcombe, 1985; Heide and John, 1988; Pisano, 1989). Prior studies focus on equity linkage, primarily direct equity linkage which means that the supplier holds some stakes in the customer, or the customer holds some stakes in the supplier. Unlike prior research, the current study focuses on indirect equity linkage where a common investor holds stakes in *both* the supplier and the customer. Though direct equity linkage can alleviate opportunism of the supplier or customer, it is not as common as indirect equity linkage in practice. Fee et al. (2006) show that only 3.31% supplier–customer relationships (sample size of 10,211) have direct equity linkage where the customer holds shares of the supplier. However, in my preliminary sample,[5] 47.63% supplier–customer relationships (sample size of 36,059) have indirect equity linkage where at least one institutional investor (whose type is 3 or 4) holds both the supplier's and the customer's stocks. While indirect equity linkage is pervasive in practice, there is little knowledge about whether overlapping institutional investors play an efficient monitoring role in a supply chain. Like direct equity linkage, indirect equity linkage can be an efficient monitoring mechanism through relating both the supplier's and the customer's profitability to the common investors'. Prior research on institutional investors shows that, on one hand, institutional investors excel in gathering and interpreting

[5] The preliminary sample refers to the sample before excluding missing or extreme observations.

information (e.g., Ali et al., 2008) and, on the other hand, entrepreneurial investors are efficient monitors (e.g., Klein and Zur, 2009). Thus, entrepreneurial investors may be more efficient monitors than corporations for which external investments are not core activities. In fact, Mcconnell and Servaes (1990) find an insignificant relation between blockholder ownership and Tobin's Q while significantly positive relation between institutional ownership and Tobin's Q.

1.2.1 Overlap in institutional investors and individual partner performance

Both power dependence theory (Emerson, 1962) and bilateral deterrence theory (Lawler, 1986) predict the adverse effect of asymmetric interdependence on the conciliation of a relationship. The difference between the two theories is that the first predicts that the higher-power party will use its power to appropriate the lower-power party and the lower-power party will balance its asymmetric dependence on the higher-power party, while the latter predicts that both the higher-power party and lower-power party will use power to inhibit its opponent (Lawler, 1992). Thus, the power dependence theory suggests that asymmetric interdependence will benefit the higher-power party but harm the lower-power party in the short term. However, the bilateral deterrence theory suggests that asymmetric interdependence will harm both the parties regardless of their status in a relationship. One line of prior studies provides evidence consistent with the power dependence theory (e.g., Crook and Combs, 2007; Schloetzer, 2012), while another supports the bilateral deterrence theory (e.g., Lawler et al., 1988; Kumar et al., 1995). Regarding the first, Crook and Combs (2007) show that when task interdependence among supply chain members is not reciprocal, strong members utilize their bargaining power to appropriate partnership gains. Schloetzer (2012) uses the relative dependence of a distributor on the manufacturer as a proxy for

the potential for hold-up in supply chains and finds that with a decrease in interdependence asymmetry, the process integration and information sharing between partners in the supply chain increase, resulting in favorable financial performance for the partners and contract renewal. By contrast, Lawler et al. (1988) provide a test of bilateral deterrence versus conflict spiral theory and find supporting results for bilateral deterrence theory from two experiments. Using survey data from automobile dealers, Kumar et al. (1995) show that with an increase in the absolute value of the difference between the dealer and supplier dependence, conflicts between the dealer and the supplier increase, and trust and commitments decrease.

Since both the power dependence and bilateral deterrence theory predict adverse impact of asymmetric interdependence on partnership, overlapping institutional investors are likely to play a role as an efficient monitor within supplier–customer relationships because of the following reasons. First, institutional investors may have information advantage. As a common shareholder of the supplier and the customer, the institutional investor has access to information of both firms (Cohen and Frazzini, 2008), which provides opportunities for the common institutional investor to influence decisions that could benefit both partners. Second, diversified active institutional investors tend to maximize their benefits via maximizing the value of portfolios rather than individual firms (e.g., Hansen and Lott, 1996; Rubin, 2006). Hansen and Lott (1996) theoretically show that shareholders' diversification across related firms (e.g., supplier and customer) help internalize externalities that one firm has on the others. Rubin (2006) argues that diversified shareholders force the board of directors make decisions under consideration of the total benefits of firms within

the portfolio of diversified shareholders rather than an individual firm, propel the firm to conduct corporate social responsibility behaviors without which another firm in the shareholders' portfolio may suffer a loss, make capital budgeting decisions based on the future cash flow of firms within the portfolio and improve the sensitivity of executive compensation to the performance of other firms within the portfolio. Therefore, overlapping institutional investors between supplier and customer may internalize the externalities one partner has on the other, pushing the two partners maximizing their total benefits rather than individual profit[6], and as a result, solve the conflict between the partners and mitigate associated adverse effects of asymmetric interdependence.

More specifically, for the lower-power party (the supplier in my sample), since the two theories agree that asymmetric interdependence is adverse, I predict that overlapping institutional investors mitigate the adverse effect of asymmetric interdependence between the supplier and the customer on its individual performance. For the higher-power party (the customer in my sample), since the two theories have opposite predictions regarding the role of asymmetric interdependence on its performance, the mitigating role of overlapping institutional investors on the effect of asymmetric interdependence on performance may not be obvious. The overall discussion above leads to my first hypothesis in the alternative form:

> **Hypothesis 1**: Overlap in institutional ownership mitigates the adverse effect of asymmetric interdependence between suppliers and customers on their individual performance.

[6] In the literature on supply chain management, the activities which benefit the whole supply chain rather than an individual member is called supply chain collaboration or pie-expansion effort (Jap, 1999).

1.2.2 Overlap in institutional investors and underlying channels of partner performance

In this section, I explore the channels through which overlapping institutional investors mitigate the adverse effect of asymmetric interdependence on individual partner performance. Drawing on transaction cost economics (TCE) literature, I identify relationship-specific investments and partnership duration as potential channels.

First, I hypothesize that overlapping institutional investors mitigate the inhibition of asymmetric interdependence on partners' incentive of relationship-specific investments. Transaction cost economics (TCE) not only supports the importance of relationship-specific investments to maintain the supplier–customer relationship and determine the choice of governance mechanism, but also stresses that relationship-specific assets pose a contractual hazard and need to be safeguarded (Williamson, 1996). Palmatier et al. (2007) find a positive relationship between relationship-specific investments and inter-organizational relationship performance. Without an efficient mechanism to safeguard relationship-specific assets, especially when asymmetric interdependence is high, the partner with relatively low bargaining power will be reluctant to invest relationship-specific assets *ex ante*. Consistent with this argument, Coughlan et al. (2001) show the potential for appropriation of relationship-specific investments when two partners have unequal interdependence. Schloetzer (2012) also finds that the extent of process integration and information sharing with the manufacturer the distributors engage in is negatively associated with interdependence asymmetry.

For the partner with relatively high bargaining power, relationship-specific investments tend to be insufficient in that the partner has no incentive to increase its dependence on the other (Buchanan, 1992), and the other has no power to force it to do so, especially when mutual dependence between the two partners is low. Research on shareholder activism (e.g., Klein and Zur, 2009) shows that active institutional investors affect their investees' investment strategies. If overlapping institutional investors are efficient monitors of the partners in the supply chain, they will both increase relationship-specific investments of the lower-power partner and monitor the other in case of appropriation and exert an external force on the higher-power partner to keep its relationship-specific assets at an efficient level, thus solving the underinvestment problem for the partnership. This leads to my second hypothesis:

> **Hypothesis 2:** Overlap in institutional ownership mitigates the negative effect of asymmetric interdependence between suppliers and customers on their individual relationship-specific investments.

Second, I hypothesize that overlapping institutional investors affect supplier–customer relationship characteristics. Because of data unavailability to test partnership performance directly, I focus on a partnership characteristic which indicates a healthy partnership. Based on prior research on supplier–customer relationship (e.g., Schloetzer, 2012), I consider relationship duration as a proxy for partnership performance. A large body of research on transaction cost economics (e.g., Fee et al., 2006; Macher and Richman, 2008; Costello, 2013)[7] examines supplier–customer relationships via the duration of partnerships. Schloetzer (2012) suggests that interdependence asymmetry reduces the likelihood of contract

[7] Fee et al. (2006) examine the relationship between ownership of the customer in the supplier and the governance of supplier-customer relationships. Macher and Richman (2008) provide a review of empirical research on transaction cost economics; Costello (2013) examines the effect of asset specificity and information asymmetry on the design of long-term supply contracts.

renewal. So, in general, interdependence asymmetry may hurt duration of the supplier–customer relationship. Existing literature on economic links between the supplier and customer (e.g., Hendricks and Singhal, 2005) shows the negative effect of supply chain disruptions on the partner's long-term performance. Hendricks and Singhal (2005) find that firms suffer a significantly negative abnormal return within a window starting one year before through two years after the supply chain disruption announcement date and do not recover quickly from such negative effects. To the extent that overlapping institutional investors are efficient monitors of the partnership, they will alleviate the adverse effect of asymmetric interdependence on partnership duration via reconciling the interests of the two partners and thus avoid the negative effect of supply chain disruption on firm performance. This leads to my third hypothesis:

> **Hypothesis 3:** Overlap in institutional ownership mitigates the negative effect of asymmetric interdependence on the duration of supplier–customer relationships.

1.3 Data

1.3.1 Customer data

I identify supplier–customer relationships from COMPUSTAT segment files.[8] The sample period is 1980[9]–2011 because 1980 is the first year I can access Thomson Reuters Institutional (13f) Holdings database via WRDS. The method I employ to identify the supplier–customer relationship is similar to that of Fee and Thomas (2004). First, I use an algorithm to match customer names to the name file, which is a COMPUSTAT segment file, and select the one with the

[8] Majority of prior research on US supplier-customer relationships in finance or accounting use the data source. An inexhaustive list includes: Fee and Thomas (2004), Fee et al. (2006), Cohen and Frazzini (2008), Banerjee et al. (2008) and Hui et al. (2012).

[9] I select the data of supplier–customer relationships from 1979 because for some main analysis, I need to lag variables for supplier–customer-relationship characteristics one year.

smallest difference. Then, I conduct visual inspection and use industry information to verify whether the one selected is indeed the supplier's customer. In the end, I match customer names to identifiers in COMPUSTAT, CRSP and Thomson Reuters and gain fundamental customer information. To preclude observations where the supplier and the customer are in a business group, I use data from WRDS corporate library to check whether the supplier is the dominant shareholder of the customer or the customer is the dominant shareholder of the supplier or they have the same dominant shareholder. Because WRDS corporate library data begin at 2001, I also use WRDS blockholders database to find the block holders of the supplier and the customer and delete the supplier–customer fiscal years where one's shareholding rate of the other is greater than 25%.[10] Following prior research, I exclude observations where the supplier or the customer is a financial (SIC codes between 6000 and 6999) or utility firm (SIC codes between 4900 and 4999). Further, I exclude observations where supplier sales or customer cost of goods sold is negative and where the proportion of sales to the customer or the proportion of cost of goods sold from the supplier is greater than 1. I find that 625 out of 21,564 supplier–customer relationship observations have a dominant supplier when I exclude observations with missing proportion of sales to the customer or with missing proportion of cost of goods sold from the supplier. To purify the results, I delete those 625 observations for firm-level analysis but keep them for relationship-level analysis for which the direction of dependence does not matter. All continuous variables are winsorized at the 1% and 99% levels to minimize the effect of outliers.

[10] Though the WRDS blockholders database starts at 1996, the data used in my main analysis only include one observation before 1996. Through Internet search, I do not find evidence showing that the one partner controls the other or that the two are controlled by a common shareholder.

1.3.2 Institutional investor data

Institutional investor data are based on the Thomson Reuters Institutional (13f) Holdings database from 1980 to 2011. However, I find that the identifier of institutions is not unique or permanent through time.[11] Since I need a unique identifier (MGRNO) of institutions to identify the overlapping institutional investors in a supply chain, I check whether the same MGRNO proxies for different institutions and whether different MGRNOs proxy for the same institution by searching the SEC EDGAR database. In the former situation, I assign a different MGRNO beyond the MGRNO range of the database to the latter institution. In the latter situation, I assign the same institution the same MGRNO, the smaller of the two MGRNOs. When I cannot determine whether two institutions are different, I treat them different. I assume that a MGRNO assigned to each institution does not change within a calendar year. Based on Klein and Zur (2009) who find that hedge funds, individuals, private equity funds, venture capital firms and asset management groups are monitors, I select all Thomson Reuters institutional shareholdings data from 1980 to 2011 where the type code is 3 or 4. Then, I search within these data to find the overlapping institutional investors between the supplier and the customer.

1.3.3 Other data

Financial data are from COMPUSTAT or CRSP/COMPUSTAT Merged database. Market data are from CRSP/COMPUSTAT Merged database. Data for directors are from RiskMetrics[12] and data for analysts are from IBES.

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[11] Though the database provides a permanent key to indicate the institution, in most cases, it is missing, and in some cases, it is still not permanent.

[12] In RiskMetrics, the director identifier is not unique. I check the data by hand to ensure that each identifier proxies for one director.

1.3.4 Sample description

Table 1 presents the characteristics of suppliers and customers in the final sample. Consistent with prior research, customers are much larger and older than suppliers or typical COMPUSTAT firms. Customers have more capital expenditures and higher growth potential than suppliers and COMPUSTAT firms at the median level. However, R&D intensity of customers is lower than that of suppliers, consistent with the argument that the partner with bargaining power tends to underinvest (Buchanan, 1992). Compared with all COMPUSTAT firms, the suppliers have smaller firm size, are older, and have higher growth potential and greater R&D expenditure. Further analysis shows that nearly 15% (9%) of COMPUSTAT observations are covered in my suppliers (customers) sample.

1.3.5 Descriptive statistics

Table 2 shows descriptive statistics of supplier–customer relationships in the sample. Univariate analysis is presented in Panel A. For relationships with an institutional investor overlap, the average (median) overlapping institutional ownership is 4.7% (3.7%). To be more specific, the average (median) ownership of overlapping institutional investors holding in suppliers is 9.3% (6.4%) and the average (median) ownership of overlapping institutional investors holding in customers is 5.8% (4.8%). In the full sample, median mutual dependence (MDEP) is 0.2%, while median asymmetric interdependence (ADEP) is 14%. 58.4% of the relationship-years have at least one overlapping institutional investor. Only 0.2% of the relationship-years have the same director (OVPD). 11.7% of the relationship-years have the same analyst (OVPAN), and 19.4% have the same auditor (OVPAU). In 41.2% (2.7%) of relationships, the supplier and the customer are in the same GIC group (city). At least ¼ of the overlapping institutional

investors hold the two partners' stocks for at least two years. On average, the duration of supplier–customer relationship is around 3 years. In the supplier sample, the average firm value over total assets (FMV/A) is 1.994 and the average excess return (r-R^B) is 0.03. On average, about 15% of sales ($e^{-1.952}$) are gained on credit. R&D expenditure as a proportion of total assets (RDI) in durable industries is about 8.8% on average. Overlapping institutional ownership weighted by the percentage of sales to the customer (weighted OVPINST) is 3.9% (2.6%) on average (at the median level). On average, the level of asymmetric interdependence (mutual dependence) weighted by the percentage of sales to the customer is similar to that at the relationship-level. In the customer sample, firm performance (FMV/A or r-R^B) is a bit better than that of suppliers, and relationship characteristics are similar to those in the supplier sample, but the R&D expenditure as a proportion of total assets (RDI) in durable industries is lower than that of suppliers. In Panel B, I present the correlation matrix of selected variables. For suppliers, asymmetric interdependence (weighted ADEP) is positively correlated with firm performance (FMV/A or r-R^B) and R&D intensity (RDI) in durable industries, but negatively correlated with mutual dependence (weighted MDEP) and overlapping institutional ownership (weighted OVPINST). Moreover, overlapping institutional ownership (weighted OVPINST) is positively correlated with firm performance and mutual dependence (weighted MDEP). For customers, the results are similar, except that asymmetric interdependence (weighted ADEP) is not correlated with R&D intensity in durable industries based on Spearman correlation.

1.4 Analysis of overlapping institutional ownership and individual performance

To examine the economic consequences of overlap in institutional ownership, I first show the effect of overlap in institutional ownership on supplier and customer performance. In the following section, I examine the channels through which overlap in institutional ownership affects partner performance.

1.4.1 Measuring overlap in institutional ownership

Cohen and Frazzini (2008) and Jung (2013) define investor overlap mainly as the number of overlapping institutional investors divided by the total number of institutional investors. However, it may not be sufficient to detect the incentive of overlapping institutional investors to monitor the two investees. Since a higher level of ownership represents a higher probability that the benefits of monitoring exceed the costs (Aghion et al., 2013), ownership of overlapping institutional investors is expected to be a more efficient proxy for their monitoring incentive along the supply chain. To measure the ownership of overlapping institutional investors, for any supplier–customer-relationship fiscal year, I first calculate the sum of the ownerships for all the overlapping institutional investors held in the supplier and the customer separately, and then identify the minimum value of the two ownerships. The minimum value can be considered as the lower bound of the overlapping institutional investors' incentive to monitor the partners along the supply chain. To reduce the effect of measurement error and to use relatively sufficient information, I use the decile rank (0–9) of the minimum value when overlapping institutional ownership is an independent variable in the model.

1.4.2 Methodology

To test the effect of overlapping institutional investors on individual performance (H1), I employ the model of Fama and French (1998) and add variables regarding the characteristics of supplier–customer relationship and firm-specific institutional ownership. The regression model is specified as follows:

$$\begin{aligned}\mathrm{FMV_t/A_t} = {} & \alpha_0 + \alpha_1\mathrm{ADEP_t} + \alpha_2\mathrm{MDEP_t} + \alpha_3\mathrm{OVPD_t} + \alpha_4\mathrm{OVPAN_t} + \alpha_5\ \mathrm{OVPAU_t} \\ & + \alpha_6\mathrm{INST_t} + \alpha_7\mathrm{E_t/A_t} + \alpha_8\mathrm{dE_t/A_t} + \alpha_9\mathrm{dE_{t+2}/A_t} + \alpha_{10}\mathrm{dA_t/A_t} \\ & + \alpha_{11}\mathrm{dA_{t+2}/A_t} + \alpha_{12}\mathrm{RD_t/A_t} + \alpha_{13}\mathrm{dRD_t/A_t} + \alpha_{14}\mathrm{dRD_{t+2}/A_t} \\ & + \alpha_{15}\mathrm{D_t/A_t} + \alpha_{16}\mathrm{dD_t/A_t} + \alpha_{17}\mathrm{dD_{t+2}/A_t} + \alpha_{18}\mathrm{I_t/A_t} + \alpha_{19}\mathrm{dI_t/A_t} \\ & + \alpha_{20}\mathrm{dI_{t+2}/A_t} + \alpha_{21}\mathrm{dFMV_{t+2}/A_t} + \sum\nolimits_{\mathrm{j}} \partial_{3\mathrm{j}}\mathrm{FYEAR_j} \\ & + \sum\nolimits_{\mathrm{j}} \partial_{4\mathrm{j}}\mathrm{IND_j} + \omega_{\mathrm{fv}} \qquad (1)\end{aligned}$$

where FMV is calculated as the sum of market value of equity and book value of total liability. The variable of interest to test H1 is ADEP, which is the asymmetric interdependence, calculated as sales dependence (sales to the customer divided by the total sales of the supplier) minus cost dependence (purchases from the supplier divided by the total costs of goods sold of the customer). MDEP is the minimum of sales dependence and cost dependence[13]; it is used to control for the effect of

[13] In existing literature, researchers measure mutual dependence as sales dependence plus cost dependence or sales dependence by cost dependence. But these two measures are inappropriate. If sales dependence or customer dependence is 0, mutual dependence based on the first measurement can be non-zero, which is hard to visualize. The second measurement encounters similar problems if we let sales dependence or customer dependence be 0+ε where ε is positive but infinitely small. In this case, one partner is almost independent on the other, but mutual dependence based on the second measurement can be equal to or greater than that of partners significantly interdependent with each other. For example, when ε=0.01 for cost dependence and sales dependence is 1, mutual dependence is 0.01; when both cost dependence and sales dependence equal 0.1, mutual dependence is also 0.01. In the former case, the mutual dependence is high only because the supplier is highly dependent on the customer but the customer is weakly dependent on the supplier. However, in the latter case, both the partners are highly dependent on each other. It is hard to believe that the mutual dependence in the two cases is equal. Using the minimum between sales dependence and cost dependence to measure mutual dependence is consistent with the argument of Casciaro and Piskorski (2005)

mutual dependence between the partners. Both power dependence theory and bilateral deterrence theory predict the beneficial role of mutual dependence on supply chain collaboration. Overlapping director (OVPD), overlapping analyst (OVPAN) and overlapping auditor (OVPAU) are indicators of whether the two partners have the same director, analyst or auditor. I add these indicators to control for the effects of other communication channels between the supplier and the customer.

Furthermore, I control for institutional ownership because prior research (e.g., Dittmar and Mahrt-Smith, 2007) shows a positive effect of institutional ownership on firm value using the model of Fama and French (1998). Another benefit of controlling for institutional ownership is to show the incremental role of overlapping institutional ownership. Following Fama and French (1998), dX_t is a compact notation for the two-year change, $X_t - X_{t-2}$. All Xs are adjusted for inflation to 2011. E is inflation adjusted earnings before extraordinary items; A is inflation adjusted total assets; RD is inflation adjusted R&D expenditures; D is inflation adjusted total dividends and I is inflation adjusted interest expense. FYEAR and IND are indicators for fiscal year and industries based on GIC sectors[14]. Specific definitions of variables are shown in Appendix I. Median regression is used to control for the effect of outliers[15].

To test H1, I divide the full samples of both suppliers and customers equally into three subsamples respectively, based on the level of overlapping institutional

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that when mutual dependence is low, higher-power partner does not depend on the lower-power partner because mutual dependence under this measurement is equal to the dependence of higher-power partner on the lower-power partner.

[14] To decrease multicollinearity between the indicators, I control for the fixed effects of industries and fiscal years having at least 10 observations.

[15] Different from OLS where parameters are estimated by minimizing the sum of squared residual, median regression estimates parameters by minimizing the sum of absolute residuals (Koenker, 2005). Guthrie et al. (2012) show that median regression is more robust than OLS to control for the effect of outliers.

ownership and compare the coefficients (α_1) on asymmetric interdependence (ADEP) between the two extreme subsamples. If H1 holds, the coefficient (α_1) on ADEP in the High group where overlapping institutional ownership lies in the third tertile is more positive (or less negative) than that in the Low group where overlapping institutional ownership lies in the first tertile.

Since, for each fiscal year, one supplier can have more than one customer and one customer can have more than one supplier, repeating data can be an issue. To minimize this problem, in my main analysis, I treat all customers for each supplier-year as a portfolio and weight the relationship-level variables (ADEP, MDEP, OVPD, OVPAN and OVPAU) by sales dependence (sales to the customer divided by the total sales of the supplier). In a similar way, I treat all suppliers for each customer-year as a portfolio and weight those relationship-level variables by cost dependence (purchases from the supplier divided by the total costs of goods sold of the customer). The weighted relationship-level variables are defined as weighted ADEP, weighted MDEP, weighted OVPD, weighted OVPAN, and weighted OVPAU, respectively. As a robustness test, I choose the largest customer (greatest sales dependence) for each supplier-year or the largest supplier (greatest cost dependence) for each customer-year to make the same analysis.

1.4.3 Main results

In this section, I first present the main results on performance (H1) using the actual value of overlapping institutional ownership and then provide a series of robustness checks using an alternative valuation model, the predicted value of overlapping institutional ownership, and different samples.

1.4.3.1 Results using actual value of overlapping institutional ownership[16]

Table 3 shows the results of the firm value regression with the weighted relationship-level variables for the full sample, and High and Low subsample groups respectively, where High (Low) group represents overlapping institutional ownership that lies above (below) the upper (lower) tertile[17]. For suppliers (left three columns), the effect of asymmetric interdependence (weighted ADEP) on firm value is significantly positive (coef. of 0.484, with $p<0.01$) in the High group. It suggests that a 1% increase in weighted ADEP results in a 0.484% increase in firm value. However, it is insignificant for the Low group[18]. The coefficient on weighted ADEP is significantly higher for the High group than that in the Low group ($p<0.05$)[19], as shown in the bottom row. For a 1% increase in weighted ADEP, the firm value of suppliers in the High group increases 0.475% more than that of suppliers in the Low group. For customers (right three columns), the coefficients on weighted ADEP are positive but insignificant in both groups. These results suggest that the beneficial role of overlapping institutional investors on firm performance is more evident for suppliers than for customers. There are two potential explanations for the finding. First, though customers identified for each supplier are most important, suppliers identified for each customer can be

[16] I also measure overlapping institutional ownership based on dedicated institutional investors rather than the total institutional investors. The classification of institutional investors is from Bushee's website (http://acct3.wharton.upenn.edu/faculty/bushee/IIclass.html). For both partners, the coefficient on weighted ADEP is higher in the High group than that in the low group, but the difference is insignificant. Furthermore, I find that for customers, the coefficient on weighted ADEP is significantly positive in the High group when mutual dependence is high where asymmetric interdependence is more likely to have adverse effect of customers (Casciaro and Piskorski, 2005).

[17] I also run the regression in the second tertile group and find that for suppliers, the coefficient on weighted ADEP is positive but insignificant and that for customers, the coefficient on weighted ADEP is significantly positive. For both partners, both the economic and statistical significance of the effect of weighted ADEP on performance increase, compared with the results of the Low group.

[18] When I restrict the sample to suppliers without overlapping institutional investors, the coefficient on weighted ADEP is negative but insignificant. Given that only 15.9% (1107 out of 6951) supplier-years in the full sample have no overlapping institutional investors, I find a positive coefficient on ADEP generally.

[19] To test the difference in coefficient of (weighted) ADEP between High and Low groups, I add the model an indicator for High group and its interactions with all variables and then examine whether its interaction with (weighted) ADEP is significant or not.

less important. Second, in my sample, customers have a dominant power over their suppliers. Power dependence theory and bilateral deterrence theory give opposite predications regarding the role of asymmetric interdependence on the higher-power party. On average, the two opposite effects may be balanced out for the customers.

Regarding other relationship variables, mutual dependence (weighted MDEP) is positively associated with the two partners' performance, consistent with prior research, although the beneficial effect of mutual dependence on the supplier's performance is significant only in the High group. The coefficients on indicators for other communication channels (weighted OVPD, weighted OVPAN and weighted OVPAU) between the supplier and the customer are mostly insignificant.[20]

Regarding other control variables, institutional ownership (INST) is positively associated with firm performance, consistent with prior research on institutional investors (except for the High group of customers). The results of other control variables are in general consistent with those in Fama and French (1998). Overall, the results in Table 3 are consistent with H1 and highlight that overlapping institutional investors mitigate the adverse effect of asymmetric interdependence on the dominated partner.

[20] For customers, the indicator for overlapping analysts (weighted OVPAN) is significantly and positively associated with performance, consistent with the monitoring role of analysts (Moyer et al., 1989), However, the indicator for overlapping auditors (weighted OVPAU) is negatively associated with performance, inconsistent with prediction. The overlapping auditor is identified at the firm level rather than the office level. The negative effect may come from endogeneity. Our additional analysis shows that such a negative effect does not sustain.

1.4.3.2 Robustness checks

1.4.3.2.1 Using excess return as a performance measure

Alternative to firm value (FMV) as a performance measure, I use the excess return model from Faulkender and Wang (2006) adding relationship variables as specified in the following regression model[21]:

$$r_t - R_t^B = \beta_0 + \beta_1 LH_t + \beta_2 HL_t + \beta_3 OVPD_t + \beta_4 OVPAU_t + \beta_5 OVPAN_t + \beta_6 \Delta INST_t + \beta_7 \Delta E_t/M_{t-1} + \beta_8 \Delta A_t/M_{t-1} + \beta_9 \Delta RD_t/M_{t-1} + \beta_{10} \Delta I_t/M_{t-1} + \beta_{11} \Delta D_t/M_{t-1} + \beta_{12} C_{t-1}/M_{t-1} + \beta_{13} L_t + \beta_{14} NF_t/M_{t-1} + \sum_j \beta_{3j} FYEAR_j + \sum_j \beta_{4j} IND_j \quad (2)$$

where ΔX indicates the change in X from t-1 to t. The dependent variable is r- R^B, which is realized stock return during the fiscal year adjusted by the value-weighted return of the Fama-French size-BE/ME portfolio (5*5) to which the firm belongs.[22] LH (HL) equals 1 if (weighted) mutual dependence decreases (increases) and (weighted) asymmetric interdependence increases (decreases) and 0 otherwise. Similar to Model 1, I control for (weighted) overlapping director (OVPD), (weighted) overlapping auditor (OVPAU), (weighted) overlapping analyst (OVPAN), and change in institutional ownership (ΔINST). Other variables are defined as in Model 1. Specific definitions of the variables are given in Appendix I. Again, the model is estimated by median regression to exclude the effects of outliers.

The power dependence theory and the bilateral deterrence theory suggest that an increase (a decrease) in asymmetric interdependence and a decrease (an

[21] I do not use the change in OVPD / OVPAU / OVPAN because these variables do not vary much from t-1 to t. I also use the change in OVPD / OVPAU / OVPAN and find similar main results.

[22] Both the quintiles of size and book-to-market and the returns of 25 portfolios are from French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

increase) in mutual dependence harms (benefits) a relationship. To test H1, I compare the coefficient on LH in the positive change in overlapping institutional ownership group (Increase group column) and that in the non-positive change in overlapping institutional ownership group (Non-increase group column) for both suppliers and customers. If H1 holds, the coefficient on LH is more positive (or less negative) in the Increase group than that in the Non-increase group, especially for suppliers[23].

Table 4 presents the results of excess return regression for the full sample. For suppliers, the coefficient on the indicator for a decrease in mutual dependence and an increase in asymmetric interdependence (LH) is negative and insignificant in the full sample. When I further divide the full sample into two subsamples based on whether overlapping institutional ownership increases or not, I find that the coefficient on LH is significantly negative (p<0.05) in the Non-increase group whereas insignificant in the Increase group. In the Non-increase group, suppliers with a decrease in mutual interdependence and an increase in asymmetric interdependence (LH) have on average 3.7% lower realized excess stock returns than the benchmark (firms with an increase or a decrease in both asymmetric interdependence and mutual dependence). The test for the difference in the coefficient on LH between the two subgroups shows that the coefficient on LH in the Increase group is significantly higher than that in the Non-increase group (p<0.10) as shown in the bottom row. The coefficient difference (0.044) suggests that on average, suppliers with a decrease in mutual dependence and an increase in asymmetric interdependence (LH) in the Increase group have 4.4% higher

[23] I also group the full sample based on the level of overlapping institutional ownership at t-1 and the results are consistent.

realized excess stock returns than those in the Non-increase group. For customers, the coefficients on LH in the full sample or the two subgroups are positive but insignificant. The difference in the coefficient between the two groups is insignificant as well. Consistent with the power dependence theory and the bilateral deterrence theory, coefficients on the indicator for increase in mutual dependence and decrease in asymmetric interdependence (HL) are positive in the full sample and the two subgroups for both suppliers and customers. Overall, the results in Table 4 are marginally consistent with those in Table 3.

1.4.3.2.2 Using the predicted value of overlapping institutional ownership[24]

To control for the endogeneity of overlapping institutional ownership and the self-selection bias of customer information disclosure (Ellis et al., 2012), I first estimate inverse Mills ratios (Heckman, 1979) using all COMPUSTAT firms exclusive of financial and utility firms for the period 1979–2011 and then predict the normal value of overlapping institutional ownership using a Tobit model which performs well with censored data with inverse Mills ratio as a control variable. The determinants of customer information disclosure are discussed in Appendix II.A and the details of the prediction model of overlapping institutional ownership are given in Appendix II.B. Table AI shows the result for the determinants of customer information disclosure. Except for two variables (Net intangibles to assets and Ln(Assets)), the results for other variables are generally consistent with those in Ellis et al. (2012).[25] Table AII presents the result for the

[24] I also use the predicted overlapping institutional ownership to estimate the excess return regression. For both the supplier and the customer, the effect of LH (indicator for decrease in mutual dependence and increase in asymmetric interdependence) on excess return in the Increase group where predicted overlapping institutional ownership increases from t-1 to t is greater than that in the Non-increase group, though the difference is not significant.

[25] Unlike the results of Ellis et al. (2012), Net intangibles to assets is marginally positively associated with customer-information disclosure in my sample. Ln(Assets) is significantly negatively associated with customer-information disclosure in my sample but consistent with their prediction that smaller firms are more

prediction model of overlapping institutional ownership. Overlapping analyst (OVPAN) is positively associated with overlapping institutional ownership. Mutual dependence (MDEP) is negatively associated with overlapping institutional ownership, which suggests that institutional investors tend not to increase their overlapping institutional ownership of supplier–customer relationships with high mutual dependence. Absolute asymmetric interdependence (abs(ADEP)) is not significantly associated with overlapping institutional ownership. These results indicate that the positive effect of weighted MDEP and weighted ADEP on firm performance for the High group in Table 3 is probably not because overlapping institutional investors hold high ownership of supplier–customer relationships with high mutual dependence and low asymmetric interdependence. The results for other variables are generally consistent with prior research.

Table 5 presents the results of firm value regression using the predicted overlapping institutional ownership. Consistent with the results using the actual value of overlapping institutional ownership (Table 3), for suppliers, the coefficient on asymmetric interdependence (weighted ADEP) is significantly positive ($p<0.01$) in the High group but insignificant in the Low group. Further test shows that the coefficient in the High group is significantly higher ($p<0.05$) than that in the Low group (as shown in the bottom row). For a 1% increase in asymmetric interdependence, the increase in average firm value deflated by total assets in the High group is 0.654% greater than that in the Low group. For customers, the effects of asymmetric interdependence on firm value are

likely to disclose customer information because they are more likely to be affected by the disclosure requirement than larger firms.

insignificant in both groups[26], consistent with Table 3. In sum, the results using the predicted overlapping institutional ownership are consistent with those of the main analysis.

1.4.3.2.3 Using overlapping institutional ownership as an independent variable

Another method to detect the monitoring role of overlapping institutional investors is to use overlapping institutional ownership as an independent variable in the model and examine whether the coefficient on this variable is more significant in the group with higher asymmetric interdependence.

Table 6 presents the result. For suppliers, the coefficient on weighted OVPINST is significantly positive in the full sample (p<0.01). An increase of one decile rank in overlapping institutional ownership results in a 2.8% increase in market value of equity over total assets. In the two subsamples based on whether asymmetric interdependence falls above the upper tertile (High) or below the first tertile (Low), the coefficient on weighted OVPINST is still significantly positive (p<0.0), but it is more significant in the High group where the conflict between the partners is more likely due to high asymmetric interdependence, compared with the Low group (p<0.1). The results are consistent with the explanation that overlapping institutional investors monitor the partners to alleviate the negative effect of asymmetric interdependence. For customers, the coefficient on weighted OVPINST is insignificant in either the full sample or the two subsamples, and the difference in the coefficient between the two subsamples is insignificant,

[26] Though the difference in the coefficient on weighted ADEP between the two groups is significantly negative, the direct effect of overlapping institutional ownership on customer performance is not significant (unreported).

suggesting that the monitoring role of overlapping institutional investors on customers is not significant, consistent with my main analysis.

Therefore, results using overlapping institutional ownership as an independent variable are consistent with those of my main analysis.

1.4.3.2.4 Subsample of supplier–largest customer or customer–largest supplier relationship

Another method to minimize the concern on repeating data is to use a typical supplier–customer relationship for each supplier and customer. Therefore, I focus on a subsample of supplier–largest customer or customer–largest supplier relationships to test whether the results of the main analysis still hold.

Table 7 presents the results of the firm value regression for the supplier–largest customer or customer–largest supplier relationship. Panel A presents the results based on the actual overlapping institutional ownership. Consistent with Table 3, for suppliers, the effect of asymmetric interdependence (ADEP) is significantly positive (p<0.10) only in the High group where the overlapping institutional ownership is above the upper tertile. But the difference in such an effect between the High and Low group is statistically insignificant (the bottom row). For customers, the effect of ADEP is insignificant for the High group as before. While in the Low group, the coefficient on ADEP is significantly positive (p<0.05), consistent with the dependence theory. However, the difference in such an effect between the High and Low group is still statistically insignificant (the bottom row). Panel B presents the results based on the predicted overlapping institutional ownership. Consistent with Table 3, for suppliers, asymmetric interdependence (ADEP) is positively associated with performance in the High group (p<0.01) and the difference in the coefficient on ADEP between the High

and Low groups is significantly positive (p<0.10). For customers, the effects of asymmetric interdependence (ADEP) on performance are still insignificant.

Table 8 presents the results of excess return regression for the supplier–largest customer or the customer–largest supplier relationship.[27] For suppliers, the indicator for a decrease in mutual dependence and an increase in asymmetric interdependence (LH) is significantly negatively associated with excess return in the Non-increase group (p<0.05), but not in the Increase group, similar to the results in Table 4. For customers, the coefficients on LH are positive but insignificant in both groups.

To directly test the difference in difference effect, I use the actual value of change in mutual dependence (ΔMDEP) and change in asymmetric interdependence (ΔADEP), and decompose the change in overlapping institutional ownership into four groups: from institutional investor overlap at t-1 to institutional investor overlap at t (OVP_OVP), from institutional investor overlap at t-1 to non-overlap at t (OVP_NOVP), from non-overlap at t-1 to overlap at t (NOVP_OVP), and non-overlap at both t and t-1 which is the base case. The result in column (4) shows that for the suppliers, the coefficient on ΔADEP*NOVP_OVP is significantly positive (p<0.10), and the coefficient on ΔADEP*OVP_NOVP is significantly negative (p<0.01). For the suppliers with the change from non-overlap in institutional investor to overlap (from overlap to non-overlap), the coefficient on the change in asymmetric interdependence (ΔADEP) is 2.161 (-1.556).[28] For customers, neither the coefficient on

[27] I also estimate the excess return model for the supplier-largest customer or customer-largest supplier relationship based on the change in predicted overlapping institutional ownership. The results are generally consistent with those in Table 4.

[28] The coefficient on ΔADEP for suppliers with the change from non-overlap in institutional investor to overlap (from overlap to non-overlap), is 0.212+1.949 (0.212-1.768), equal to 2.161 (-1.556).

ΔADEP*NOVP_OVP nor the coefficient on ΔADEP*OVP_NOVP is significant, suggesting that the effect of the change in asymmetric interdependence (ΔADEP) on customer excess return does not change substantially with the different change types of overlapping institutional ownership. To sum it up, the results for the supplier–largest customer or customer-largest supplier relationship are consistent with those of the main analysis.

1.4.3.2.5 Subsample of suppliers with low customer industry competition or customers with low supplier industry competition

Pfeffer and Salancik (1978) argue that an important factor determining the dependence of an organization is the extent to which there are few alternatives. If there are many alternative customers (suppliers), even a high proportion of sales to a specific customer (cost of goods sold from a specific supplier) does not mean that the supplier (customer) depends much on the customer (supplier). Considering this, I examine H1 in the low industry competition group where the industry sales–based Herfindahl–Hirschman index is above the upper tertile.[29] Table 9 presents the partner performance analysis in the low customer industry competition group for the supplier and in the low supplier industry competition group for the customer. Panel A presents the results of firm value regression (Model 1), which are generally consistent with those in Table 3. For suppliers, asymmetric interdependence (weighted ADEP) is positively associated with performance in the High group, but not in the Low group. The difference in the coefficient on weighted ADEP between the High and Low group is positive though insignificant. For customers, the coefficients on the asymmetric

[29] I calculate the industry competition based on the sales of all COMPUSTAT firms with the same three-digit SIC code.

interdependence (weighted ADEP) are insignificant. Panel B presents the results of excess return regression (Model 2). The results for suppliers are similar to those in Table 4. However, for customers, LH is positively associated with excess return in both the Increase and Non-increase groups. In sum, the results in the subsample of suppliers with low customer industry competition or customers with low supplier industry competition are generally consistent with those of the main analysis.

Overall, our main results in Table 3 survive to a series of sensitivity tests and show that overlapping institutional ownership alleviates the adverse effect of asymmetric interdependence between the supplier and its customer on the partner performance especially for suppliers, generally consistent with H1.

1.5 Analysis of overlapping institutional ownership and underlying channels of partner performance

To explore the mechanism through which overlapping institutional investors affect the partner performance, I examine whether overlapping institutional ownership increases relationship-specific assets (H2) and relationship duration (H3).

1.5.1 Overlapping institutional ownership and relationship-specific investments (H2)

Relationship-specific investment lies at the core of the supplier–customer relationship. It is commonly recognized that an efficient governance mechanism should safeguard the relationship-specific investment, solve the related hold-up problems and improve its efficiency. Thus, I examine whether overlap in institutional ownership can increase the partners' incentive to invest relationship-specific assets. Following Raman and Shahrur (2008), I run the

regression model below to test the effect of overlapping institutional investors on the partner relationship-specific investments (H3).

$$\begin{aligned}\mathrm{RDI}_t = {} & \delta_0 + \delta_1 \mathrm{ADEP}_t + \delta_2 \mathrm{MDEP}_t + \delta_3 \mathrm{OVPD}_t + \delta_4 \mathrm{OVPAN}_t + \delta_5 \mathrm{OVPAU}_t \\ & + \delta_6 \mathrm{INST}_t + \delta_7 \mathrm{size}_t + \delta_8 \mathrm{book-to-market}_t \\ & + \delta_9 \mathrm{sales\ growth}_t + \delta_{10} \mathrm{return}_t + \delta_{11} \mathrm{leverage}_t \\ & + \delta_{12} \mathrm{ocf\ surplus}_t + \delta_{13} \mathrm{financing\ cash\ flow}_t + \delta_{14} \mathrm{cash}_t \\ & + \delta_{15} \mathrm{CAPX}_t + \delta_{16} \mathrm{SGA}_t + \delta_{17} \mathrm{industry\ RD}_t + \sum\nolimits_j \delta_{2j} \mathrm{FYEAR}_j \\ & + \sum\nolimits_j \delta_{3j} \mathrm{IND}_j + \omega_{rd} \end{aligned} \quad (3)$$

RDI is R&D intensity defined as R&D expenditures deflated by total assets[30]. In addition to the variables (ADEP, MDEP, OVPD, OVPAN, OVPAU, INST, FYEAR and IND) used in Model 1, I include other control variables based on Raman and Shahrur (2008). Raman and Shahrur (2008) show that (1) book-to-market and stock return (leverage) are negatively (positively) associated with supplier R&D intensity, but not with customer R&D intensity; (2) capital expenditure (CAPX) is negatively associated with customer R&D intensity, but not with supplier R&D intensity; (3) operating cash flow surplus (ocf surplus), financing cash flow, cash, capital expenditures (CAPX), SGA expenses and industry R&D intensity are positively associated with both supplier R&D intensity and customer R&D intensity. To test H2, I follow the research design of H1 and divide the full sample equally into three subsamples based on the level of overlapping institutional ownership and compare the coefficient on ADEP

[30] Consistent with prior research (e.g., Raman and Shahrur, 2008), I treat missing R&D expenditure as 0. If I exclude the observations with missing R&D expenditure for my main analysis (Table 10), for suppliers, the coefficient on weighted ADEP in the high overlapping institutional ownership group is greater than that in the low institutional ownership group but the difference is insignificant and for customers, the results are similar.

between the two extreme subsamples. H2 predicts that the coefficient on ADEP (δ_1) is significantly greater in the High group where overlapping institutional ownership falls above the upper tertile than that in the Low group where overlapping institutional ownership falls below the lower tertile. The specific definitions of the variables are presented in Appendix I. Consistent with the preceding models, this model is estimated by median regression.

Consistent with the main analysis of H1, I treat all customers for each supplier-year as a portfolio and weight the relationship-level variables (ADEP, MDEP, OVPD, OVPAN and OVPAU) by sales dependence (sales to the customer divided by the total sales of the supplier). In a similar way, I treat all suppliers for each customer-year as a portfolio and weight those relationship-level variables by cost dependence (purchases from the supplier divided by the total costs of goods sold of the customer). The weighted relationship-level variables are defined as weighted ADEP, weighted MDEP, weighted OVPD, weighted OVPAN, and weighted OVPAU, respectively.

Based on prior research (e.g., Banerjee et al., 2008), my analysis here only considers durable sector firms (primary SIC codes of 3400 and above but less than 4000) for which the investments are probably supplier–customer–relationship specific. Consistent with the analysis in the preceding sections, I first present the main results using actual value of overlapping institutional ownership and then provide several robustness checks using the predicted value and alternative samples.

1.5.2.1 Results using actual value of overlapping institutional ownership

Results using the actual value of overlapping institutional ownership are shown in Table 10. For suppliers, both in the full sample and in the two

subsamples, asymmetric interdependence (weighted ADEP) is positively associated with relationship-specific investment (p<0.01). However, the coefficient on weighted ADEP in the High group where overlapping institutional ownership is above the upper tertile is significantly greater than that in the Low group where overlapping institutional ownership is below the lower tertile (coef. of 0.040; p<0.05). If weighted ADEP increases by 1%, relationship-specific investment intensity in the High group increases by 0.040% more than that in the Low group does. Hence, overlapping institutional ownership increases the suppliers' incentive to invest relationship-specific assets. For customers, the effect of asymmetric interdependence (weighted ADEP) on relationship-specific investment is insignificant in either the full sample or the two subsamples. In the Low group, the coefficient on weighted ADEP is negative, consistent with the argument of Buchanan (1992) that the dominating partner has no incentive to increase its relationship-specific investment. However, in the High group, the coefficient on weighted ADEP is positive, which is significantly greater than that in the Low group (coef. of 0.034; p<0.05). If weighted ADEP increases by 1%, relationship-specific investment intensity in the High group increases by 0.034% more than that in the Low group does. Thus, overlapping institutional ownership also increases the customers' incentive to invest relationship-specific investment. As a whole, overlapping institutional investors mitigate the negative effect of asymmetric interdependence between suppliers and customers on their individual relationship-specific investments, consistent with Hypothesis 2.

Regarding other relationship variables, mutual dependence (weighted MDEP) does not show a beneficial role on relationship-specific investments of the partners. The effect of overlapping directors (weighted OVPD) on customer

relationship-specific investment is significantly positive in the full sample (p<0.05), consistent with the explanation that overlapping directors increase relationship-specific investments of customers. The effect of overlapping analysts (weighted OVPAN) on partners' relationship-specific investments is constantly insignificant. The effect of overlapping auditors (weighted OVPAU) on partners' relationship-specific investments conditions on the level of overlapping institutional ownership. In the Low group, the coefficient on weighted OVPAU is significantly negative for both suppliers (p<0.1) and customers (p<0.01). However, in the High group, the coefficient on weighted OVPAU is significantly positive (p<0.05) for suppliers and insignificantly negative for customers. The difference in the coefficient on weighted OVPAU in the two groups probably shows the monitoring role of overlapping institutional investors.[31] Total institutional ownership (INST) tends to increase relationship-specific investments. The results for other control variables from Raman and Shahrur (2008) are generally consistent with their study.

In summary, results using the actual value of overlapping institutional ownership provide some evidences to show that overlapping institutional ownership increases relationship-specific investments of partners.

1.5.2.2 Robustness checks

As robustness checks, I first present the results using the predicted overlapping institutional ownership and then examine the results in the high customer (supplier) concentration group for suppliers (customers).[32]

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[31] There are alternative explanations. For example, the auditors in the Low group may have lower audit quality than those in the High group.

[32] I do not examine H2 in the subsample of suppliers (customers) with low customer (supplier) industry competition because the sample testing H2 is confined to durable sector firms (primary SIC codes of 3400 and above but less than 4000).

1.5.2.2.1 Using the predicted value of overlapping institutional ownership

Results using the predicted overlapping institutional ownership are presented in Table 11. The results are generally consistent with those shown in Table 10. For suppliers, the coefficient on weighted ADEP is significantly positive in both the full sample and the two subsamples. Again, the coefficient on weighted ADEP in the High group where overlapping institutional ownership lies above the upper tertile is significantly greater than that in the Low group where overlapping institutional ownership falls below the lower tertile as shown in the bottom row (coef. of 0.038; $p<0.05$). If weighted ADEP increases by 1%, relationship-specific investment intensity in the High group increases by 0.038% more than that in the Low group does. For customers, the coefficient on weighted ADEP is insignificant in either the full sample or the two subsamples. The difference in the coefficient on weighted ADEP between the High and Low groups becomes insignificant, contrasted with the result in Table 10. Hence, results using predicted overlapping institutional ownership further confirm the role of overlapping institutional investors in mitigating the inhibition of asymmetric interdependence on supplier incentive to invest relationship-specific assets, and thus improving supplier relationship-specific investments.

1.5.2.2.2 Subsample of suppliers (customers) with high customer (supplier) concentration

In my earlier analysis, to ensure that R&D investment is relationship-specific, I confine the analysis to durable industries. However, if the supplier's (customer's) customer (supplier) concentration is low, R&D investment of the supplier (customer) is less likely to be relationship specific to the principal customers (suppliers) identified. Thus, I further confine the analysis to the high customer

concentration group (for suppliers) or high supplier concentration group (for customers). Following Patatoukas (2012), I use sales-based (cost of goods sold-based) Herfindahl–Hirschman index to measure customer (supplier) concentration.[33] The high customer (supplier) concentration group consists of all the suppliers (customers) of which the customer (supplier) concentration is above the sample median (upper quartile).[34]

The results set forth in Table 12 show that the coefficient on weighted ADEP in the High group where overlapping institutional ownership lies above the upper tertile is significantly greater than that in the Low group where overlapping institutional ownership falls below the lower tertile for both suppliers (coef. of 0.031; p<0.1) and customers (coef. of 0.109; p<0.1). They suggest that overlapping institutional investors alleviate the negative effect of asymmetric interdependence on the partners' incentive to invest relationship-specific assets, consistent with the results presented in Table 10. For suppliers (customers), if asymmetric interdependence increases by 1%, relationship-specific investment intensity in the High group increases by 0.031% (0.109%) more than that in the Low group does. The economic significance of overlapping institutional ownership mitigating the inhibition of asymmetric interdependence on customer incentive to invest relationship-specific assets is stronger than that in Table 10. Thus, results in the subsample of suppliers (customers) with high customer (supplier) concentration provide evidence that overlapping institutional ownership

[33] Customer concentration for supplier i with j customers in year t equals $\sum_{j=1}^{n}\left(\frac{sales\ to\ customer_{i,j,t}}{total\ sales_{i,t}}\right)^2$. Supplier concentration for customer i with j suppliers in year t equals $\sum_{j=1}^{n}\left(\frac{cost\ of\ goods\ sold\ from\ supplier_{i,j,t}}{total\ cost\ of\ goods\ sold_{i,t}}\right)^2$.

[34] I use different criteria to define high supplier concentration group and high customer concentration group because customer concentration (mean: 0.0772; median: 0.0289) is much greater than supplier concentration (mean: 0.0027; median: 0.0001; upper quartile: 0.0016) in my sample.

increases relationship-specific investments for both partners via mitigating the inhibition of asymmetric interdependence on their incentive to invest relationship-specific assets.

In sum, the results on relationship-specific investment support the argument that customers use their bargaining power to force their suppliers to increase relationship-specific investment but to decrease their own relationship-specific investment, and that suppliers expect the appropriation of relationship-specific investments by the customers and have limited incentive to increase relationship-specific investment though they are under pressure to invest some relationship-specific assets, and that overlapping institutional investors propel the two partners to increase their relationship-specific assets which benefit the whole partnership, consistent with H2.

1.5.2 Overlapping institutional ownership and supplier–customer relationship duration (H3)

To examine the effect of overlap in institutional ownership on partnership performance (H3), I focus on partnership duration. Specifically, following prior research on duration (e.g., Fee et al., 2006), I use a following Cox proportional hazard model to test the relation between overlap in institutional ownership and supplier–customer relationship duration.

$$\begin{aligned}\text{Duration} = {} & \theta_0 + \theta_1 \text{abs(ADEP)} + \theta_2 \text{MDEP} + \theta_3 \text{OVPD} + \theta_4 \text{OVPAN} + \theta_5 \text{OVPAU} \\ & + \theta_6 \text{customer RD/sales} + \theta_7 \text{supplier RD/sales} \\ & + \theta_8 \max(\text{customer age, supplier age}) + \theta_9 \text{supplier size} \\ & + \theta_{10} \text{customer size} \\ & + \theta_{11} \min(\text{customer free cash flow, supplier free cash flow}) \\ & + \theta_{12} \text{Same industry} + \theta_{13} \text{Same city} \\ & + \theta_{14} \text{Year} + \omega_{\text{dur}} \end{aligned} \quad (4)$$

The dependent variable, Duration, is the fiscal year the supplier–customer relationship ends minus the first fiscal year the supplier–customer relationship exists. If a relationship ends because one of the partners becomes inactive in COMPUSTAT or if the relationship lasts up to the end of the sample period (2011), I treat the relationship right censored. All the independent variables are measured as the first fiscal year in my sample period the supplier–customer relationship is observable. ADEP, MDEP, OVPD, OVPAN, OVPAU and FYEAR are defined as in Model 1. abs(ADEP) is the absolute value of ADEP. Factors related to R&D intensity, firm age, firm size, free cash flow and time distance between the beginning year of the relationship and 1976 when customer information is available from COMPUSTAT (Year) are included because Fee et al. (2006) show that their effects on supplier–customer relationship duration are significant. I include "Same industry" to control for common industry effect. "Same city" is used to control for the effect of geographic distance between the two partners. The specific definitions of the variables are presented in Appendix I. To test H3, I divide the full sample equally into three subgroups based on the level of overlapping institutional ownership and predict the hazard ratio of abs(ADEP) is lower in the High group where overlapping institutional ownership lies in the third

tertile, compared with that in the Low group where overlapping institutional ownership lies in the first tertile. I first use the actual value of overlapping institutional ownership to test H3 and then use an alternative measurement and sample for robustness checks.

1.5.3.1 Results using actual value of overlapping institutional ownership

Results using the actual value of overlapping institutional ownership are shown in Table 13. Inconsistent with prior research (e.g., Schloetzer, 2012), asymmetric interdependence (abs(ADEP)) does not show a harmful role on supplier–customer relationship duration in the full sample or the two groups. The reason is probably that asymmetric interdependence is relatively low in my sample (mean: 0.178), compared with that in the sample of Schloetzer (2012) (mean: 0.81). Further test (unreported) shows that asymmetric interdependence could harm the relationship duration if it is sufficiently high[35]. Given that asymmetric interdependence is highly correlated with the percentage of supplier sales to the customer (spearman correlation coefficient: 0.915), the positive effect of asymmetric interdependence on partnership duration is consistent with the result of Fee et al. (2006) that the percentage of supplier sales to the customer is positively associated with duration when this percentage is low. In the full sample, the hazard ratio (0.397) indicates that if abs(ADEP) increases from its first quartile (0.092) to third quartile (0.200), the probability that the relationship ends relative to the probability that the relationship endures (hazard ratio) decreases by 9.50% ($1-0.397^{0.108}$). Though the hazard ratios of abs(ADEP) in both the Low group where the overlapping institutional ownership is below the lower tertile and the High group where the overlapping institutional ownership is above the upper

[35] The square of asymmetric interdependence is significantly positive ($p<0.01$).

tertile are smaller than 1, the latter is smaller than the former. For a 1% increase in abs(ADEP), the decrease in probability that the relationship ends relative to the probability that the relationship endures in the High group is 0.1% ($0.38^{1\%}$-$0.342^{1\%}$) higher than that in the Low group. Hence the results are consistent with the argument that overlapping institutional ownership benefits the supplier–customer relationship, supporting H3.

Regarding other relationship variables, the effect of mutual dependence (MDEP) on supplier–customer relationship is insignificant. Overlapping analyst (OVPAN) shows a beneficial role on relationship duration in the full sample. Coefficients on other communication channels—overlapping directors (OVPD), and overlapping auditors (OVPAU)—are insignificant. Whether the two partners are geographically close to each other (Same city) is not significantly associated with relationship duration. Partners in the same industry (Same industry) are more likely to end the relationship in a short period of time when the overlapping institutional ownership is high. The coefficients on other control variables are generally consistent with those in Fee et al. (2006).

1.5.3.2 Robustness checks

As robustness checks, I first use the predicted value of overlapping institutional ownership and then test the results in the subsample of relationships with low industry competition where the minimum between supplier industry competition and customer industry competition based on the sales of all COMPUSTAT firms with the same three-digit SIC code is above the upper quartile for each fiscal year.[36]

[36] I use upper quartile rather than upper tertile here to define the low industry competition group because the minimum between supplier industry competition and customer industry competition is very low

1.5.3.2.1 Using the predicted value of overlapping institutional ownership

Results using the predicted overlapping institutional ownership are presented in Table 14. Consistent with the results in Table 13, the coefficient on abs(ADEP) in both the full sample and the two groups (High and Low) is significantly negative (p<0.01). The hazard ratio (0.267) indicates that if abs(ADEP) increases from its first quartile (0.092) to third quartile (0.182), the probability that the relationship ends relative to the probability that the relationship endures (hazard ratio) decreases by 11.2% ($1-0.267^{0.09}$), which is more economically significant than that in Table 13 (9.5%). Though the hazard ratios of abs(ADEP) are significantly less than 1 in both the High group where predicted overlapping institutional ownership is above the upper tertile and the Low group where predicted overlapping institutional ownership is below the lower tertile, the former is lower than the latter. For a 1% increase in abs(ADEP), the decrease in the probability that the relationship ends relative to the probability that the relationship endures in the High group is 0.6% higher than that in the Low group ($0.283^{1\%}-0.146^{\%}$) which is more economically significant than that in Table 13 (0.1%). Therefore, results using the predicted overlapping institutional ownership further provide evidence that overlapping institutional ownership benefits supplier–customer relationship duration.

1.5.3.2.2 Subsample of relationships with low industry competition

To ensure that sales (cost of goods sold) proportion from the customer (supplier) measures the dependence of the supplier (customer) on the customer (supplier), I test H3 in the subsample of relationships with low industry

(median: 0.187; upper quartile: 0.257). The industry competition above its upper quartile is even significantly lower than that above the upper tertile of supplier industry competition in the full sample (p<0.01).

competition. Table 15 presents supplier–customer duration analysis in the low relationship–level industry competition group where relationship–level industry competition is the minimum between supplier industry competition and customer industry competition. The results are consistent with those in Table 13. The hazard ratios of abs(ADEP) are significantly less than 1 in both the full sample and the two groups (High and Low), and less than their counterparts in Table 13. Again, the hazard ratio of abs(ADEP) in the High group is less than that in the Low group. Hence, results in the subsample of relationships with low industry competition are consistent with the argument that overlapping institutional ownership benefits relationship duration.

To sum it up, results on supplier–customer relationship duration show that overlapping institutional ownership benefits the whole partnership. Though I find a positive rather than negative effect of asymmetric interdependence on duration because of small asymmetric interdependence in my sample, the evidence shows that even in this case, overlapping institutional investors reinforce the positive effect of asymmetric interdependence on duration.

1.6 Further evidence

To further test the monitoring role of overlapping institutional investors, I examine whether overlapping institutional investors improve the efficiency of allocating trade credits between the partners.

The emergence of trade credits can be considered as a natural consequence of a commercial interaction (Cunat, 2007). Petersen and Rajan (1997) and Banerjee et al. (2007) demonstrate the importance of trade credits for members in a supply chain. Both studies agree that providing trade credits is a method for the supplier to help the customer with high financial constraints by eliminating financial

shocks. Since research on cash value (e.g., Denis and Sibilkov, 2010) shows that cash is more valuable for financially constrained firms, if overlapping institutional investors are efficient monitors of partners in the supply chain, they will allocate trade credits according to partners' relative financial constraints. Specifically, they will decrease (increase) trade credits when the supplier is more (less) financially constrained than the customer.

Four main theories are presented to explain the existence of trade credits. Financial advantage theory argues that suppliers have advantages over financial institutions in providing credits to their customers. Price discrimination theory maintains that suppliers can discriminate price and attract risky customers via using trade credits. Transaction cost theory stresses that suppliers decrease transaction costs via using trade credits. Another theory based on bargaining power (Wilner, 2000) proposes that customers could use their bargaining power to make the suppliers concede if they are in financial distress and that financially constrained customers anticipate this concession and prefer trade credits. Except transaction cost theory, all the other three theories predict that trade credits attract customers with high credit risk. For empirical evidences, Banerjee et al. (2007) find that trade credit is negatively associated with customer bargaining power, while Wilson and Summers (2002) document that trade credit period is positively associated with the asymmetric power of the customers using small firms with 10 employees on average. Since supplier size (total assets) in my sample (mean: 1564.409; median: 138.257) is bigger than that in the sample of Banerjee et al. (2007) (mean: 334.71; median: 27.37), I do not expect asymmetric interdependence between the partners is positively associated with trade credits.

Following Banerjee et al. (2007), I use the following regression model:

$$\log(\mathrm{ar/s})_t = \gamma_0 + \gamma_1\,\mathrm{OVPINST_t} + \gamma_2\mathrm{ADEP_t} + \gamma_3\mathrm{ADEP_t} * \mathrm{OVPINST_t}$$
$$+ \gamma_4\mathrm{MDEP_t} + \gamma_5\mathrm{OVPD_t} + \gamma_6\mathrm{OVPAN_t} + \gamma_7\mathrm{OVPAU_t} + \gamma_8\mathrm{INST_t}$$
$$+ \gamma_9\log(\text{total assets/sales})_t + \gamma_{10}\log(\text{sales})_t$$
$$+ \gamma_{11}\log(\text{inventories/sales})_{t-1} + \gamma_{12}\mathrm{LDM_{t-1}}$$
$$+ \gamma_{13}\log(\text{marginal cost/sales})_{t-1}$$
$$+ \gamma_{14}(\text{cash flow/totalassets})_{t-1} + \gamma_{15}industry\log(ar/s)_t$$
$$+ \sum\nolimits_{\mathrm{j}} \gamma_{2\mathrm{j}}\mathrm{FYEAR_j} + \sum\nolimits_{\mathrm{j}} \gamma_{3\mathrm{j}}\mathrm{IND_j} + \omega_{\mathrm{ar}} \qquad (5)$$

The dependent variable, log(ar/s), is the logarithm of the ratio of accounts receivable to sales. OVPINST is overlapping institutional ownership. In addition to the variables (ADEP, MDEP, OVPD, OVPAN, OVPAU, INST, FYEAR and IND) used in Model 1, I include other control variables based on Banerjee et al. (2007). Banerjee et al. (2007) find that while long-term debt ratio (LDM) is negatively associated with accounts receivable, all other variables (log(total assets/sales), log(sales), log(inventories/sales), log(marginal cost/sales) and cash flow/total assets) in Model 5 are positively associated with accounts receivable. I add industry log(ar/s) to control for the industry stickiness of accounts receivable. I use the interaction term, ADEP * OVPINST, to examine whether the effect of asymmetric interdependence (ADEP) on trade credits varies with overlapping institutional ownership. For each supplier, all customers are treated as a portfolio and the relationship-level variables (OVPINST, ADEP, MDEP, OVPD, OVPAN, and OVPAU) are weighted by the percentage of sales to the customer. The weighted relationship-level variables are defined as weighted OVPINST, weighted ADEP, weighted MDEP, weighted OVPD, weighted OVPAN, and weighted OVPAU, respectively.

Since external financing sources are the substitutes of internal financing sources such as trade credits, firms with limited financing sources are more likely to rely on trade credits. I decompose the full supplier sample into two subsamples based on whether the supplier external financing constraint is greater than the customer external financing constraint at the beginning of the fiscal year. Following Hadlock and Pierce (2010), I use SA index[37] to measure external financing constraint. If overlapping institutional investors are efficient monitors along the supply chain, the marginal effect of OVPINST is significantly positive (negative) for suppliers with relatively low (high) financial constraints. The specific definitions of the variables are presented in Appendix I. I use median regression to control for the effect of outliers.

Table 16 presents the result. The coefficient on weighted ADEP is significantly negative in the full sample and the Relatively High Financial Constraint group where the supplier has relatively high financial constraints compared with the customer, but not significant in the Relatively Low Financial Constraint group where the supplier has relatively low financial constraints compared with the customer, showing that asymmetric interdependence benefits, rather than harms, the efficiency of allocating trade credits between the supplier and the customer, consistent with Banerjee et al. (2007). As a result, I observe no significance of the coefficient on weighted ADEP * weighted OVPINST in the full sample or the two groups. At the bottom of the table, I present the marginal effect of weighted OVPINST on accounts receivable. In the full sample, overlapping institutional ownership is negatively associated with accounts receivable (p<0.05). An increase of one decile rank in overlapping institutional

[37] SA index equals -0.737*log(total assets)+0.043*log(total assets)**2-0.04*firm age.

ownership results in approximately a 0.50% ($1-e^{-0.005}$) decrease rate in accounts receivable over sales. I find a similar result in the Relatively High Financial Constraint group where the supplier has relatively high financial constraints compared with the customer. The marginal effect of weighted OVPINST is significantly negative ($p<0.01$) and an increase of one decile rank in overlapping institutional ownership results in approximately a 0.70% ($1-e^{-0.007}$) decrease rate in accounts receivable over sales. When customer has relatively high financial constraints compared with the supplier, the marginal effect of overlapping institutional ownership is insignificant. Hence, the negative marginal effect of overlapping institutional ownership in the full sample mainly comes from the Relatively High Financial Constraint group where suppliers are more financially constrained and thus rely more on internal cash flows than their customers, consistent with the explanation that overlapping institutional ownership improves the efficiency of allocating trade credits.

Regarding other relationship variables, mutual dependence (weighted MDEP) tends to decrease trade credits regardless of the relative financial constraints status between the supplier and the customer. Overlapping director (weighted OVPD) tends to increase trade credits when the supplier has relatively high financial constraints compared with the customer, opposite to the explanation of efficient trade credit allocation. However, the positive effect of overlapping auditor (weighted OVPAU) on accounts receivable comes from the Relatively Low Financial Constraint group, consistent with the explanation of efficient trade credit allocation. Overlapping analyst (weighted OVPAN) is not significantly associated with accounts receivable. Total institutional ownership (INST) is positively associated with accounts receivable, and the positive effect comes from the

Relatively Low Financial Constraint group, consistent with the efficient trade credit allocation explanation. The coefficient on industry log(ar/s) is significantly positive, showing industry convergence of accounts receivable. Results of other control variables are generally consistent with those in Banerjee et al. (2007).

I also test the effect of overlapping institutional ownership on trade credits using predicted overlapping institutional ownership, subsample with low customer competition where the customer industry Herfindahl–Hirschman index based on the sales of all COMPUSTAT firms with the same three-digit SIC code is above the upper tertile for each fiscal year and subsample with high customer concentration where the customer concentration (sales-based Herfindahl–Hirschman index) is above the sample median (unreported). The results still show that overlapping institutional ownership improves the efficiency of trade credit allocation.

1.7 Conclusion

In this paper, I examine whether the overlap in institutional ownership between the supplier and the customer serves as an efficient monitoring mechanism in the product market. Results show that overlapping institutional ownership indeed benefits the supplier and the customer, especially suppliers' firm value, through improved relationship-specific investment and relationship duration. Specifically, the overlap in institutional ownership helps alleviate the adverse effect of asymmetric interdependence on supplier performance and maintains the positive effect of asymmetric interdependence on customer performance. I also find that institutional investor overlap mitigates the inhibition of asymmetric interdependence on partners' incentive to invest relationship-specific assets, increasing relationship-specific investments for both

partners especially the dominated one. Furthermore, overlapping institutional ownership reinforces the positive effect of asymmetric interdependence on partnership duration in my sample where the asymmetric interdependence is low on average compared with prior research. As a further test, I find that overlapping institutional investors play a beneficial role in allocating trade credits between the partners. Generally, when the supplier is more financially constrained than the customer, overlapping institutional ownership is negatively associated with trade credits.

This is the first paper to examine the monitoring role of overlapping institutional ownership along the supply chain. It provides potential mechanisms for suppliers (customers) to monitor customers (suppliers) and suggests that it is possible for a partner with low bargaining power to monitor the other with relatively high bargaining power. Furthermore, it contributes to the research on institutional investors by revealing the incremental monitoring role of overlapping institutional investors.

The paper has some limitations. Although I provide robustness tests to control for the endogeneity of the overlap in institutional investors, there might be still an issue related to unobserved omitted variables. Furthermore, I test the monitoring role of overlapping institutional investors using outcome variables but they may not directly capture how these investors monitor suppliers and customers along the supply chain. Future research on overlapping institutional investor activism to monitor the supplier and the customer would be valuable.

Appendix I Variable definitions

Variables	Definition
variables for firm value regression (Model 1)	
FMV_t	price at the end of the fiscal year * shares outstanding + total liability
$SDEP_t$	sales dependence, calculated as sales from the customer divided by the total sales of the supplier
$CDEP_t$	cost dependence, calculated as purchases from the supplier divided by the total cost of goods sold of the customer
$MDEP_t$	$\min(SDEP_t, CDEP_t)$
$ADEP_t$	$SDEP_t - CDEP_t$
$OVPD_t$	1 if the supplier and the customer have a same director, 0 otherwise
$OVPAN_t$	1 if the supplier and the customer have a same analyst, 0 otherwise
$OVPAU_t$	1 if the supplier and the customer have a same auditor, 0 otherwise
$INST_t$	institutional ownership
E_t	earnings before extraordinary items, adjusted for inflation to 2011
dE_t	the change in inflation adjusted earnings before extraordinary items from t-2 to t
dE_{t+2}	the change in inflation adjusted earnings before extraordinary items from t to t+2
dA_t	the change in inflation adjusted total assets from t-2 to t
dA_{t+2}	the change in inflation adjusted total assets from t to t+2
RD_t	R&D expenditures, adjusted for inflation to 2011
dRD_t	the change in inflation adjusted R&D expenditures from t-2 to t
dRD_{t+2}	the change in inflation adjusted R&D expenditures from t to t+2
D_t	dividends, adjusted for inflation to 2011
dD_t	the change in inflation adjusted dividends from t-2 to t
dD_{t+2}	the change in inflation adjusted dividends from t to t+2
I_t	interest expense, adjusted for inflation to 2011
dI_t	the change in inflation adjusted interest expense from t-2 to t
dI_{t+2}	the change in inflation adjusted interest expense from t to t+2
$dFMV_{t+2}$	the change in inflation adjusted market value from t to t+2
FYEAR	Indicators for every fiscal year except the base year

Variables	Definition
IND	Indicators for every GIC sector except the base sector
variables for excess return regression (Model 2)	
r_t	Realized stock return during fiscal year t
R^B	value-weighted return of the Fama-French size-BE/ME portfolio to which the firm belongs
LH_t	1 if MDEP decreases and ADEP increases from t-1 to t
HL_t	1 if MDEP increases and ADEP decreases from t-1 to t
$\Delta INST_t$	Change in INST from t-1 to t
ΔE_t	Change in inflation adjusted earnings before extraordinary items from t-1 to t
ΔA_t	Change in inflation adjusted total assets from t-1 to t
ΔRD_t	Change in inflation adjusted R&D expenditures from t-1 to t
ΔI_t	Change in inflation adjusted interest expense from t-1 to t
ΔD_t	Change in inflation adjusted dividends from t-1 to t
C_{t-1}	Cash plus marketable securities at time t-1
L_t	Total debt / (total debt + market value of equity)
NF_t	total equity issuance minus repurchases plus debt issuance minus debt redemption
M_t	market value of equity (common shares outstanding * price at the end of the fiscal year)
additional variables for R&D intensity regression (Model 3)	
RDI_t	R&D intensity, calculated as R&D expenditures deflated by total assets. Missing R&D expenditures are treated as 0.
$size_t$	log(total assets)
book-to-market$_t$	total assets / (total debt + common shares outstanding * price at the end of the fiscal year)
sales growth$_t$	one-year growth rate in sales
leverage$_t$	total debt / total assets
ocf surplus$_t$	cash flow from assets in place divided by total assets
financing cash flow$_t$	cash flow from financing activities divided by total assets
cash$_t$	cash and short term investments divided by total assets
$CAPX_t$	capital expenditure divided by total assets
SGA_t	SGA expenses divided by total assets
industry RD_t	industry level R&D expenditures divided by industry level total assets
additional variables for relationship duration regression (Model 4)	
Duration	the fiscal year the supplier–customer relationship ends minus the first fiscal year the supplier–customer relationship exists

Variables	Definition
Customer RD/sales	R&D expenditure/sales of the customer. Missing value is treated as 0.
Supplier RD/sales	R&D expenditure/sales of the supplier. Missing value is treated as 0.
Max(customer age, supplier age)	max(current fiscal year minus the supplier's IPO year or its first fiscal year in COMPUSTAT, current fiscal year minus the customer's IPO year or its first fiscal year in COMPUSTAT)
supplier size	log(total assets) of the supplier
customer size	log(total assets) of the customer
min(customer free cash flow, supplier free cash flow)	min((supplier operating cash flow - supplier capital expenditures) / supplier total assets, (customer operating cash flow - customer capital expenditures) / customer total assets)
Same industry	1 if the supplier and the customer are in a same GIC group, 0 otherwise
Same city	1 if the supplier and the customer are headquartered in a same city, 0 otherwise
Year	The beginning year of the relationship minus 1976
additional variables for trade credits regression (Model 5)	
log $(ar/s)_t$	log(receivables-trade / net sales)
$OVPINST_t$	Overlapping institutional ownership
$log(total\ assets/sales)_t$	log(total assets / net sales)
$log(sales)_t$	log(net sales)
$log(inventories/sales)_{t-1}$	log(total inventories divided by sales) at t-1
LDM_{t-1}	total long term debt / (total debt + market value of equity) at t-1
$log(marginal\ cost/sales)_{t-1}$	log((sales-cost of goods sold) / sales) at t-1
$(cash\ flow/total\ assets)_{t-1}$	(income before extraordinary items + depreciation and amortization) / total assets at t-1
industry log $(ar/s)_t$	log(receivables-trade/net sales) in the GIC sector
variables for predicting the minimum value of the two ownerships overlapping institutional investors hold in supplier and customer (Model B)	
size	log(total assets) of the supplier
customer size	log(total assets) of the customer
hhi	Herfindal-Hirschman concentration index based on sales for the supplier's GIC sector
customer hhi	Herfindal-Hirschman concentration index based on sales for the customer's GIC sector
sectorovpinst	the proportion of firms within the supplier's GIC sector having at least one overlapping institutional investor
customer sectorovpinst	the proportion of firms within the customer's GIC sector having at least one overlapping institutional investor
$leverage_{t-1}$	the ratio of long-term debt to total assets of the supplier at t-1

Variables	Definition
customer leverage$_{t-1}$	the ratio of long-term debt to total assets of the customer at t-1
ROA$_{t-1}$	earnings before extraordinary items, deflated by total assets of the supplier at t-1
customer ROA$_{t-1}$	earnings before extraordinary items, deflated by total assets of the customer at t-1
tangibility	capital expenditure divided by total assets of the supplier
customer tangibility	capital expenditure divided by total assets of the customer
turnover	average monthly trading volume divided by common shares outstanding of the supplier
customer turnover	average monthly trading volume divided by common shares outstanding of the customer
log(price)	log(average monthly stock price) of the supplier
customer log(price)	log(average monthly stock price) of the customer
tobinq	(stock price at the end of the fiscal year * common shares outstanding + total liabilities) / total assets of the supplier
customer tobinq	(stock price at the end of the fiscal year * common shares outstanding + total liabilities) / total assets of the customer
age	the duration of the supplier from IPO year or the first year in COMPUSTAT to t
customer age	the duration of the customer from IPO year or the first year in COMPUSTAT to t
return	annual stock return of the supplier
customer return	annual stock return of the customer
volatility	standard deviation of the supplier's midpoint of bid and ask price during fiscal year t
customer volatility	standard deviation of the customer's midpoint of bid and ask price during fiscal year t
baspread	the supplier's average bid-ask spread during fiscal year t
customer baspread	the customer's average bid-ask spread during fiscal year t
IMR	inverse Mills ratio for firms disclosing customer information

Note: all t refers to fiscal year t.

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Table 1
Sample description

Supplier–customer relationships are identified from COMPUSTAT segment files. Variables-compustat are calculated using all the COMPUSTAT data within the same time period to my final sample period. Tobinq is calculated as (price at the fiscal year end * common shares outstanding + total liabilities) / total assets. Age equals fiscal year minus the minimum between IPO year and the first year the firm exists in COMPUSTAT. R&D intensity equals R&D expenditure divided by total assets. Missing capital expenditure and R&D expenditure are set to 0.

		Compustat	Supplier	Customer
Total Assets	Mean	4907.328	1564.409	45965.845
	Median	165.597	138.257	16539.000
	Observations	196583	25631	25623
Capital Expenditure/Total Assets	Mean	0.061	0.061	0.068
	Median	0.036	0.037	0.059
	Observations	196560	25631	25622
Tobinq	Mean	2.035	2.183	2.040
	Median	1.263	1.498	1.571
	Observations	194374	25439	25567
Age	Mean	13.616	14.059	30.700
	Median	9.000	10.000	31.000
	Observations	211255	25393	25493
R&D Intensity	Mean	0.043	0.083	0.037
	Median	0.000	0.026	0.009
	Observations	196560	25631	25622

Table 2
Descriptive statistics

This table presents the descriptive statistics for the supplier–customer relationship. OVPINST is overlapping institutional ownership calculated as the minimum value of ownerships the overlapping institutional investors hold in the supplier and the customer. Supplier (Customer) OVPINST is the ownership of overlapping institutional investors holding in the supplier (customer). MDEP is mutual dependence calculated as the minimum of sales dependence (percentage of sales to the customer) and cost dependence (percentage of cost of goods sold from the supplier). ADEP is asymmetric interdependence calculated as the difference between sales dependence and cost dependence. Dummy OVPINST equals 1 if there is an overlapping institutional investor and 0 otherwise. OVPD is an indicator for overlapping director. OVPAN is an indicator for overlapping analyst. OVPAU is an indicator for overlapping auditor. Same industry is 1 if the supplier and the customer are in the same GIC group and 0 otherwise. Same city is 1 if the supplier and the customer are in the same city and 0 otherwise. Holding duration of overlapping institutional investors is the number of years for an institutional investor holds the stakes of both the supplier and the customer. Duration of supplier–customer relationship is the number of years for a supplier–customer relationship lasts. FMV/A is calculated as (price at the end of the fiscal year * shares outstanding + total liability) / total assets. r-R^B is realized stock return during fiscal year t adjusted by value-weighted return of the Fama-French size-BE/ME portfolio to which the firm belongs. log(ar/s) is the logarithm of accounts receivables deflated by net sales. RDI (durable industries) is the R&D intensity in durable industries (primary SIC codes of 3400 and above but less than 4000), calculated as R&D expenditures deflated by total assets. Missing R&D expenditure is treated as 0. In supplier (customer) sample, all the relationship-level variables are weighted by the percentage of sales to the customer (percentage of cost of goods sold from the supplier).

Panel A: univariate analysis

Variable	Obs.	Mean	Min	1%	25%	Median	75%	99%	Max
Characteristics of supplier–customer relationships									
OVPINST (Dummy OVPINST=1)	12144	0.047	0.000	0.000	0.009	0.037	0.068	0.213	0.391
Supplier OVPINST(Dummy OVPINST=1)	12159	0.093	0.000	0.000	0.022	0.064	0.129	0.466	0.890
Customer OVPINST(Dummy OVPINST=1)	12152	0.058	0.000	0.000	0.023	0.048	0.078	0.243	0.604
MDEP	20821	0.011	0.000	0.000	0.000	0.002	0.008	0.122	0.602
ADEP	20821	0.193	0.000	0.006	0.099	0.140	0.228	0.914	1.000
Dummy OVPINST	20849	0.584	0	0	0	1	1	1	1
OVPD	20849	0.002	0	0	0	0	0	0	1
OVPAN	20849	0.117	0	0	0	0	0	1	1
OVPAU	20849	0.194	0	0	0	0	0	1	1
Same industry	5976	0.412	0	0	0	0	1	1	1
Same city	5949	0.027	0	0	0	0	0	1	1
Holding duration of overlapping institutional investors	154579	1.838	1	1	1	1	2	8	21
Duration of supplier–customer relationship	5976	3.337	1	1	1	2	4	16	28
Selected variables in supplier sample									
FMV/A	9082	1.994	0.301	0.588	1.097	1.476	2.204	9.122	41.318
r-R^B	6282	0.030	-1.006	-0.906	-0.313	-0.072	0.197	2.992	3.720
weighted ADEP	9243	0.195	0.000	0.009	0.104	0.148	0.230	0.849	1.000
weighted MDEP	9243	0.012	0.000	0.000	0.001	0.003	0.010	0.121	0.472
weighted OVPINST	9243	0.039	0.000	0.000	0.001	0.026	0.061	0.197	0.391
log(ar/s)	7755	-1.952	-4.181	-3.695	-2.192	-1.902	-1.661	-0.860	-0.485
RDI (durable industries)	2305	0.088	0.000	0.000	0.020	0.068	0.125	0.446	0.494

Panel A: univariate analysis									
Variable	Obs.	Mean	Min	1%	25%	Median	75%	99%	Max
Selected variables in customer sample									
FMV/A	4700	2.050	0.573	0.793	1.201	1.552	2.347	8.327	16.138
r-R^B	3707	0.031	-0.845	-0.761	-0.190	-0.004	0.186	1.568	1.938
weighted ADEP	5099	0.194	0.000	0.007	0.095	0.144	0.231	0.883	1.000
weighted MDEP	5099	0.022	0.000	0.000	0.002	0.008	0.027	0.184	0.602
weighted OVPINST	5099	0.030	0.000	0.000	0.000	0.009	0.049	0.195	0.359
RDI(durable industries)	1249	0.070	0.000	0.000	0.026	0.056	0.101	0.264	0.264

Panel B: correlation matrix of selected variables[38] (upper triangular: Pearson correlation; lower triangular: Spearman correlation)

Variable	FMV/A	r-R^B	weighted ADEP	weighted MDEP	weighted OVPINST	RDI
Supplier sample						
FMV/A	1.000	0.390	0.035	0.069	0.157	0.259
		0.000	0.001	0.000	0.000	0.000
r-R^B	0.293	1.000	-0.023	0.082	0.085	-0.036
	0.000		0.064	0.000	0.000	0.171
weighted ADEP	0.109	0.025	1.000	-0.041	-0.048	0.040
	0.000	0.043		0.000	0.000	0.065
weighted MDEP	0.001	0.012	-0.065	1.000	0.225	-0.011
	0.940	0.341	0.000		0.000	0.623
weighted OVPINST	0.056	0.040	-0.088	0.118	1.000	-0.015
	0.000	0.002	0.000	0.000		0.498
RDI(durable industries)	0.206	-0.015	0.085	-0.042	-0.063	1.000
	0.000	0.572	0.000	0.052	0.003	
Customer sample						
FMV/A	1.000	0.333	0.087	0.156	0.099	0.389
		0.000	0.000	0.000	0.000	0.000
r-R^B	0.298	1.000	0.017	-0.005	0.059	0.003
	0.000		0.291	0.748	0.000	0.923
weighted ADEP	0.113	0.018	1.000	-0.024	-0.061	0.058
	0.000	0.261		0.084	0.000	0.047
weighted MDEP	0.098	0.026	-0.044	1.000	0.266	0.345
	0.000	0.116	0.002		0.000	0.000
weighted OVPINST	0.016	0.061	-0.100	0.137	1.000	-0.031
	0.272	0.000	0.000	0.000		0.285
RDI(durable industries)	0.295	0.018	0.025	0.247	-0.018	1.000
	0.000	0.591	0.404	0.000	0.539	

[38] Values below correlation coefficients are p values for testing whether the correlation coefficient is 0.

Table 3
The effect of overlap in institutional investor on supplier's and customer's Performance (firm value)

This table presents the effect of overlap in institutional investor on partners' individual performance. The regression model is Model 1 and estimated by median regression. The dependent variable is the market value of equity plus total liabilities (FMV), and then divided by total assets. All variables for supplier–customer relationship are weighted by the percentage of sales to each customer (percentage of cost of goods sold from each supplier) for suppliers (customers). Fiscal year and industry fixed effects are controlled for. The full sample is divided into two subsamples based on overlapping institutional ownership. High group is where overlapping institutional ownership is above the upper tertile. Low group is where overlapping institutional ownership is below the lower tertile. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full sample (1)		High (2)		Low (3)		Full sample (4)		High (5)		Low (6)	
Intercept	1.044	***	0.838	***	1.058	***	0.859	***	0.862	***	0.825	***
	19.730		8.000		9.893		12.886		6.098		5.720	
weighted $ADEP_t$	**0.130**	*	**0.484**	***	**0.009**		**0.161**	***	**0.152**		**0.097**	
	1.795		**2.780**		**0.097**		**2.661**		**1.020**		**1.146**	
weighted $MDEP_t$	0.283		1.587	***	-0.368		1.914	***	3.329	***	2.026	***
	1.041		2.709		-1.173		4.954		5.899		2.966	
weighted $OVPD_t$	0.223		0.168		8.477		0.540		0.622		0.829	
	1.175		0.757		0.119		0.734		0.307		0.504	
weighted $OVPAN_t$	0.021		-0.040		0.052		0.068	**	0.017		-0.165	
	0.791		-1.027		0.427		2.077		0.368		-0.771	
weighted $OVPAU_t$	-0.025		0.009		-0.005		-0.098	***	-0.122	***	-0.030	
	-1.215		0.214		-0.151		-4.371		-2.724		-0.728	
$INST_t$	0.260	***	0.279	*	0.229	**	0.221	**	-0.518	**	0.451	***
	3.686		1.728		2.066		2.576		-2.443		3.437	
E_t/A_t	-0.753	***	0.424		-1.194	***	4.328	***	4.946	***	3.032	***
	-4.297		1.340		-6.708		12.435		7.526		5.413	
dE/A_t	0.719	***	0.474	**	0.671	***	-0.251		-0.863	*	-0.420	
	7.169		2.492		5.680		-1.101		-1.746		-1.028	
dE_{t+2}/A_t	0.119		0.560	**	-0.192		2.188	***	2.410	***	1.749	***
	1.184		2.555		-1.620		9.664		6.627		4.842	
dA_t/A_t	0.497	***	0.492	***	0.435	***	0.163	***	0.210	**	0.455	***
	11.928		5.577		7.793		2.789		2.131		3.777	
dA_{t+2}/A_t	0.844	***	0.618	***	0.721	***	0.317	***	0.228	**	0.394	***
	15.710		6.047		11.243		4.947		2.552		3.419	
RD_t/A_t	4.751	***	5.887	***	3.243	***	5.461	***	5.709	***	4.704	***
	23.870		13.304		11.267		16.547		8.768		7.851	
dRD/A_t	0.226		0.156		0.451		5.806	***	3.941	**	1.047	
	0.597		0.188		0.912		5.858		2.011		0.639	
dRD_{t+2}/A_t	4.071	***	4.049	***	2.589	***	9.124	***	11.870	***	9.311	***
	10.258		4.518		5.377		8.580		6.659		5.770	
D_t/A_t	9.624	***	13.192	***	6.695	***	9.964	***	10.538	***	12.506	***
	11.487		8.658		5.679		12.019		6.924		8.127	
dD_t/A_t	0.729		-2.606		2.994	**	0.923		2.789		-0.249	
	0.587		-0.898		2.028		0.539		0.843		-0.079	
dD_{t+2}/A_t	9.288	***	12.459	***	6.192	***	9.436	***	15.359	***	6.293	**
	6.766		4.766		2.923		5.853		4.617		2.157	
I_t/A_t	2.432	***	1.668		1.603	*	-3.084	***	-4.261	**	-4.271	***
	4.420		1.215		1.872		-3.913		-2.456		-3.175	

	Supplier						Customer					
	Full sample (1)		High (2)		Low (3)		Full sample (4)		High (5)		Low (6)	
dI_t/A_t	-4.610	***	-5.425	***	-2.119	**	-1.441		-6.744	***	-0.630	
	-6.069		-3.019		-2.010		-1.078		-2.593		-0.290	
dI_{t+2}/A_t	-4.901	***	-5.551	***	-3.617	***	-4.969	***	-5.044	**	-6.632	***
	-5.489		-2.600		-3.091		-4.170		-2.052		-3.537	
$dFMV_{t+2}/A_t$	-0.231	***	-0.128	***	-0.156	***	-0.098	***	-0.037		-0.129	**
	-11.046		-2.599		-5.425		-3.640		-1.048		-2.561	
Observations	6949		2316		2316		4459		1486		1486	
Test the difference in the coefficient on weighted $ADEP_t$ between groups			**0.475** **2.363**	**					**0.055** **0.308**			

Table 4
The effect of overlap in institutional investor on supplier's and customer's performance (excess return)

This table presents the effect of overlap in institutional investor on the partners' individual performances using Model 2. The dependent variable is the realized stock return adjusted by the value-weighted return of the Fama-French size-BE/ME portfolio (5*5) to which the firm belongs. All variables for supplier–customer relationship are weighted by the percentage of sales to each customer (percentage of cost of goods sold from each supplier) for suppliers (customers). Fiscal year and industry fixed effects are controlled for. The full sample is divided into two subsamples based on the change in overlapping institutional ownership. Increase group is where the change in overlapping institutional ownership is positive. Non-increase group is where the change in overlapping institutional ownership is non-positive. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times[39]. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full sample		Increase		Non-increase		Full sample		Increase		Non-increase	
Intercept	0.094	***	0.036		0.106	**	0.073	**	0.096	*	0.034	
	2.644		0.477		2.386		2.265		1.944		0.770	
LH_t	**-0.019**		**0.008**		**-0.037**	**	**0.003**		**0.016**		**0.012**	
	-1.398		**0.410**		**-2.119**		**0.250**		**0.911**		**0.644**	
HL_t	0.014		0.008		0.032	*	0.013		0.016		0.001	
	0.948		0.382		1.665		0.977		0.965		0.035	
weighted $OVPD_t$	0.076		-0.024		0.163		0.049		-0.157		0.118	
	0.539		-0.105		0.221		0.165		-0.317		0.163	
weighted $OVPAN_t$	0.002		-0.021		0.010		0.010		-0.011		0.035	*
	0.185		-1.115		0.565		0.757		-0.614		1.817	
weighted $OVPAU_t$	0.014		0.004		0.013		-0.002		0.026		-0.050	**
	1.016		0.221		0.636		-0.109		1.159		-1.969	
$\Delta INST_t$	0.560	***	0.580	***	0.453	***	0.350	***	0.381	***	0.331	**
	6.974		4.745		4.465		3.514		2.664		2.252	
$\Delta E_t/M_{t-1}$	0.540	***	0.719	***	0.448	***	0.468	***	0.479	***	0.521	***
	12.197		7.722		9.349		7.460		4.659		7.750	
$\Delta A_t/M_{t-1}$	0.278	***	0.238	***	0.285	***	0.270	***	0.244	***	0.292	***
	10.709		5.941		8.587		10.088		5.481		9.413	
$\Delta RD_t/M_{t-1}$	0.535	*	0.334		0.526		-0.592		-1.402		-0.137	
	1.750		0.731		1.425		-1.132		-1.531		-0.175	
$\Delta I_t/M_{t-1}$	-3.758	***	-4.636	***	-3.434	***	-2.186	***	-2.752	***	-1.790	***
	-8.638		-6.496		-7.155		-3.803		-2.622		-2.756	
$\Delta D_t/M_{t-1}$	1.772	***	2.075	**	2.322	***	0.353		1.719		-2.485	*
	3.080		2.560		2.880		0.347		1.435		-1.731	
C_{t-1}/M_{t-1}	0.140	***	0.194	***	0.126	**	0.309	***	0.333	***	0.285	***
	3.771		3.237		2.525		6.433		4.597		3.276	
L_t	-0.353	***	-0.369	***	-0.327	***	-0.443	***	-0.433	***	-0.457	***
	-13.113		-8.508		-8.607		-12.653		-8.806		-10.688	
NF_t/M_{t-1}	0.002		0.066		-0.005		-0.133	*	0.081		-0.327	***
	0.044		0.886		-0.083		-1.717		0.809		-3.426	

[39] Sometimes, the coefficients are still unstable under the 10000 resampling times, and then I try higher resampling times.

	Supplier			Customer		
	Full sample	Increase	Non-increase	Full sample	Increase	Non-increase
Observations	6282	3120	3162	3707	1757	1950
Test the difference in the coefficient on LHt between groups		**0.044** *			**0.005**	
		1.737			**0.183**	

Table 5
The effect of overlap in institutional investor on supplier's and customer's performance (firm value) – controlling for endogeneity

This table presents the effect of overlap in institution investor on supplier's or customer's performance under the consideration of endogeneity issue. The regression model is Model 1 and estimated by median regression. The dependent variable is the market value of equity plus total liabilities (FMV), and then divided by total assets. All variables for supplier–customer relationship are weighted by the percentage of sales to each customer (percentage of cost of goods sold from each supplier) for suppliers (customers). Fiscal year and industry fixed effects are controlled for. The full sample is equally divided into three subsamples based on the predicted overlapping institutional ownership. The prediction model is Model B in Appendix II. High group is where the predicted overlapping institutional ownership is above the upper tertile. Low group is where the predicted overlapping institutional ownership is below the lower tertile. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
Intercept	0.936	***	0.699	***	0.968	***	0.714	***	0.596	***	0.913	***
	12.187		4.062		5.157		6.258		2.633		3.583	
weighted $ADEP_t$	**0.151**		**0.826**	***	**0.172**		**0.055**		**-0.206**		**-0.034**	
	1.623		**3.783**		**1.274**		**0.559**		**-1.300**		**-0.158**	
weighted $MDEP_t$	0.818	**	2.637	***	-0.093		2.097	***	2.450	***	0.989	
	2.072		3.792		-0.140		2.929		3.170		0.642	
weighted $OVPD_t$	0.350	**	-0.056		0.600		1.071		0.204		2.248	
	2.331		-0.273		0.121		1.595		0.181		0.539	
weighted $OVPAN_t$	-0.068	**	-0.246	***	0.109		0.033		0.065		0.655	
	-2.353		-5.900		0.712		0.719		1.420		1.397	
weighted $OVPAU_t$	-0.030		-0.051		-0.006		-0.187	***	-0.069		-0.171	**
	-1.005		-1.072		-0.114		-5.377		-1.442		-2.324	
$INST_t$	0.747	***	0.280		0.242		0.626	***	0.376		1.325	***
	5.109		1.086		0.769		2.915		1.435		3.148	
E_t/A_t	-0.305		2.854	***	-1.510	***	5.721	***	5.742	***	4.987	***
	-1.516		5.712		-5.781		10.302		7.674		5.452	
dE/A_t	0.605	***	0.195		0.686	***	-0.236		-0.852		0.594	
	6.314		0.625		4.361		-0.670		-1.547		0.981	
dE_{t+2}/A_t	0.405	***	1.668	***	-0.111		3.679	***	2.955	***	3.799	***
	2.953		4.970		-0.516		8.616		5.404		5.124	
dA_t/A_t	0.482	***	0.304	***	0.404	***	0.053		0.150		0.092	
	9.525		2.670		5.475		0.645		1.312		0.535	
dA_{t+2}/A_t	1.064	***	0.566	***	1.297	***	0.498	***	0.515	***	0.677	***
	16.340		4.031		11.275		4.620		3.354		3.408	
RD_t/A_t	5.513	***	8.268	***	3.749	***	7.399	***	5.845	***	7.883	***
	20.961		15.919		9.348		15.521		7.425		8.225	
dRD/A_t	0.023		-0.100		0.161		7.383	***	3.177		8.456	***
	0.050		-0.129		0.247		6.116		1.272		3.779	
dRD_{t+2}/A_t	5.274	***	6.049	***	4.585	***	13.433	***	9.957	***	15.624	***
	9.595		5.265		5.108		8.818		3.594		5.027	
D_t/A_t	10.114	***	8.933	***	4.963	**	8.219	***	7.852	***	10.555	***
	8.683		5.461		2.364		5.902		3.849		4.438	
dD_t/A_t	-2.156		-5.180	**	5.879	**	0.411		0.626		-0.895	
	-1.226		-2.004		2.158		0.211		0.243		-0.172	
dD_{t+2}/A_t	9.210	***	5.027	***	12.655	***	9.648	***	10.022	***	8.267	*
	6.228		2.652		3.193		4.455		3.274		1.793	

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
I_t/A_t	2.867	***	3.870	**	3.325	**	-6.035	***	-4.693	**	-6.453	**
	3.667		2.123		2.434		-3.927		-2.342		-2.227	
dI_t/A_t	-5.275	***	-3.915		-5.401	***	-1.326		-5.326		1.618	
	-4.516		-1.638		-3.034		-0.579		-1.624		0.320	
dI_{t+2}/A_t	-5.722	***	1.478		-3.758		-4.773	*	-7.899	**	-6.407	
	-3.948		0.507		-1.535		-1.792		-2.035		-1.402	
$dFMV_{t+2}/A_t$	-0.343	***	-0.296	***	-0.447	***	-0.439	***	-0.423	***	-0.465	***
	-11.462		-3.839		-7.830		-8.107		-4.035		-5.732	
Observations	4392		1464		1464		2265		755		755	
Test the difference in the coefficient on weighted $ADEP_t$ between groups			**0.654** **2.518**	**					**-0.172** **-0.682**			

Table 6
Alternative research design to detect the monitoring role of overlapping institutional investors

This table presents the effect of overlap in institution investor on supplier's or customer's performance using an alternative research design. The regression model is based on Model 1 and estimated by median regression. The dependent variable is the market value of equity plus total liabilities (FMV), and then divided by total assets. All variables for supplier–customer relationship are weighted by the percentage of sales to each customer (percentage of cost of goods sold from each supplier) for suppliers (customers). Fiscal year and industry fixed effects are controlled for. The full sample is equally divided into three subsamples based on the asymmetric interdependence. High group is where asymmetric interdependence is above the upper tertile. Low group is where asymmetric interdependence is below the lower tertile. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
Intercept	0.936	***	1.182	***	0.828	***	0.865	***	0.689	***	0.966	***
	17.737		11.588		9.112		12.485		4.933		9.095	
weighted $OVPINST_t$	**0.028**	***	**0.034**	***	**0.019**	***	**0.001**		**0.007**		**-0.005**	
	8.089		**4.733**		**3.493**		**0.374**		**0.979**		**-0.902**	
weighted $MDEP_t$	0.369		1.106	*	0.801	**	1.890	***	2.237	***	2.440	***
	1.523		1.667		2.212		4.614		2.586		4.641	
weighted $OVPD_t$	0.280		1.678		0.264		0.505		2.864	**	1.634	
	1.566		0.910		1.097		0.675		2.225		0.910	
weighted $OVPAN_t$	-0.044	*	-0.119	*	0.075	**	0.055		-0.028		0.059	
	-1.652		-1.928		1.975		1.636		-0.320		1.163	
weighted $OVPAU_t$	-0.031		-0.079	**	0.015		-0.094	***	-0.190	***	-0.063	*
	-1.416		-1.996		0.433		-4.320		-3.930		-1.693	
$INST_t$	0.006		-0.335	**	0.022		0.195	**	-0.002		0.394	***
	0.079		-2.090		0.187		2.224		-0.014		3.256	
E_t/A_t	-0.859	***	-1.273	***	-0.430		4.322	***	7.052	***	2.816	***
	-5.017		-6.043		-1.475		12.641		11.116		5.334	
dE/A_t	0.749	***	0.986	***	0.659	***	-0.356		-1.397	***	0.386	
	7.429		6.270		4.086		-1.631		-3.092		1.163	
dE_{t+2}/A_t	0.088		-0.041		0.077		2.183	***	3.433	***	1.507	***
	0.881		-0.261		0.427		9.896		8.317		4.195	
dA_t/A_t	0.496	***	0.514	***	0.364	***	0.180	***	0.242	*	0.234	***
	11.093		6.975		4.983		3.102		1.931		2.662	
dA_{t+2}/A_t	0.837	***	0.958	***	0.738	***	0.316	***	0.335	***	0.410	***
	15.713		9.627		9.079		4.987		2.837		4.169	
RD_t/A_t	4.703	***	4.323	***	4.724	***	5.550	***	6.642	***	5.368	***
	24.501		15.055		12.427		16.762		10.618		9.715	
dRD/A_t	0.296		0.776		1.013		5.650	***	4.767	**	4.098	***
	0.792		1.359		1.403		5.597		2.527		2.729	
dRD_{t+2}/A_t	4.083	***	4.294	***	3.270	***	9.298	***	12.741	***	6.672	***
	10.778		7.062		4.321		8.993		7.283		4.262	
D_t/A_t	9.728	***	4.682	***	12.241	***	10.021	***	3.950	***	14.187	***
	12.163		4.159		11.062		11.922		2.951		10.084	
dD_t/A_t	0.666		2.564		-1.044		1.309		3.091		-2.225	
	0.523		1.246		-0.519		0.759		1.189		-0.651	
dD_{t+2}/A_t	9.678	***	9.096	***	10.202	***	9.838	***	1.663		8.532	***
	6.441		4.826		4.345		6.273		0.565		2.833	
I_t/A_t	2.124	***	2.808	***	1.738	*	-3.075	***	-6.817	***	-1.358	

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
	3.745		2.770		1.779		-3.847		-4.034		-1.052	
dI_t/A_t	-4.424	***	-5.041	***	-3.692	***	-1.617		-1.056		-3.582	*
	-5.650		-3.679		-2.887		-1.218		-0.405		-1.875	
dI_{t+2}/A_t	-5.292	***	-4.946	***	-5.760	***	-5.178	***	-9.741	***	-3.380	
	-5.785		-2.950		-3.751		-4.279		-4.085		-1.484	
$dFMV_{t+2}/A_t$	-0.227	***	-0.301	***	-0.183	***	-0.098	***	-0.109	***	-0.138	**
	-10.723		-7.567		-4.771		-3.635		-2.653		-2.455	
Observations	6949		2316		2316		4459		1486		1486	
Test the difference in the coefficient on weighted OVPINSTt between groups			**0.015** **1.653**	*					**0.012** **1.271**			

Table 7

The effect of overlap in institutional investor on the performance (firm value) of supplier–largest customer and customer–largest supplier relationship

This table presents the effect of overlap in institution investor on supplier's or customer's performance using the largest customer for the supplier and largest supplier for the customer. The regression model is Model 1 and estimated by median regression. The dependent variable is the market value of equity plus total liabilities (FMV), and then divided by total assets. Fiscal year and industry fixed effects are controlled for. In Panel A, the full sample is equally divided into three subsamples based on the actual value of overlapping institutional ownership. High group is where overlapping institutional ownership is above the upper tertile. Low group is where overlapping institutional ownership is below the lower tertile. In Panel B, the full sample is equally divided into three subsamples based on the predicted overlapping institutional ownership. The prediction model is Model B in Appendix II. High group is where the predicted overlapping institutional ownership is above the upper tertile. Low group is where the predicted overlapping institutional ownership is below the lower tertile. In the Low group of supplier sample, OVPD is not included because of no variation. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
Panel A: Using actual value of overlapping institutional ownership												
Intercept	1.057	***	0.962	***	0.988	***	0.858	***	0.888	***	0.781	***
	19.655		8.976		8.718		12.682		6.107		5.456	
$ADEP_t$	**0.105**		**0.299**	*	**0.015**		**0.101**	*	**-0.020**		**0.215**	**
	1.475		**1.696**		**0.163**		**1.785**		**-0.170**		**2.490**	
$MDEP_t$	0.315		1.280	**	-0.435		1.733	***	3.042	***	0.715	
	1.269		2.271		-1.241		4.679		6.130		1.201	
$OVPD_t$	0.216		0.159				-0.040		0.236		-0.103	
	1.136		0.710				-0.056		0.115		-0.172	
$OVPAN_t$	0.005		-0.060		0.062		0.048	*	0.037		0.036	
	0.212		-1.591		0.568		1.676		0.966		0.102	
$OVPAU_t$	-0.007		0.022		0.014		-0.080	***	-0.108	***	-0.032	
	-0.335		0.558		0.418		-4.170		-3.087		-0.793	
$INST_t$	0.268	***	0.241		0.209	*	0.214	**	-0.480	**	0.136	
	3.761		1.429		1.920		2.516		-2.228		0.925	
E_t/A_t	-0.795	***	0.276		-1.218	***	4.361	***	4.647	***	3.399	***
	-4.499		0.900		-6.489		12.738		7.380		6.037	
dE/A_t	0.731	***	0.616	***	0.782	***	-0.355		-0.522		-0.227	
	7.255		3.230		6.050		-1.582		-1.032		-0.633	
dE_{t+2}/A_t	0.105		0.534	**	-0.079		2.141	***	2.341	***	1.938	***
	1.059		2.443		-0.618		9.438		6.487		5.231	
dA_t/A_t	0.495	***	0.505	***	0.447	***	0.159	***	0.194	**	0.538	***
	11.778		5.950		7.781		2.671		2.005		4.549	
dA_{t+2}/A_t	0.839	***	0.632	***	0.747	***	0.304	***	0.210	**	0.528	***
	15.632		6.196		10.391		4.707		2.342		4.389	
RD_t/A_t	4.717	***	5.715	***	3.384	***	5.515	***	5.293	***	6.080	***
	23.520		13.113		10.876		16.875		7.758		11.709	
dRD/A_t	0.276		0.003		1.108	**	5.892	***	6.668	***	0.763	
	0.721		0.004		2.080		5.909		3.108		0.516	
dRD_{t+2}/A_t	4.077	***	3.686	***	2.500	***	9.192	***	10.959	***	7.858	***
	10.205		3.983		4.801		8.524		6.417		5.235	
D_t/A_t	9.509	***	13.155	***	7.060	***	9.812	***	11.733	***	10.868	***

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
	11.425		8.432		5.930		12.061		7.987		6.981	
dD_t/A_t	0.828		-2.260		2.613	*	1.110		2.419		3.346	
	0.663		-0.790		1.788		0.653		0.754		1.001	
dD_{t+2}/A_t	8.853	***	12.821	***	6.108	***	9.514	***	14.806	***	5.500	*
	6.406		4.697		3.039		6.088		4.527		1.789	
I_t/A_t	2.468	***	1.224		1.343		-2.941	***	-3.972	**	-4.843	***
	4.442		0.910		1.502		-3.771		-2.431		-3.501	
dI_t/A_t	-4.695	***	-6.128	***	-3.296	***	-1.613		-6.947	***	-0.659	
	-6.165		-3.324		-3.089		-1.212		-2.722		-0.311	
dI_{t+2}/A_t	-5.028	***	-5.231	**	-3.821	***	-4.903	***	-3.939	*	-8.387	***
	-5.484		-2.396		-3.295		-4.145		-1.766		-3.927	
$dFMV_{t+2}/A_t$	-0.228	***	-0.161	***	-0.178	***	-0.094	***	-0.037		-0.105	**
	-11.051		-3.217		-5.893		-3.472		-1.018		-2.183	
Observations	6949		2316		2316		4455		1485		1590	
Test the difference in the coefficient on $ADEP_t$ between groups			**0.284**						**-0.235**			
			1.351						**-1.587**			

Panel B: Using predicted overlapping institutional ownership

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
Intercept	0.926	***	0.678	***	1.064	***	0.692	***	0.288		0.497	
	11.882		3.616		6.109		5.863		1.167		1.633	
$ADEP_t$	**0.097**		**0.628**	***	**0.162**		**0.061**		**-0.039**		**0.105**	
	1.084		**2.787**		**1.191**		**0.705**		**-0.281**		**0.570**	
$MDEP_t$	0.687	*	2.582	***	0.032		1.908	***	1.726	**	0.664	
	1.914		4.015		0.052		3.140		2.526		0.428	
$OVPD_t$	0.245		-0.082				0.147		0.077		2.085	
	1.592		-0.367				0.251		0.049		0.510	
$OVPAN_t$	-0.070	**	-0.230	***	0.019		0.026		0.055		0.721	
	-2.514		-5.608		0.121		0.682		1.391		1.562	
$OVPAU_t$	-0.017		-0.005		0.020		-0.167	***	-0.058		-0.140	**
	-0.595		-0.110		0.419		-5.270		-1.468		-1.997	
$INST_t$	0.763	***	0.284		0.206		0.698	***	0.473	*	1.337	***
	5.190		1.026		0.639		3.303		1.793		2.961	
E_t/A_t	-0.300		2.670	***	-1.678	***	5.712	***	6.153	***	5.037	***
	-1.501		5.411		-6.438		10.472		7.886		5.446	
dE/A_t	0.598	***	0.151		0.749	***	-0.224		-0.850		0.991	
	6.203		0.472		4.817		-0.631		-1.423		1.616	
dE_{t+2}/A_t	0.403	***	1.495	***	-0.322		3.655	***	3.475	***	4.333	***
	2.908		4.554		-1.446		8.620		6.016		5.563	
dA_t/A_t	0.479	***	0.346	***	0.415	***	0.066		0.128		0.019	
	9.222		3.047		5.790		0.798		1.074		0.113	
dA_{t+2}/A_t	1.067	***	0.585	***	1.305	***	0.491	***	0.389	**	0.668	***
	15.727		3.913		11.089		4.546		2.481		3.266	
RD_t/A_t	5.531	***	8.576	***	3.791	***	7.443	***	6.824	***	8.142	***
	21.021		15.995		9.395		15.578		7.963		8.497	
dRD/A_t	0.015		-0.453		0.359		7.172	***	3.430		8.080	***
	0.033		-0.579		0.558		6.069		1.265		3.670	
dRD_{t+2}/A_t	5.293	***	6.173	***	4.478	***	13.074	***	13.026	***	17.151	***
	9.597		5.604		4.947		8.718		4.967		5.274	
D_t/A_t	10.035	***	10.172	***	4.630	**	8.254	***	7.258	***	9.943	***
	8.400		5.945		2.225		6.033		3.715		4.252	
dD_t/A_t	-2.317		-5.121	*	4.832	*	0.808		-1.399		-0.388	
	-1.317		-1.812		1.750		0.412		-0.509		-0.073	

	Supplier						Customer					
	Full sample		High		Low		Full sample		High		Low	
dD_{t+2}/A_t	9.060	***	5.863	***	13.677	***	9.775	***	8.803	***	8.179	*
	6.087		2.979		3.755		4.653		2.693		1.793	
I_t/A_t	3.101	***	4.192	**	3.921	***	-5.950	***	-4.723	**	-8.732	***
	3.916		2.324		2.825		-3.820		-2.065		-2.940	
dI_t/A_t	-5.486	***	-4.683	**	-5.255	***	-1.659		-1.556		6.230	
	-4.780		-1.989		-3.088		-0.719		-0.438		1.258	
dI_{t+2}/A_t	-5.558	***	0.377		-4.200	*	-4.331		-7.813	*	-5.990	
	-3.832		0.132		-1.700		-1.615		-1.888		-1.232	
$dFMV_{t+2}/A_t$	-0.345	***	-0.307	***	-0.401	***	-0.433	***	-0.381	***	-0.477	***
	-11.370		-3.832		-6.810		-7.917		-3.748		-5.982	
Observations	4392		1464		1464		2265		755		755	
Test the difference in the coefficient on $ADEP_t$ between groups			**0.467**	*					**-0.144**			
			1.767						**-0.651**			

Table 8

The effect of overlap in institutional investor on the performance (excess return) of supplier–largest customer and customer–largest supplier relationship

This table presents the effect of overlap in institutional investor on the partners' performances for supplier–largest customer and customer–largest supplier relationships using excess return model (Model 2). The dependent variable is the realized stock return adjusted by the value-weighted return of the Fama-French size-BE/ME portfolio (5*5) to which the firm belongs. Fiscal year and industry fixed effects are controlled for. The full sample is divided into two subsamples based on the change in overlapping institutional ownership. Increase group is where the change in overlapping institutional ownership is positive. Non-increase group is where the change in overlapping institutional ownership is non-positive. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier				Customer			
	(1)	Increase (2)	Non-increase (3)	(4)	(5)	Increase (6)	Non-increase (7)	(8)
Intercept	0.088 **	0.040	0.087 **	0.114 ***	0.097 ***	0.078	0.066	0.074 **
	2.523	0.516	2.118	3.266	2.655	1.485	1.374	2.002
LH_t	**-0.037 *****	**-0.031**	**-0.040 ****		**0.010**	**0.033**	**0.008**	
	-2.740	**-1.424**	**-2.336**		**0.669**	**1.343**	**0.402**	
HL_t	0.051 ***	0.031	0.066 ***		-0.019	0.015	-0.046 **	
	3.270	1.294	3.779		-1.259	0.695	-2.198	
$\Delta ADEP_t$				0.212				-0.267
				0.602				-0.662
$\Delta MDEP_t$				0.013				0.099
				0.067				1.180
OVP_OVP_t				-0.021				0.033 ***
				-1.333				2.591
$NOVP\_OVP_t$				0.027				-0.027
				0.383				-0.806
OVP_NOVP_t				-0.107 *				-0.012
				-1.909				-0.293
$\Delta ADEP_t$* OVP_OVPt				0.095				-0.121
				0.457				-1.080
$\Delta ADEP_t$* $NOVP\_OVP_t$				**1.949 ***				**0.278**
				1.717				**0.880**
$\Delta ADEP_t$* OVP_NOVP_t				**-1.768 *****				**0.075**

	Supplier								Customer							
	(1)		Increase (2)		Non-increase (3)		(4)		(5)		Increase (6)		Non-increase (7)		(8)	
							-3.204								**0.206**	
$OVPD_t$	0.028		-0.030		0.166		0.025		-0.031		-0.313		0.042		-0.031	
	0.148		-0.097		0.160		0.165		-0.042		-0.122		0.044		-0.043	
$OVPAU_t$	-0.004		-0.032	*	0.008		-0.005		0.004		-0.014		0.032	*	0.008	
	-0.302		-1.735		0.454		-0.449		0.303		-0.698		1.814		0.620	
$OVPAN_t$	0.010		-0.004		0.010		0.008		-0.019		-0.001		-0.042	*	-0.027	*
	0.757		-0.202		0.546		0.597		-1.288		-0.046		-1.797		-1.790	
$\Delta INST_t$	0.565	***	0.585	***	0.476	***	0.565	***	0.480	***	0.400	***	0.465	***	0.473	***
	7.163		4.674		4.923		7.197		4.606		3.129		2.773		4.515	
$\Delta E_t/M_{t-1}$	0.535	***	0.666	***	0.451	***	0.545	***	0.464	***	0.572	***	0.537	***	0.463	***
	11.375		6.709		8.688		11.980		7.025		5.562		7.268		7.106	
$\Delta A_t/M_{t-1}$	0.248	***	0.251	***	0.257	***	0.283	***	0.260	***	0.229	***	0.283	***	0.259	***
	9.567		5.724		7.926		10.971		8.477		5.131		7.321		8.707	
$\Delta RD_t/M_{t-1}$	0.550	*	0.186		0.213		0.518		-0.637		-0.738		-0.577		-0.524	
	1.796		0.378		0.525		1.556		-1.135		-0.803		-0.778		-0.949	
$\Delta I_t/M_{t-1}$	-3.659	***	-5.144	***	-3.022	***	-3.669	***	-2.353	***	-4.633	***	-1.317	*	-2.442	***
	-8.464		-6.471		-6.358		-8.691		-3.827		-4.761		-1.934		-3.911	
$\Delta D_t/M_{t-1}$	1.683	***	2.255	***	1.637	*	1.539	***	0.176		2.188		-1.322		0.172	
	2.921		2.724		1.888		2.681		0.168		1.619		-0.892		0.159	
C_{t-1}/M_{t-1}	0.125	***	0.254	***	0.108	**	0.127	***	0.303	***	0.369	***	0.283	***	0.304	***
	3.457		3.817		2.397		3.384		6.442		5.106		3.706		6.592	
L_t	-0.336	***	-0.364	***	-0.297	***	-0.339	***	-0.451	***	-0.388	***	-0.469	***	-0.460	***
	-12.416		-7.976		-7.976		-12.783		-12.458		-7.297		-11.405		-12.925	
NF_t/M_{t-1}	0.006		0.051		-0.034		-0.023		-0.062		0.202		-0.209	**	-0.058	
	0.119		0.671		-0.667		-0.490		-0.781		1.627		-2.056		-0.700	
Observations	5943		2843		3100		5943		3060		1306		1754		3060	
Test the difference in the coefficient on LH_t between groups			**0.009**								**0.024**					
			0.322								**0.753**					

Table 9

The effect of overlap in institutional investor on supplier's and customer's performance (low customer or supplier industry competition group)

This table presents the effect of overlap in institution investor on partners' individual performance in low customer (for suppliers) or supplier (for customers) industry competition group. The low customer (supplier) industry competition group consists of all suppliers (customers) of which the customer (supplier) industry Herfindahl–Hirschman index based on the sales of all COMPUSTAT firms with the same three-digit SIC code is above the upper tertile for each fiscal year. In Panel A, the regression model is Model 1. The dependent variable is the market value of equity plus total liabilities (FMV), and then divided by total assets. High group is where the overlapping institutional ownership is above the upper tertile. Low group is where the overlapping institutional ownership is below the lower tertile. In Panel B, the regression model is Model 2 and the dependent variable is the realized stock return adjusted by the value-weighted return of the Fama-French size-BE/ME portfolio (5*5) to which the firm belongs. The two models are both estimated by median regression. All variables for supplier–customer relationship are weighted by the percentage of sales to each customer (percentage of cost of goods sold from each supplier) for suppliers (customers). Fiscal year and industry fixed effects are controlled for. Increase group is where the change in overlapping institutional ownership is positive. Non-increase group is where the change in overlapping institutional ownership is non-positive. In some subsamples, weighted OVPD is not included because of no variation. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier				Customer			
	High		Low		High		Low	
Panel A : firm value regression								
Intercept	0.585	***	0.757	***	0.679	***	1.249	***
	3.842		2.909		2.826		6.197	
weighted $ADEP_t$	0.472	**	0.254		-0.035		0.258	*
	2.056		1.394		-0.173		1.779	
weighted $MDEP_t$	0.010		2.546	*	2.883	***	2.116	**
	0.009		1.658		3.439		2.551	
weighted $OVPD_t$	0.103				7.611			
	0.349				1.584			
weighted $OVPAN_t$	-0.094	**	-0.166		0.044		-0.124	
	-2.043		-0.352		0.686		-0.058	
weighted $OVPAU_t$	0.053		-0.091		-0.225	***	0.115	
	0.997		-1.115		-3.571		1.421	
$INST_t$	-0.011		0.233		-0.085		0.112	
	-0.050		0.823		-0.225		0.508	
E_t/A_t	2.523	***	-0.660		7.691	***	6.007	***
	4.358		-1.397		6.321		6.680	
dE/A_t	-0.162		0.953	***	-0.607		-1.514	***
	-0.474		3.125		-0.722		-2.949	
dE_{t+2}/A_t	1.107	**	0.426		3.968	***	2.880	***
	2.487		1.509		3.909		4.491	
dA_t/A_t	0.468	***	0.426	***	0.368	*	0.483	***
	3.459		3.886		1.877		2.780	
dA_{t+2}/A_t	0.400	***	0.440	***	0.297		0.192	
	2.782		3.155		1.182		0.975	
RD_t/A_t	11.024	***	5.075	***	2.345		1.723	

	Supplier				Customer			
	High		Low		High		Low	
	15.974		4.715		1.505		1.495	
dRD/A_t	0.176		0.720		-3.623		4.245	
	0.164		0.372		-0.754		1.165	
dRD_{t+2}/A_t	5.804	***	4.003	**	-0.205		8.554	**
	3.817		2.059		-0.063		2.569	
D_t/A_t	14.469	***	9.595	***	8.893	***	11.862	***
	8.728		2.799		3.403		4.620	
dD_t/A_t	-2.439		5.257		1.720		-9.578	*
	-0.726		1.120		0.369		-1.888	
dD_{t+2}/A_t	18.434	***	2.807		19.131	***	8.382	
	4.119		0.743		3.644		1.474	
I_t/A_t	4.585	***	2.848		-5.654	*	-5.027	**
	3.152		1.595		-1.959		-2.454	
dI_t/A_t	-8.002	***	-2.328		-10.575	**	-1.652	
	-3.111		-1.172		-2.091		-0.494	
dI_{t+2}/A_t	0.754		-2.870		-3.135		-4.169	
	0.263		-1.228		-0.500		-1.374	
$dFMV_{t+2}/A_t$	-0.119		-0.100		-0.053		-0.140	*
	-1.326		-1.424		-0.577		-1.863	
Observations	874		579		484		499	
Test the difference in the coefficient on weighted $ADEP_t$ between groups	**0.218** **0.721**				**-0.293** **-1.146**			

Panel B: excess return regression

	Supplier				Customer			
	Increase		Non-increase		Increase		Non-increase	
Intercept	-0.010		-0.108	**	0.068		-0.071	
	-0.141		-2.260		0.849		-0.886	
LH_t	**0.012**		**-0.026**		**0.060**	*	**0.051**	*
	0.399		**-1.047**		**1.926**		**1.848**	
HL_t	-0.005		0.088	***	-0.006		-0.064	**
	-0.146		2.991		-0.193		-2.117	
weighted $OVPD_t$	0.009		0.229		2.610		-2.651	
	0.014		0.506		0.911		-0.166	
weighted $OVPAN_t$	-0.050		0.017		0.029		-0.070	*
	-1.514		0.587		0.692		-1.818	
weighted $OVPAU_t$	-0.005		0.056	*	-0.012		0.061	
	-0.158		1.934		-0.342		1.616	
$\Delta INST_t$	0.450	**	0.271	*	0.459	**	0.145	
	2.182		1.715		2.419		0.549	
$\Delta E_t/M_{t-1}$	0.603	***	0.406	***	0.467	***	0.453	***
	4.905		4.313		2.728		4.262	
$\Delta A_t/M_{t-1}$	0.209	***	0.100	*	0.174	**	0.305	***
	3.221		1.693		2.146		4.105	
$\Delta RD_t/M_{t-1}$	0.943		1.194		-5.468	*	-1.472	
	1.000		1.464		-1.751		-0.709	
$\Delta I_t/M_{t-1}$	-3.386	***	-3.143	***	0.139		-0.707	
	-3.311		-3.110		0.075		-0.606	
$\Delta D_t/M_{t-1}$	1.059		2.572	*	-0.107		-5.363	***
	1.098		1.735		-0.055		-2.659	
C_{t-1}/M_{t-1}	0.050		0.237	**	0.259	**	0.298	**
	0.476		2.298		2.092		2.140	
L_t	-0.318	***	-0.430	***	-0.403	***	-0.384	***

	Supplier		Customer		
	High	Low	High	Low	
	-4.406	-7.303	-4.878	-5.257	
NF_t/M_{t-1}	-0.052	0.169	-0.006	-0.495	***
	-0.459	1.507	-0.031	-3.213	
Observations	1120	973	583	653	
Test the difference in the coefficient on LH_t between groups	**0.038**		**0.009**		
	0.940		**0.211**		

Table 10
The effect of overlap in institutional investor on relationship-specific investments

This table presents the effect of overlap in institutional investor on relationship-specific investments. The sample only consists of durable sector (primary SIC from 3400 to 3990) firms (suppliers and customers). The regression model is Model 3 and estimated by median regression. The dependent variable is R&D intensity, calculated as R&D expenditures deflated by total assets. Missing R&D expenditure is treated as 0. The full sample is equally divided into three subsamples based on the overlapping institutional ownership. High group is where overlapping institutional ownership is above the upper tertile. Low group is where overlapping institutional ownership is below the lower tertile. To control for the repeating data problem, I weighted the relationship-level variables. Specifically, for suppliers, the relationship-level variables are weighted by sales proportion to each customer; for customers, the relationship-level variables are weighted by the percentage of cost of goods sold from each supplier. In the Low group of supplier sample, weighted OVPD is not included because of no variation. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
Intercept	-0.138	***	-0.124	***	-0.129	***	-0.052	***	-0.058	***	-0.022	
	-17.195		-9.478		-6.568		-4.887		-3.039		-1.092	
weighted $ADEP_t$	**0.042**	***	**0.062**	***	**0.022**	***	**-0.003**		**0.020**		**-0.014**	
	6.839		**4.337**		**3.008**		**-0.505**		**1.589**		**-1.432**	
weighted $MDEP_t$	-0.087	**	-0.100		-0.066		0.056		-0.047		0.117	
	-2.097		-1.461		-1.203		1.282		-0.889		1.503	
weighted $OVPD_t$	0.017		0.008				0.064	*	0.003		0.080	
	1.070		0.503				1.810		0.031		1.618	
weighted $OVPAN_t$	-0.001		-0.003		0.000		0.005		0.005		0.012	
	-0.566		-0.885		0.005		1.401		1.239		1.327	
weighted $OVPAU_t$	-0.001		0.006	**	-0.006	*	-0.008	**	-0.001		-0.021	***
	-0.580		2.158		-1.710		-2.430		-0.183		-4.478	
$INST_t$	0.018	**	0.031	***	-0.005		0.012	*	-0.000		0.020	
	2.555		2.755		-0.374		1.671		-0.004		1.477	
$Size_t$	0.011	***	0.008	***	0.015	***	0.002	***	0.002		0.002	
	14.318		6.921		10.930		2.997		1.526		1.639	
$book\text{-}to\text{-}market_t$	0.002		0.003	*	0.002		0.005	**	0.006		0.003	
	1.204		1.675		0.546		2.514		1.428		0.759	
$sales\ growth_t$	-0.002		0.002		-0.013	*	-0.017	***	-0.004		-0.024	**
	-0.607		0.387		-1.781		-2.772		-0.498		-2.171	
$return_t$	-0.002	*	-0.002		0.000		-0.003		0.000		-0.007	*
	-1.727		-0.695		-0.026		-1.457		0.114		-1.865	
$leverage_t$	0.015	***	0.029	***	0.013		0.011		0.010		-0.015	
	2.763		2.978		1.143		1.292		0.664		-0.962	
$ocf\ surplus_t$	0.090	***	0.131	***	0.093	***	0.219	***	0.221	***	0.248	***
	9.599		6.758		5.404		11.160		7.078		6.803	
financing cash $flow_t$	0.026	***	0.020		0.040	**	0.063	***	0.076	***	0.086	***
	3.582		1.417		2.372		4.376		3.176		3.119	
$cash_t$	0.058	***	0.041	***	0.056	***	0.051	***	0.031	*	-0.003	
	10.078		4.255		5.588		4.644		1.659		-0.193	
$CAPX_t$	0.031	*	-0.014		0.032		0.078	***	0.174	***	0.155	***
	1.910		-0.423		0.999		2.644		3.352		2.642	

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
SGA_t	0.387	***	0.352	***	0.394	***	0.154	***	0.208	***	0.105	***
	39.907		17.772		24.577		12.384		8.996		5.726	
industry RD_t	0.488	***	0.539	***	0.622	***	0.297	***	-0.018		0.536	***
	13.151		7.322		8.723		5.398		-0.192		6.222	
Observations	2305		768		768		1249		416		416	
Test the difference in the coefficient on weighted $ADEP_t$ between groups			**0.040** **2.382**	**					**0.034** **2.120**	**		

Table 11
The effect of overlap in institutional investor on relationship-specific investments - controlling for endogeneity

This table presents the effect of overlap in institutional investor on relationship-specific investments using predicted overlapping institutional ownership as the grouping basis. The sample only consists of durable sector (primary SIC from 3400 to 3990) firms (suppliers and customers). The regression model is Model 3 and estimated by median regression. The prediction model for overlapping institutional ownership between the supplier and the customer is Model B in Appendix II. The dependent variable is R&D intensity, calculated as R&D expenditures deflated by total assets. Missing R&D expenditure is treated as 0. The full sample is equally divided into three subsamples based on the predicted overlapping institutional ownership. High group is where the predicted overlapping institutional ownership is above the upper tertile. Low group is where the predicted overlapping institutional ownership is below the lower tertile. To control for the repeating data problem, I weighted the relationship-level variables. Specifically, for suppliers, the relationship-level variables are weighted by sales proportion to each customer; for customers, the relationship-level variables are weighted by the proportion of cost of goods sold from each supplier. In some subsamples, weighted OVPD is not included because of no variation. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
Intercept	-0.129	***	-0.089	***	-0.149	***	-0.061	***	-0.044	*	-0.117	***
	-11.830		-5.632		-5.206		-3.982		-1.925		-4.042	
weighted $ADEP_t$	**0.055**	***	**0.067**	***	**0.029**	*	**0.001**		**0.035**		**0.008**	
	5.381		**4.610**		**1.784**		**0.078**		**1.599**		**0.629**	
weighted $MDEP_t$	-0.242	***	-0.331	***	-0.101		0.116	*	-0.045		0.295	**
	-3.556		-4.402		-0.791		1.752		-0.616		2.379	
weighted $OVPD_t$	0.005		0.010				0.005		-0.016			
	0.195		0.523				0.207		-0.245			
weighted $OVPAN_t$	-0.001		0.001		0.024		0.000		-0.011	**	0.001	
	-0.436		0.308		1.311		0.036		-2.328		0.027	
weighted $OVPAU_t$	0.001		-0.000		0.004		-0.007	*	-0.010	**	-0.002	
	0.239		-0.118		0.785		-1.908		-2.187		-0.215	
$INST_t$	0.017		0.008		-0.013		0.004		-0.013		-0.047	*
	1.356		0.599		-0.365		0.263		-0.489		-1.753	
$size_t$	0.012	***	0.007	***	0.016	***	0.003	***	0.001		0.007	***
	11.065		5.154		6.489		3.365		0.530		3.550	
book-to-$market_t$	-0.001		-0.004		0.002		0.005		0.012	*	0.002	
	-0.291		-0.992		0.521		1.593		1.844		0.329	
sales $growth_t$	-0.002		-0.009	*	-0.001		-0.014	*	-0.012		-0.008	
	-0.368		-1.662		-0.140		-1.856		-0.995		-0.435	
$return_t$	-0.002		-0.002		-0.004		0.000		0.003		-0.001	
	-1.372		-0.664		-1.378		0.093		0.581		-0.168	
$leverage_t$	0.012		0.019	**	0.018		0.030	***	0.029		0.000	
	1.488		2.177		0.947		2.728		1.552		0.018	
ocf $surplus_t$	0.092	***	0.156	***	0.072	***	0.272	***	0.303	***	0.225	***
	6.890		6.606		3.499		10.671		6.848		4.566	
financing cash $flow_t$	0.019	*	0.014		0.017		0.075	***	0.055	*	0.142	***
	1.764		1.059		0.727		3.911		1.779		3.219	
$cash_t$	0.055	***	0.017		0.092	***	0.042	***	0.031		0.056	*
	6.670		1.548		6.315		2.895		1.451		1.719	
$CAPX_t$	0.028		0.019		-0.010		0.110	**	0.164	**	0.292	***
	1.002		0.510		-0.182		2.110		2.036		2.716	
SGA_t	0.384	***	0.349	***	0.386	***	0.117	***	0.145	***	0.164	***

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
	23.799		12.554		15.975		5.684		3.164		4.710	
industry RD_t	0.504	***	0.578	***	0.458	***	0.323	***	0.245	*	0.439	***
	8.529		6.425		4.904		4.302		1.754		3.503	
Observations	1370		457		456		703		234		234	
Test the difference in the coefficient on weighted $ADEP_t$ between groups			**0.038** **1.798**	*					**0.027** **1.057**			

Table 12
The effect of overlap in institutional investor on relationship-specific investments (high supplier or customer concentration group)

This table presents the effect of overlap in institutional investor on relationship-specific investments in the high customer concentration group (for suppliers) and high supplier concentration group (for customers). High customer (supplier) concentration group consists of all the suppliers (customers) of which the customer (supplier) concentration is above the sample median (upper quartile)[40]. The sample only consists of durable sector (primary SIC from 3400 to 3990) firms (suppliers and customers). The regression model is Model 3 and estimated by median regression. The dependent variable is R&D intensity, calculated as R&D expenditures deflated by total assets. Missing R&D expenditure is treated as 0. The full sample is equally divided into three subsamples based on overlapping institutional ownership. High group is where overlapping institutional ownership is above the upper tertile. Low group is where overlapping institutional ownership is below the lower tertile. To control for the repeating data problem, I weighted the relationship-level variables. Specifically, for suppliers, the relationship-level variables are weighted by sales proportion to the customer; for customers, the relationship-level variables are weighted by the proportion of cost of goods sold from the supplier. In the Low group of supplier sample, weighted OVPD is not included because of no variation. See the Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
Intercept	-0.125	***	-0.134	***	-0.161	***	-0.069	***	-0.033		-0.172	***
	-12.180		-7.067		-7.365		-3.198		-0.809		-2.721	
weighted ADEP$_t$	0.033	***	0.044	***	0.013		**0.027**		**0.046**		**-0.064**	
	4.625		2.930		1.215		**1.478**		**1.394**		**-1.191**	
weighted MDEP$_t$	-0.107	**	-0.043		-0.214	**	-0.149	***	-0.172	**	-0.040	
	-2.184		-0.490		-2.461		-3.761		-2.141		-0.400	
weighted OVPD$_t$	0.015		0.022				0.056		-0.031		0.072	
	0.122		0.153				0.531		-0.085		0.435	
weighted OVPAN$_t$	0.000		-0.006		-0.014		0.007		-0.004		-0.040	
	0.050		-1.239		-0.648		1.072		-0.362		-1.363	
weighted OVPAU$_t$	-0.003		0.008		-0.011	**	-0.019	***	-0.017		-0.003	
	-0.875		1.550		-2.059		-2.859		-1.590		-0.137	
INST$_t$	0.019	*	0.041	**	-0.017		-0.050	***	-0.051		-0.020	
	1.678		2.362		-0.845		-2.941		-1.518		-0.550	
size$_t$	0.010	***	0.009	***	0.016	***	0.002	*	-0.001		0.017	***
	9.399		4.482		8.144		1.770		-0.296		2.828	
book-to-market$_t$	-0.003		0.000		0.004		0.006		0.013		0.016	
	-1.383		-0.009		0.826		1.199		1.354		0.689	
sales growth$_t$	-0.001		0.009		-0.022	**	-0.003		-0.001		-0.007	
	-0.235		1.283		-2.313		-0.333		-0.077		-0.213	
return$_t$	-0.005	***	-0.006	*	-0.003		-0.012	**	-0.005		-0.032	**
	-2.767		-1.676		-1.095		-2.186		-0.671		-2.068	
leverage$_t$	0.016	**	0.044	***	0.025		0.029		0.020		-0.060	
	2.071		2.852		1.462		1.537		0.458		-0.740	
ocf surplus$_t$	0.088	***	0.161	***	0.103	***	0.172	***	0.262	***	0.163	*
	7.111		5.256		4.848		5.101		4.959		1.862	

[40] I use different criteria to define high supplier concentration group and high customer concentration group because customer concentration (mean: 0.0772; median: 0.0289) is much greater than supplier concentration (mean: 0.0027; median: 0.0001; upper quartile: 0.0016) in my sample.

	Supplier						Customer					
	Full Sample		High		Low		Full Sample		High		Low	
financing cash flow$_t$	0.020	*	-0.012		0.026		0.072	***	0.051		0.078	
	1.833		-0.638		1.091		2.604		1.035		0.871	
cash$_t$	0.061	***	0.052	***	0.079	***	0.073	***	0.069	**	0.101	
	7.156		3.338		5.236		4.140		2.067		1.549	
CAPX$_t$	0.039		-0.035		0.078	*	0.120	**	0.080		0.026	
	1.466		-0.621		1.718		2.265		0.887		0.095	
SGA$_t$	0.375	***	0.370	***	0.351	***	0.276	***	0.224	***	0.222	***
	25.624		12.743		14.421		11.832		5.926		3.328	
industry RD$_t$	0.541	***	0.473	***	0.836	***	0.434	***	0.274		1.099	**
	9.104		3.977		7.449		3.765		1.452		2.380	
Observations	1153		348		404		312		147		81	
Test the difference in the coefficient on weighted ADEP between groups			**0.031** **1.663**	*					**0.109** **1.905**	*		

Table 13

The effect of overlap in institutional ownership on relationship duration

This table presents the effect of overlap in institutional ownership on supplier–customer relationship duration. The sample consists of all supplier–customer relationships identified. A Cox proportional hazard model is used here. The regression model is Model 4. The dependent variable is the length of the observed supplier–customer relationship. If a relationship ends because one of the partners becomes inactive in COMPUSTAT or if the relationship lasts up to the end of the sample period (2011), I treat the relationship right censored. Values below the coefficients are hazard ratios. All the independent variables are measured based on the first fiscal year when I observe the relationship. See the Appendix I for details on how to define the variables. 'High' group consists of observations where overlapping institutional ownership is above its upper tertile. 'Low' group consists of observations where overlapping institutional ownership is below its lower tertile. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Full sample		High		Low	
abs(ADEP)	**-0.924**	***	**-1.072**	***	**-0.967**	***
	0.397		**0.342**		**0.380**	
MDEP	-0.059		-1.105		0.494	
	0.943		0.331		1.639	
OVPD	0.191		0.160		0.080	
	1.211		1.173		1.083	
OVPAN	-0.199	***	-0.021		-0.462	*
	0.820		0.979		0.630	
OVPAU	0.028		0.045		0.007	
	1.029		1.046		1.007	
Same city	0.004		-0.114		-0.104	
	1.004		0.892		0.901	
Customer RD/sales	0.725	***	0.824	**	0.667	**
	2.064		2.279		1.949	
RD/sales	0.030	*	0.065	*	0.022	
	1.030		1.068		1.023	
Max(customer age, supplier age)	0.001		0.001		0.004	**
	1.001		1.001		1.004	
size	-0.098	***	-0.133	***	-0.043	**
	0.906		0.876		0.957	
customer size	-0.037	***	-0.056	**	-0.036	**
	0.964		0.946		0.964	
min(customer free cash flow, supplier free cash flow)	-0.246	***	-0.002		-0.388	***
	0.782		0.998		0.678	
Same industry	0.073	**	0.171	**	-0.036	
	1.075		1.187		0.965	
Year	-0.002		-0.008		0.001	
	0.998		0.992		1.001	
Likelihood Ratio	349.429		126.862		99.005	
Events	3747		1081		1402	
Observations	4837		1612		1612	

Table 14
The effect of overlap in institutional ownership on relationship duration - controlling for endogeneity

This table presents the effect of overlap in institutional ownership on supplier–customer relationship duration, controlling for endogeneity issue. Specifically, I use the predicted overlapping institutional ownership rather than the actual one. The prediction model for overlapping institutional ownership between the supplier and the customer is Model B in Appendix II. A Cox proportional hazard model is used here. The regression model is Model 4. The dependent variable is the length of the observed supplier–customer relationship. If a relationship ends because one of the partners becomes inactive in COMPUSTAT or if the relationship lasts up to the end of the sample period (2011), I treat the relationship right censored. Values below the coefficients are hazard ratios. All the independent variables are measured based on the first fiscal year when I observe the relationship. See the Appendix I for details on how to define the variables. 'High' group consists of observations where the predicted overlapping institutional ownership is above its upper tertile. 'Low' group consists of observations where the predicted overlapping institutional ownership is below its lower tertile. In the Low group, OVPD is omitted because of no variation. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Full sample		High		Low	
abs(ADEP)	**-1.320**	***	**-1.922**	***	**-1.264**	***
	0.267		**0.146**		**0.283**	
MDEP	-2.600	**	-4.910	**	-0.350	
	0.074		0.007		0.705	
OVPD	0.144		-0.071			
	1.154		0.931			
OVPAN	-0.089		-0.012		-0.045	
	0.915		0.988		0.956	
OVPAU	-0.015		-0.108		0.115	
	0.985		0.898		1.122	
Same city	0.066		0.041		0.091	
	1.068		1.041		1.095	
Customer RD/sales	1.142	***	1.208	*	1.117	*
	3.135		3.348		3.057	
RD/sales	0.022		0.014		0.026	
	1.023		1.014		1.027	
Max(customer age, supplier age)	0.001		-0.002		0.001	
	1.001		0.998		1.001	
size	-0.067	***	-0.047		-0.047	
	0.935		0.954		0.954	
customer size	-0.031		0.007		-0.014	
	0.969		1.007		0.986	
min(customer free cash flow, supplier free cash flow)	-0.280	***	0.087		-0.416	***
	0.756		1.091		0.660	
Same industry	0.166	***	0.212	*	0.049	
	1.181		1.236		1.050	
Year	-0.003		0.034		-0.011	
	0.997		1.035		0.990	
Likelihood Ratio	113.261		37.332		35.833	
Events	1374		372		532	
Observations	1949		650		649	

Table 15
The effect of overlap in institutional ownership on relationship duration (low industry competition group)

This table presents the effect of overlap in institutional ownership on supplier–customer relationship duration in low industry competition group. The low industry competition group consists of all supplier–customer relationships of which the minimum between supplier industry Herfindahl–Hirschman index and customer industry Herfindahl–Hirschman index based on the sales of all COMPUSTAT firms with the same three-digit SIC code is above its upper quartile for each fiscal year. A Cox proportional hazard model is used here. The regression model is Model 4. The dependent variable is the length of the observed supplier–customer relationship. If a relationship ends because one of the partners becomes inactive in COMPUSTAT or if the relationship lasts up to the end of the sample period (2011), I treat the relationship right censored. Values below the coefficients are hazard ratios. All the independent variables are measured based on the first fiscal year when I observe the relationship. See the Appendix I for details on how to define the variables. 'High' group consists of observations where overlapping institutional ownership is above its upper tertile. 'Low' group consists of observations where overlapping institutional ownership is below its lower tertile. In the Low group, OVPD is omitted because of no variation. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Full sample		High		Low	
abs(ADEP)	**-1.348**	***	**-1.640**	*	**-1.564**	***
	0.260		**0.194**		**0.209**	
MDEP	-1.066		-2.637		-0.381	
	0.344		0.072		0.683	
OVPD	-11.042		-12.539			
	0.000		0.000			
OVPAN	-0.210		-0.226		-0.725	
	0.810		0.798		0.484	
OVPAU	0.137		0.228		-0.135	
	1.146		1.256		0.874	
Same city	0.350		0.785	*	0.301	
	1.419		2.192		1.352	
Customer RD/sales	1.562	**	1.812		0.609	
	4.769		6.122		1.838	
RD/sales	-0.039		0.441		-0.050	
	0.962		1.554		0.951	
Max(customer age, supplier age)	0.005	*	0.005		0.008	*
	1.005		1.005		1.008	
size	-0.134	***	-0.177	***	-0.101	**
	0.875		0.838		0.904	
customer size	-0.118	***	-0.144	**	-0.092	**
	0.889		0.865		0.912	
min(customer free cash flow, supplier free cash flow)	-0.463	***	-1.351		-0.397	*
	0.629		0.259		0.672	
Same industry	0.026		0.190		-0.051	
	1.027		1.209		0.951	
Year	0.012	*	0.016		0.010	
	1.012		1.016		1.010	
Likelihood Ratio	158.834	***	58.998	***	42.156	***
Events	888		218		379	
Observations	1214		390		432	

Table 16

The effect of overlap in institutional ownership on trade credits

This table presents the effect of overlap in institutional ownership on trade credits. The regression model is Model 5 and estimated by median regression. The dependent variable is the logarithm of receivables from trades divided by sales of the supplier. Fiscal year and industry fixed effects are controlled for. In Relatively High (Low) Financial Constraint group, supplier SA index is greater (smaller) than the weighted customer SA index at the beginning of the fiscal year. The marginal effect of weighted OVPINST is calculated at the median value of weighted ADEP in the corresponding sample. See Appendix I for details on how to define the variables. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Full sample		Relatively High Financial Constraint		Relatively Low Financial Constraint	
Intercept	-1.140	***	-1.204	***	-0.927	***
	-19.257		-17.161		-7.010	
weighted OVPINST	-0.006	*	-0.006		-0.009	
	-1.685		-1.474		-1.390	
weighted ADEP	-0.187	**	-0.198	**	0.003	
	-2.399		-2.456		0.013	
weighted ADEP * weighted OVPINST	0.004		-0.007		0.032	
	0.244		-0.368		0.874	
weighted MDEP	-1.802	***	-2.529	***	-1.096	***
	-8.443		-8.764		-3.587	
weighted OVPD	0.149	**	0.131	**	0.460	
	2.508		2.162		0.103	
weighted OVPAN	0.012		0.025		-0.010	
	0.809		1.350		-0.379	
weighted OVPAU	0.026	**	0.010		0.053	**
	2.125		0.736		2.195	
$INST_t$	0.091	*	0.015		0.198	*
	1.870		0.285		1.806	
$\log(\text{total assets/sales})_t$	0.121	***	0.135	***	0.045	
	9.437		9.657		1.465	
$\log(\text{sales})_t$	0.004		0.010	**	-0.017	**
	1.244		2.315		-2.272	
$\log(\text{inventories/sales})_{t-1}$	0.060	***	0.058	***	0.034	*
	9.628		8.926		1.702	
LDM_{t-1}	-0.139	***	-0.150	***	-0.234	***
	-5.032		-4.574		-3.813	
$\log(\text{marginal cost/sales})_{t-1}$	0.033	***	0.037	***	0.048	*
	2.822		2.826		1.689	
$(\text{cash flow/total assets})_{t-1}$	-0.100	**	-0.062		-0.627	***
	-2.061		-1.239		-3.297	
industry $\log(ar/s)_t$	0.328	***	0.296	***	0.405	***
	13.263		10.302		8.765	
Observations	7600		6092		1508	
Marginal effect of weighted OVPINST	**-0.005**	**	**-0.007**	***	**-0.005**	
	-2.448		**-2.761**		**-1.444**	

Appendix II

A. Determinants of customer disclosure

From Ellis et al. (2012), managers choose to disclose the information of their customers with a tradeoff between the benefits of reducing information asymmetry and the costs of leaking proprietary information. To control for this self-selection issue, I run a PROBIT model to estimate the probability for the managers to disclose customers' information using all COMPUSTAT observations exclusive of financial and utility firm-years from 1980 to 2011 and get inverse Mills ratios (Heckman, 1979). The determinants are all those found by Ellis et al. (2012). The model is:

$$\begin{aligned}\text{customer\_disclosure} &= \mathrm{F}(\epsilon_0 + \epsilon_1 \text{R\&D to sales} + \epsilon_2 \text{Net intangibles to assets} \\ &+ \epsilon_3 \text{Advertising to sales} + \epsilon_4 \text{SEO within next year} \\ &+ \epsilon_5 \text{Ln(Assets)} + \epsilon_6 \text{BigN auditor} \\ &+ \epsilon_7 \text{Supplier industry nondisclosure rate} + \varepsilon) \qquad \text{(A)}\end{aligned}$$

customer_disclsoure equals 1 if the firm discloses major customers information and 0 otherwise. F refers to the standard normal distribution function. R&D to sales is R&D expenditure over sales. I treat the missing R&D expenditure as 0. Net intangibles to assets is calculated as (total intangible assets - goodwill) / total assets. Advertising to sales is advertising expense over sales and the missing advertising expense is set to be 0. SEO within next year is 1 if common shares issued change from t-1 to t and 0 otherwise. Ln(Assets) is the logarithm of total assets. BigN auditor is 1 if the audit firm is BIG 4 and 0 otherwise. Supplier industry nondisclosure rate is the proportion of firms within the same four-digit SIC code who don't disclose customer information.

Table AI
The determinants of customer information disclosure

This table presents the determinants of customer information disclosure. The regression model is Model A. The event is 1 if the firm discloses identifiable customer information and 0 otherwise. The values below coefficients are chi-square statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	0.974	***
	857.486	
R&D to sales	-0.040	***
	52.026	
Net intangibles to assets	0.114	*
	3.286	
Advertising to sales	-0.410	**
	4.615	
SEO within next year	0.087	***
	24.558	
Ln(Assets)	-0.068	***
	461.037	
BigN auditor	0.119	***
	34.020	
Supplier industry nondisclosure rate	-1.883	***
	4066.741	
Events	15713	
Observations	52667	
Log Likelihood	-29635.920	

B. Determinants of overlapping institutional ownership

Prior research such as Chung and Zhang (2011), Huang (2010) and Bushee and Noe (2000) shows the endogeniety of institutional ownership. Also, for suppliers and customers without overlapping institutional investors, the explanatory variable of interest regarding the ownerships overlapping institutional investors hold in the two partners is 0. To solve for the endogenity problem of institutional ownership and the problem coming from censored data, I use the Tobit model to estimate the predicted minimum value of the two ownerships the overlapping institutional investors hold in the supplier and the customer. The regression model is:

$$\begin{aligned}\text{OVPINST} = {} & \theta_0 + \theta_1\text{OVPAN} + \theta_2\text{OVPD} + \theta_3\ \text{OVPAU} + \theta_4\text{MDEP} + \theta_5\text{ADEP} \\ & + \theta_6\text{Same industry} + \theta_7\text{Same city} + \theta_8\text{size} + \theta_9\text{customer size} \\ & + \theta_{10}\ \text{hhi} + \theta_{11}\text{customer hhi} + \theta_{12}\text{sectorovpinst} \\ & + \theta_{13}\text{customer sectorovpinst} + \theta_{14}\text{leverage}_{t-1} \\ & + \theta_{15}\text{customer leverage}_{t-1} + \theta_{16}\text{ROA}_{t-1} + \theta_{17}\text{customer ROA}_{t-1} \\ & + \theta_{18}\text{tangibility} + \theta_{19}\text{customer tangibility} + \theta_{20}\text{turnover} \\ & + \theta_{21}\text{customer turnover} + \theta_{22}\ \log(\text{price}) \\ & + \theta_{23}\ \text{customer log(price)} + \theta_{24}\text{tobinq} + \theta_{25}\text{customer tobinq} \\ & + \theta_{26}\text{age} + \theta_{27}\text{customer age} + \theta_{28}\text{return} + \theta_{29}\text{customer return} \\ & + \theta_{30}\text{volatility} + \theta_{31}\text{customer volatility} + \theta_{32}\text{baspread} \\ & + \theta_{33}\text{customer baspread} + \theta_{34}\text{IMR} + \sum_j \theta_{4j}\text{fe}_j + \vartheta \quad \text{(B)}\end{aligned}$$

OVPINST refers to the minimum value of the two ownerships the overlapping institutional investors hold in the supplier and the customer. Subscript t is omitted for simplicity. I include the characteristics of both partners. From Brennan and Hughes (1991), analysts can be treated as information intermediaries, affecting investors' holdings. Hence, an overlap in analyst (OVPAN) may induce the overlap in institutional investors. From Reppenhagen (2010), an overlapping director (OVPD), an overlapping auditor (OVPAU) and small geographical distance (Same city) facilitate the communication between two firms. Hence, firms with an overlapping director or with an overlapping auditor or geographically close to each other may be more likely to be covered by the same institutional investor. Since prior research such as Gupta and Sapienza (1992) shows institutional investors' preferences towards industry diversification, I include an indicator—whether the two firms are in the same industry (Same

industry)—to grasp the effect. The proportion of overlapping institutional investors in an industry (sectorovpinst) is included to detect the herding behavior of investors (e.g., Sias, 2004). I include mutual dependence (MDEP) and interdependence asymmetry (ADEP) between the customer and the supplier and competition level of the industries (hhi) to examine whether the existence of overlapping institutional investors is a result of supplier's or customer's demand for monitoring the supplier–customer relationship. According to Casciaro and Piskorski (2005), the supplier (customer) which is highly dependent on the customer (supplier) is more likely to explore certain mechanism to be safeguarded, but the other partner has both the incentive and power to inhibit such a behavior and both the supplier and the customer have the incentive to explore the safeguarding mechanism if their mutual dependence is high. Based on literature on supply chain management, intense competition (Li, 2002) in the product market is an important reason for a supplier and a customer to keep a friendly relationship with each other because in this situation, the benefit of the relationship is more likely to exceed the cost. Chung and Zhang (2011) show that institutional investors prefer firms with large size (size), high leverage (leverage), low ROA (ROA), high tangibility ratio (tangibility), high stock turnover (turnover), high prior stock price (log(price)), low Tobin's Q (tobinq), long history of listing (age), high stock return (return), low stock volatility (volatility) and low bid-ask spread (baspread). So, I include those factors to predict the ownership of overlapping institutional investors. Inverse Mills ratio estimated in Model A is included to control for self-selection bias from customer disclosure.

Table AII
Prediction for the minimum value of overlapping institutional investors' ownership in the supplier and that in the customer

This table presents the prediction for the minimum value of overlapping institutional investors' ownership in the supplier and that in the customer. The regression model is Model B. The dependent variable is the minimum value of overlapping institutional investors' ownership in the suppler and that in the customer (OVPINST). See the Appendix I for details on how to define the variables. The values below coefficients are t statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	-0.138	***
	-23.559	
OVPAN	0.029	***
	23.209	
OVPD	0.012	
	1.608	
OVPAU	0.001	
	0.789	
MDEP	-0.125	***
	-6.810	
abs(ADEP)	0.002	
	0.730	
Same industry	-0.007	***
	-6.735	
Same city	-0.010	***
	-3.357	
size	0.005	***
	10.106	
customer size	-0.002	***
	-4.604	
hhi	-0.112	**
	-2.053	
customer hhi	0.035	
	0.667	
sectorovpinst	0.082	***
	11.508	
customer sectorovpinst	0.044	***
	6.075	
$leverage_{t-1}$	0.004	*
	1.651	
customer $leverage_{t-1}$	0.001	
	0.155	
ROA_{t-1}	0.003	
	1.358	
customer ROA_{t-1}	-0.007	
	-0.969	
tangibility	0.013	
	1.365	
customer tangibility	-0.106	***
	-7.529	
turnover	0.046	***
	13.683	
customer turnover	0.064	***
	14.257	
log(price)	0.013	***
	15.884	
customer log(price)	0.006	***
	6.443	
tobinq	0.001	*
	1.953	

customer tobinq	0.000	
	0.563	
age	0.000	***
	5.746	
customer age	0.000	***
	4.376	
return	-0.001	
	-1.340	
customer return	0.004	***
	3.609	
volatility	-0.001	***
	-9.243	
customer volatility	-0.000	**
	-2.051	
baspread	0.006	
	1.281	
customer baspread	0.014	***
	4.346	
IMR	-0.000	
	-0.228	
observations	9492	
-2 log likelihood ratio	4798	***

Chapter 2: The Informational Role of Overlapping Institutional Shareholders along a Supplier–Customer Relationship: Evidence from the Bond Market

2.1 Introduction

This paper examines the informational role of overlapping institutional shareholders along a supplier–customer relationship in the bond market. Specifically, I examine whether the institutional bondholder of the supplier, who is also a shareholder of both the supplier and the customer (i.e., overlapping institutional shareholder along the supplier–customer relationship), trades in the bond market based on the customer information, and thus improves the informativeness of the supplier bond price. Supplier–customer relationship is an unique setting to examine the informational role of overlapping institutional investors in that customer information is essential for the supplier (e.g., Banerjee et al., 2008; Hertzel et al., 2008; Kutsuna et al., 2012; Kolay et al., 2013), and that investors tend to underreact to the information although it is publically available (Cohen and Frazzini, 2008). Cohen and Frazzini (2008) show that customer stock return predicts supplier stock return (i.e., customer momentum) and that common mutual fund ownership between the supplier and the customer as a proxy for investor attention significantly alleviates such prediction. This study extends Cohen and Frazzini (2008) to the bond market and examines the informational role of overlapping institutional shareholders on the informativeness of bond price.

Bond market differs from stock market in terms of investor clientele and information environment (Gebhardt et al., 2005). Institutional investors dominate

in the bond market. Given the sophistication of institutional investors in gathering and processing information, bond market is expected to be at least as efficient as stock market. However, bond market is less liquid than stock market and information intermediators such as analysts are fewer in bond market than in stock market, which makes bond market less efficient than stock market. In fact, prior researchers find contradicting results regarding the efficiency of bond market compared with that of stock market. Hotchkiss and Ronen (2002) find that bond market is as efficient as stock market. However, Gebhardt et al. (2005) show that stock return predicts bond return, suggesting that bond market is less efficient than stock market. Ronen and Zhou (2013) find that when institutional trade dominates, the prediction of stock return to bond return disappears and bond market provides liquidity when equity liquidity is low. Therefore, whether the customer momentum phenomenon in the stock market exists in the bond market is an empirical question.

In this study, I focus on transient institutional investors rather than dedicated or quasi-indexing institutional investors to examine the informational role of institutional investors in the bond market. Prior research on institutional investors generally agrees that transient institutional investors provide information through frequent trading. However, dedicated institutional investors maximize their long-term value through monitoring the managers, while quasi-indexing institutional investors tend to have both limited informational role because of long-term investment horizon and limited monitoring role because of passive investment strategy (Bushee, 2001).[41]

[41] Bushee (2001) classifies institutional investors based on their prior investment patterns in the areas of portfolio turnover and diversification. Transient institutional investors have high turnover and hold high

I hypothesize that overlapping transient institutional investors along a supplier–customer relationship trading in the bond market improve the efficiency of supplier bond price to reflect customer information. To test it, I assemble a sample of 8,629 supplier–customer relationships for the period 2001–2011 and merge it with bond return data for both suppliers and customers, which leave a final sample of 371 supplier–customer relationships (10,606 relationship-level observations) with available monthly bond return data.

My results show that customer bond return predicts one-month-ahead supplier bond return, suggesting that, on average, bondholders underreact to the information of economically linked firms. This finding is consistent with the customer momentum phenomenon in the stock market found in Cohen and Frazzini (2008). More importantly, I find that overlapping institutional ownership of transient institutional investors who trade the bonds of suppliers significantly alleviates such prediction, consistent with my hypothesis. Gebhardt et al. (2005) and Jostova et al. (2013) show that stock and bond markets are interacted. I find the informational role of overlapping transient institutional investors even after controlling for the current and lagged stock returns of the supplier and lagged customer stock return and its interaction with overlapping ownership of transient institutional investors who trade the bonds of the supplier.

I conduct nine additional analyses to validate or extend my main results. First and foremost, to preclude the alternative explanation regarding the monitoring role of overlapping transient institutional investors (Aghion et al., 2013), I examine whether overlapping transient institutional ownership significantly

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diversified portfolio. Dedicated institutional investors have low turnover and large average investments in portfolio firms. Quasi-indexing institutional investors have low turnover but hold high diversified portfolio.

alleviates the prediction of customer bond return to supplier bond return when the institutional investors do not trade suppliers' bonds. The result shows that under such condition, the interaction effect of overlapping transient institutional ownership is insignificant, confirming my interpretation based on the informational role of overlapping transient institutional investors. This result precludes some other alternative explanations based on the endogeneity of overlapping transient institutional ownership. Second, I examine whether the results are more pronounced for firms in the high customer concentration and low customer industry competition group where the identified customers are more important to the supplier (e.g., Pfeffer and Salancik, 1978). The result shows that the interaction effect of overlapping transient institutional ownership is present only in the group where customer concentration is high and customer industry competition is low. Third, I examine whether the results are more pronounced in the non-investment grade firms where information is more opaque (e.g., Mansi et al., 2004). The result shows that the interaction effect is significant only for the non-investment grade firms. Fourth, I exclude firms which never had overlapping transient institutional shareholders trading the firms' bonds and conduct a within treatment group test. The main result still holds. Fifth, I test based on the largest customer to which the percentage of sales is greatest for each firm and find the results consistent with those of the main analysis. Sixth, to further alleviate the endogeneity issue, I employ a Tobit model to predict the overlapping institutional ownership of transient institutional investors who trade the bonds of suppliers, and then utilize the predicted value as an instrumental variable of the actual value to estimate the model using two-stage least squares (2SLS) method. Results are consistent with those of the main analysis. Seventh, I use the portfolio approach to

detect the customer momentum in the bond market and the role of overlapping transient institutional investors who are bondholders of the supplier. The results are generally consistent with those of regression analysis. Eighth, I examine why overlapping institutional investors improve the firm's bond price informativeness. Specifically, I investigate whether overlapping transient institutional ownership is only a proxy for investor attention. I find that overlapping transient institutional ownership has an incremental effect to overlapping bondholders in disseminating customer information, suggesting that it is more than a proxy for investor attention. Finally, to further explore whether the bondholders, who are also overlapping transient institutional investors along a supplier–customer relationship, trade based on the customer information, I examine the relationship between current customer bond return and their trading volume. I find that their trading volume is significantly associated with current customer bond return, suggesting that these institutional bondholders indeed trade based on the information of the economically linked firms.

Furthermore, I examine the real effect of customer bond return on bondholders by examining whether customer bond return predicts suppliers' future operating performance (EBIT/total assets), which is a significant predictor of credit risk (Shumway, 2001). After controlling for customer stock return, I find that customer bond return significantly predicts supplier future operating performance, suggesting the importance of customer bond return to bondholders.

This study contributes to the literature in several ways. First, it is the first study to show the existence of customer momentum in the bond market. Second, research on investor overlap is emerging and prior research (e.g., Goranova et al., 2010) emphasizes the importance of examining ownership overlap rather than the

ownership structure at a focal firm. This study provides another evidence on the economic consequence of investor overlap by showing that investor overlap between economically linked firms improves the efficiency of bond price of one firm to convey the information of its linked firms. Third, it provides new evidence on the informational role of transient institutional investors in the bond market and in the post-regulation FD period (my sample period covers the post-regulation FD period) although some researchers document that after Regulation FD, the information advantage of transient institutional investors disappears (e.g., Ke et al., 2008). Fourth, Wang and Zhang (2009) document that bondholders benefit from transient institutional shareholders in reducing information asymmetry between insiders and public investors. My research focuses on a unique setting—supplier–customer relationship—to test whether transient institutional shareholders facilitate the customer information dissemination to the supplier bond price through trading. Such an informational role of transient institutional shareholders does not exist if they do not trade in the bond market. Practically, investors can predict the performance of the bonds based on the information of the issuer's major customers if there are no overlapping transient institutional investors who trade the issuer's bonds between the issuer and its customers. Credit rating agencies may rely on the customer bond performance to predict the supplier's credit risk.

The remainder of this paper proceeds as follows. Section 2.2 presents a literature review and hypothesis development. Section 2.3 describes the data. Section 2.4 defines the variables and explains the methodology for the empirical tests. Section 2.5 presents the results. Section 2.6 examines the real effect of customer information on bondholders and Section 2.7 concludes.

2.2 Literature review and hypothesis development

2.2.1 Literature review

2.2.1.1 Informational role of transient institutional investors

Transient institutional investors are characterized by high turnover and diversification of portfolio holdings (Bushee, 2001). Prior research generally documents that transient institutional investors play a significant role in transferring information via trading although they have a weak monitoring role. Collins et al. (2003) provide evidence that for transient institutional investors, change in ownership is negatively related to accruals, consistent with the explanation that transient institutional investors trade based on information advantage. Ke and Petroni (2004) find that transient institutional investors can predict a break of consecutive earnings increases at least one quarter in advance. Ke and Ramalingegowda (2005) find that transient institutional investors exploit post-earnings announcement drift and thus improve the efficiency of stock price to reveal current earnings. Lev and Nissim (2006) find that transient institutional investors exploit accruals anomaly though the magnitude of their accruals-related trading is small. Boehmer and Kelley (2009) show that institutional shareholdings are positively associated with the informational efficiency of prices and that institutional trading activity is one mechanism through which prices become more efficient. Since transient institutional investors tend to trade more frequently than the dedicated or quasi-indexing institutional investors, it could be predictable that transient institutional investors play a certain role in improving the efficiency of stock prices. Yan and Zhang (2009) demonstrate that short-term institutions can forecast future stock returns, while long-term institutions cannot, suggesting that the positive effect of institutional ownership on future returns documented in

Gompers and Metrick (2001) is driven by short-term institutions. This study extends those prior studies that examine the effect of transient institutional investor at a focal firm to the informational role of transient institutional investor overlap between a focal firm and its economically linked firm.

Some researchers document that after Regulation FD, the informational role of transient institutional investors disappears. For example, Ke et al. (2008) find that though transient institutional investors short sell stocks in the quarter immediately preceding a bad news break in the pre-Regulation FD period, they do not do so in the post-Regulation FD period. Li et al. (2011) find a similar result around accounting restatements. By contrast, Bushee and Goodman (2007) find that the positive association between the indicator for high ownership held by the institution (high percentage of the institution's equity portfolio) and future stock performance still exists in the post-Regulation FD period regardless of the institution's type. Since my sample period falls in the post-Regulation FD period, my results in the bond market will shed light on the effect of Regulation FD on the information advantage of transient institutional investors.

Compared with the research on transient institutional investors in the stock market, related research in the bond market is much limited. Wang and Zhang (2009) find that credit spreads are negatively (positively) associated with transient (dedicated) institutional ownership, consistent with their prediction that transient (dedicated) institutional investors decrease (increase) information asymmetry of the firm. Different from that paper, I examine the informational role of overlapping transient institutional investors between a firm and its economically linked firm (customers) in disseminating information of the economically linked firm.

2.2.1.2 Efficiency of corporate bond market

Results regarding the efficiency of corporate bond market are not without controversy. Kwan (1996) finds that although stock returns are negatively associated with contemporaneous bond yield changes and predict bond yield changes, bond yield changes do not predict stock returns, suggesting that stock price lead bond price in reflecting information. Hotchkiss and Ronen (2002) show that stock returns do not predict bond returns using 20 high-yield bonds traded on fixed income pricing system (FIPS), suggesting that bond market is at least as efficient as stock market. Downing et al. (2009) find that for non-convertible junk and BBB-rated bonds, hourly stock returns lead bond returns using a comprehensive sample, showing that even after the introduction of TRACE (Transaction Reporting And Compliance Engine), bond market is less efficient than stock market. Ronen and Zhou (2013) reconcile the conflicting results regarding the relative efficiency of bond market to stock market and demonstrate that when institutional trade in the bond market dominates, the prediction of stock returns to bond returns disappears. They further find that bond market disseminates information when the liquidity of stock market is low. Hence, bond market is not always less efficient than stock market. Zhou (2009) finds that current bond returns predict future stock returns in the high-yield bond market, suggesting that both bond market and stock market play an important role in disseminating new information.

Although bond market is dominated by institutional investors (Bessembinder and Maxwell, 2008), researchers find that information tends to be underreacted or overreacted in the bond market just as it does in the stock market. Katz (1974) shows that it takes nearly 6-10 week lag for bond price to fully adjust to bond

rating changes. However, Weinstein (1977) finds that bond price efficiently adjusts to bond rating changes. Rather than focusing on a specific event, Gebhardt et al. (2005) draw a general conclusion that bond price exhibits reversals rather than momentum in the investment grade bond market. Using more comprehensive data, Jostova et al. (2013) find a momentum phenomenon for non-investment grade bonds.

Although my study is related to the efficiency of bond market, I focus on whether bond price of a focal firm reflects the public information of economically linked firms rather than the information of the focal firm.

2.2.1.3 Informational role of overlapping institutional investors

My research is also related to the recent work on the informational role of overlapping institutional investors. In a paper closely related to mine, Cohen and Frazzini (2008) find that the proportion of overlapping mutual funds who hold the stakes of both suppliers and customers to the total number of mutual funds as a proxy for investor attention alleviates the prediction of customer returns to supplier returns, consistent with the explanation that investors can overcome limited attention to a focal firm's economically linked firm if they hold the stocks of both firms. My research extends their research to the bond market with a different research focus. They focus on whether stock prices underreact to news of related firms because of limited investor attention, and the proportion of overlapping institutional investors is a proxy for investor attention. In this paper, I focus on whether overlapping institutional shareholders improve the efficiency of bond prices to reflect news of related firms. Overlapping institutional shareholders, on one hand, pay attention to both firms and, on the other hand, have high information-efficiency parameter as defined in Peng and Xiong (2006) because

they use advanced technology to process information and may have private information regarding the two firms via communicating with the managers or attending conference calls (Ke and Petroni, 2004).[42] I conjecture that overlapping institutional investors play a more important informational role than overlapping non-institutional investors examining the role of which is sufficient to detect the limited investor attention hypothesis in Cohen and Frazzini (2008), which means that overlapping institutional ownership is more than a proxy for investor attention.

2.2.2 Hypothesis development

Customer information is essential for bondholders of the supplier. Kolay et al. (2013) find that both suppliers and customers of the distressed firm incur replacement cost in the following year and that suppliers experience realized costs evidenced by increased SG&A expenses and lower margins in the subsequent year. Kutsuna et al. (2012) find a supply-chain spillover effect of IPOs by showing that suppliers of the IPO firm experience higher revenue and fixed assets growth rate, compared to other private firms. Banerjee et al. (2008) report that suppliers (customers) in durable industries that sell (purchase) a higher proportion of outputs (inputs) to (from) the dependent customer (supplier) have lower leverage, suggesting the effect of supplier–customer relationships on the partners' capital structure. Some researchers directly examine the function of customer (supplier)'s information in the debt market. Fang et al. (2012) present that firms with active strategic alliances in the product market experience lower cost of bank loans and that firms allying with a prestigious partner have lower cost of bank

[42] According to Peng and Xiong (2006), higher information-efficiency parameter denotes that the investor has an ability to process more information given amount of attention.

loans. Chen et al. (2013a) document that the macroeconomic risks of customers but not suppliers significantly affect a firm's bond yield spread. In another paper, Chen et al. (2013b) show that information asymmetry of both supplier and customer significantly affects a firm's bond yield spread. Hence, it is rational for bondholders in the secondary market to consider the information of a firm's customers to make trade decisions.

Not all traders are rational. Cohen and Frazzini (2008) conjecture that investors of a focal firm tend to underreact the firm's customer information because of limited attention. Investors may not notice the information of the customer if they only hold stakes of the supplier. Overlapping investors who hold stakes of both the supplier and the customer can overcome this constraint in that they have the incentive to gain the information of both firms to maximize their portfolio value. Compared with individual investors, institutional investors are sophisticated in both gaining and processing information (e.g., Barber and Odean, 2008). Barber and Odean (2008) document that individual investors are net buyers of the stocks catching their attention, while institutional investors exhibit the opposite trading behavior. Similar to overlapping investors in the stock market, overlapping bondholders in the bond market have the incentive to gain the information of both supplier and customer and thus overcome limited attention constraints. However, bondholders depend mainly on public information (Diamond, 1991). Hence, compared with overlapping bondholders, even overlapping institutional bondholders, overlapping institutional shareholders have information advantage. The literature on institutional investors shows that transient institutional investors are more sensitive to information asymmetry than dedicated or quasi-indexing institutional investors. Moreover, trading is a

mechanism for institutional investors convey their private information to the market (Boehmer and Kelley, 2009). Therefore, I predict that when overlapping transient institutional shareholders between the supplier and its customers trade the supplier's bonds, they play a significant role in disseminating customer information in the bond market. This prediction leads to my hypothesis:

> **Hypothesis**: When transient institutional investors hold stocks of both the supplier and its customers, their trading of the supplier's bonds improves the efficiency of supplier bond price in reflecting customer information.

2.3 Data

2.3.1 Customer data

I identify supplier–customer relationships from COMPUSTAT segment files.[43] The sample period is 2001–2011 because 2002 is the first year TRACE provides time-series bond transaction data. I impose bond returns a 180-day gap after the fiscal year-end dates to make the supplier–customer relationship publically available. The method I employ to identify the supplier–customer relationship is similar to that of Fee and Thomas (2004). First, I use an algorithm to match customer names to the name file which is a COMPUSTAT segment file and select the one with the smallest difference. Then, I use visual inspection and industry information to verify whether the one selected is in fact the supplier's customer. In the end, I match customer names to identifiers in COMPUSTAT, CRSP and Thomson Reuters and gain fundamental customer information. To preclude observations where the supplier and the customer are in a business group, I use data from WRDS corporate library to check whether the supplier is the dominant shareholder of the customer or the customer is the dominant shareholder

[43] Majority of prior research on US supplier–customer relationships in finance and accounting use the data source. An inexhaustive list includes: Fee and Thomas (2004), Fee et al. (2006), Cohen and Frazzini (2008), Banerjee et al. (2008) and Hui et al. (2012).

of the supplier or they have the same dominant shareholder. Following prior research, I exclude observations where the supplier or the customer is financial (SIC codes between 6000 and 6999) or utility firms (SIC codes between 4900 and 4999). Further, I exclude observations where supplier sales or customer cost of goods sold is negative and where the percentage of sales to the customer or the percentage of cost of goods sold from the supplier is greater than 1.

2.3.2 Institutional shareholders data

Institutional shareholders data are based on the Thomson Reuters Institutional (13f) Holdings database from 2001 to 2011. However, I find that the identifier of institutions is not unique or permanent through time.[44] Since I need a unique identifier (MGRNO) of institutions to identify the overlapping institutional shareholders along a supply chain, I check whether the same MGRNO proxies for different institutions and whether different MGRNOs proxy for the same institution by searching the SEC EDGAR database. In the former situation, I assign a different MGRNO beyond the MGRNO range of the database to the latter institution. In the latter situation, I assign the same institution the same MGRNO, the smaller of the two MGRNOs. When I cannot determine whether two institutions are different, I treat them different. I assume that a MGRNO assigned to each institution does not change within a calendar year. I exclude banks and insurance companies before the checking because they are highly regulated (Ranger-Moore et al., 1991). Then, I search within these data to find the overlapping institutional shareholders between the supplier and the customer. The

[44] Though the database provides a permanent key to indicate the institution, in most cases, it is missing, and in some cases, it is still not permanent.

classification of institutional investors is from Bushee's website (http://acct3.wharton.upenn.edu/faculty/bushee/IIclass.html).

2.3.3 Bond data

Bond data involving bond transactions, bond issue, bond rating and historical time series data are from Mergent Fixed Income Securities Database (FISD). Mergent bond transaction data provide bond purchases and disposals information of insurance companies.[45] I identify whether the overlapping institutional shareholders between the supplier and the customer trade the supplier bonds based on the items—"name_of_purchaser" and "name_of_vendor"—in FISD and "manager name" in Thomson Reuters Institutional (13f) Holdings database. I manually match the two databases based on the institution names. Institutions tend to incur M&A activities frequently during my sample period. If an M&A occurs before July 1st, I find the parent of this institution before the M&A, otherwise, I find the parent of this institution after the M&A. If two institutions have the same parent, I treat them as the same institution. FISD historical time series data is essentially identical to TRACE database. I merge the historical time series data with bond issue data to calculate monthly bond returns. I eliminate canceled or corrected trades. Finally, monthly bond returns out of 1%–99% percentile range are deleted.

2.3.4 Other data

Financial data are from COMPUSTAT or CRSP/COMPUSTAT Merged database. Market data are from CRSP/COMPUSTAT Merged database. Returns

[45] Prior research such as Bushman et al. (2009), Easton et al. (2009), Wang and Zhang (2009) and Jostova et al. (2013) also use this database to test their hypotheses. Though this dataset only include the transaction information of insurance companies, it is not an issue for my research. Actually, it tends to make my results more conservative because I can only identify a part of the overlapping institutional shareholders who trade the supplier bonds and the overlapping institutional ownership I identify is downward biased.

on the Fama-French 6 portfolios formed on size and book-to-market (2*3) are from French's website[46]. Stock returns are deleted if their percentiles fall out of the range of 1%–99%. After excluding the missing values of all the variables in my main regression model, I obtain a final supplier sample size of 6,130.

2.3.5 Sample description

Table 1 presents the sample description[47]. Panel A shows the distribution of some time-series characteristics and Panel B provides the distribution of some firm characteristics using pooled observations. At the median level, the number of customers covered in my sample is smaller than that of suppliers. It is not surprising given much bigger size of customers than suppliers shown in Panel B. The median customer size is nearly 10 (69) times larger than the median supplier (Compustat universe) size, which is similar with prior research (e.g., Cohen and Frazzini, 2008). On average, my full sample consisting of all distinct suppliers and customers cover 43.4% of bond issuer universe, 44.1% of bond value universe, and 37.3% of bond universe. On average, in 20.4% of firm–customer relationships, the firm and its customer are in the same industry based on two-digit SIC codes. Panel B shows that firms tend to be small but have high growth, compared with their customers. However, both the firms and their customers are larger and have higher growth than the Compustat universe at the median level. On average, each firm has 2 customers in the sample, and 17.3% of sales go to customers identified in my sample.

[46] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[47] This description is for the sample with valid supplier monthly bond return and lagged customer monthly bond return.

2.4 Variables and methodology

2.4.1 Main variables

2.4.1.1 Measuring overlap in transient institutional ownership

Cohen and Frazzini (2008) and Jung (2013) define investor overlap mainly as the number of overlapping institutional investors divided by the total number of institutional investors. However, institutional investors decide the efforts they exert to acquire or process the information of firms based on the tradeoff between benefits and costs. Wilson (1975) shows that the production of information exhibits increasing return to scale. So, higher proportion of stocks the institutional investors hold denotes it is more likely that the benefits of information production exceed the costs. Therefore, I measure the overlap in transient institutional investors based on ownership.[48] To measure the ownership of overlapping transient institutional investors who hold stakes of both the firm and its customer in the fiscal year and also trade the firm's bond in the corresponding year, for any firm–customer-relationship fiscal year, I first calculate the sum of the ownerships of all the overlapping transient institutional investors who trade the firm's bond in the corresponding year in the firm and its customer separately, and then I identify the minimum value of the two ownerships. The minimum value can be considered as the lower bound of these overlapping transient institutional investors' incentive to gain information of the partners along the supply chain.

2.4.1.2 Measuring bond return

Consistent with Cohen and Frazzini (2008), I use monthly return to test the hypothesis. Consistent with prior research on bond market (e.g., Jostova et al.,

[48] Please note that it is impossible to calculate the total number of institutional investors for each firm in the bond market because the bond transaction data from which I identify institutional bondholders are limited to insurance companies.

2013), I measure monthly bond return based on the dirty price (clean price adjusted by accrued interests) rather than clean price. I first calculate daily closing prices as the median price on the day to exclude the effect of extreme trades, consistent with Wang and Zhang (2009). Monthly bond returns are based on the month-end daily closing prices and computed as:

$$r_{i,t}^{b} = \frac{P_{i,t}+AI_{i,t}+Coupon_{i,t}-(P_{i,t-1}+AI_{i,t-1})}{P_{i,t-1}+AI_{i,t-1}} \quad (1)$$

where $r_{i,t}^{b}$ is bond i's month-t return, $P_{i,t}$ is the price at month-end t, $AI_{i,t}$ is the accrued interests at month-end t, and *Coupon* is the coupon paid during this month. Consistent with Bessembinder et al. (2009), I aggregate the bond return at the firm level to deal with the issue of multiple bonds per firm. Bond return at the firm level is the value weighted bond return at the bond level.[49]

2.4.2 Methodology

Based on the idea of Cohen and Frazzini (2008), I use the following regression model to test my hypothesis:

$$\begin{aligned} r_{i,t}^{b} = {} & \beta_0 + \beta_1 \text{Customer } r_{i,t-1}^{b} + \beta_2 \text{Customer } r_{i,t-1}^{s} + \beta_3 \text{TRA} + \beta_4 \text{TRA} \\ & * \text{Customer } r_{i,t-1}^{b} + \beta_5 \text{TRA} * \text{Customer } r_{i,t-1}^{s} + \beta_6 r_{i,t-1}^{b} + \beta_7 r_{i,t}^{s} \\ & + \beta_8 r_{i,t-1}^{s} + \beta_9 RF_t + \beta_{10} SMB_t + \beta_{11} HML_t + \beta_{12} RM_t \\ & + \beta_{13} TERM_t + \beta_{14} DEF_t + \beta_{15} \text{industry } r_{i,t-1}^{b} \\ & + \beta_{16} \text{customer industry } r_{i,t-1}^{b} + \varepsilon \end{aligned} \quad (2)$$

where $r_{i,t}^{b}$ is firm i's month-t bond return calculated as shown in Section 2.4.1.2. $r_{i,t}^{s}$ is its month-t stock return. TRA is the ownership of overlapping transient institutional shareholders who hold stakes of both the firm and its customer in the fiscal year and also trade the firm's bond in the corresponding year. The lag

[49] I use the offering amount of the bond rather than the amount outstanding to calculate the bond value. Since only 6.99% of the bonds issued by the suppliers or customers in my sample are putable or have a call announcement, I do not expect the results will be significantly different if I use bond amount outstanding. Alternatively, I delete the putable bonds or bonds with a call announcement, and my main result still holds (unreported).

between the fiscal-year end and market data is 180 days to ensure that the firm–customer-relationship characteristics are publically available. Based on Gebhardt et al. (2005), I use both customer bond return (Customer $r_{i,t-1}^{b}$) and customer stock return (Customer $r_{i,t-1}^{s}$) to proxy for the customer information in the prior month. Gebhardt et al. (2005) argue that as a proxy for firm fundamentals, past equity return is better than past bond return, but the utility functions of bondholders and stockholders are different. Although stockholders have significant upside potential and limited downside risk, bondholders have limited upside potential but significant downside risk (Klock et al., 2005). Since bondholders of suppliers and customers have similar utility function, I predict that customer bond return is a better proxy for customer information useful for bondholders' decision than customer stock return. Hence, Customer $r_{i,t-1}^{b}$ and its interaction with TRA (Customer $r_{i,t-1}^{b}$ * TRA) are variables of interest. I add firm bond return and stock return to control for the momentum (reversal) effect in the bond market found in Jostova et al. (2013) (Gebhardt et al. (2005)), and the momentum spillover effect shown in Gebhardt et al. (2005). Based on Fama and French (1993), I add RF, SMB, HML,TERM and DEF to control for the effect of other factors on bond returns. RF is monthly return of the 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between

monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. I compute long-term government bond return as the simple average of 10-year government bond return, 20-year government bond return and 30-year government bond return. DEF is the difference between long-term corporate bond return and long-term government bond return. Monthly long-term corporate bond return is the median return of all the corporate bonds with a maturity no less than 10 years at each month. I include industry bond return, which is the median monthly bond return of the industry, to control for the industry effect. The classification of industries is based on the two-digit SIC code.

Since the number of major customers per firm may be greater than 1, to deal with the repeating data problem, I treat all the customers as a portfolio and weight all the customer specific or firm–customer relationship level variables by the percentage of sales to the customer. For robustness checks, I choose the most important customer the percentage of sales to which is largest to test the hypothesis. If my hypothesis holds, β_4 is significantly negative.

2.5 Results

In this section, I test the hypothesis presented in Section 2.2. Descriptive statistics of variables are presented in Section 2.5.1. Section 2.5.2 presents the main results regarding the informational role of overlapping transient institutional shareholders between the firm and its customer. Section 2.5.3 shows robustness checks.

2.5.1 Descriptive statistics

Table 2 shows the descriptive statistics of the variables in equation (2). On average, the firm has higher monthly bond return and stock return than its customer. It is reasonable in that the firm tends to be smaller and has higher risk

than the customer. The average overlapping transient institutional ownership is 0.07%. Since I use the minimum ownership between that the overlapping transient institutional investors hold in the firm and that they hold in its customer, the minimum ownership tends to be the one they hold in the customer. Given the firm value of customers at median level ($24,334.607 million), 0.07% ownership denotes $17 million which is around 5% ownership of the median Compustat firm, exclusive of finance and utility firms, which is non-trivial. Further data review shows that in my final sample, 28.92% firms have at least one overlapping transient institutional investor who holds the stocks of both the firm and its customer and trades the firm's bonds in the corresponding fiscal year.

2.5.2 Main results

Table 3 presents the main results regarding the role of overlapping transient institutional shareholders in disseminating customer information when they trade the firm's bonds. Column (1) shows that for firms without an overlapping transient institutional investor trading their bonds, customer bond returns (Customer $r_{i,t-1}^{b}$) significantly predict their bond returns (p<0.05), consistent with a customer momentum phenomenon found in Cohen and Frazzini (2008)[50]. The significantly negative coefficient on Customer $r_{i,t-1}^{b}$ * TRA (p<0.01) indicates that overlapping transient institutional shareholders who trade the firm's bonds significantly alleviate the prediction of customer bond return to the firm's bond return. At the mean level of TRA (0.07%), the coefficient on Customer $r_{i,t-1}^{b}$ is 0.050 (0.068-25.198*0.07%), decreased by 26%. However, the marginal effect of Customer $r_{i,t-1}^{b}$ at this mean level is still significantly positive (p<0.1). Hence, the

[50] When I restrict the sample to firms without overlapping transient institutional investors trading in the bond market and having low institutional ownership (below the lower tertile), the coefficient on Customer $r_{i,t-1}^{b}$ is significantly positive after controlling for the firm's own current stock return and lagged stock return, further showing the existence of customer momentum.

informational role of overlapping transient institutional shareholders trading in the bond market is both statistically and economically significant. The coefficient on the lagged bond return ($r_{i,t-1}^{b}$) is significantly negative (p<0.1), consistent with Gebhardt et al. (2005) who find that bond returns exhibit reversals.[51] The coefficients on the variables from Fama and French (1993) are consistent with those in that paper. The coefficient on Industry $r_{i,t-1}^{b}$ is significantly positive (p<0.05), suggesting significant industry momentum effect in the bond market.

To control for the stock and bond market interaction effect (Gebhardt et al., 2005; Jostova et al., 2013), I add the firm's stock return at month t ($r_{i,t}^{s}$) and t-1($r_{i,t-1}^{s}$), its customer's stock return at month t-1 (Customer $r_{i,t-1}^{s}$) and the interaction between overlapping ownership of transient institutional investors trading the firm's bonds in the corresponding year (TRA) and customer stock return at t-1 (Customer $r_{i,t-1}^{s}$). Column (2) shows the results. After controlling for the firm and its customer's stock returns, the absolute interaction effect of TRA decreases but still significant (p<0.01). At the mean level of TRA (0.07%), the coefficient on Customer $r_{i,t-1}^{b}$ is 0.019 (0.031-16.64*0.07%), decreased by 38% which is still economically significant. Interestingly, the marginal effect of Customer $r_{i,t-1}^{b}$ at this mean level becomes insignificant, suggesting that the significant marginal effect in Column (1) may come from the correlation between customer bond return and customer stock return which was omitted (Pearson correlation: 0.206; Spearman: 0.105). The coefficients on Customer $r_{i,t-1}^{s}$ and Customer $r_{i,t-1}^{s}$ * TRA are insignificant, consistent with my prediction that customer bond return is more informative than customer stock return for bondholders. Bond returns exhibit more significant reversals than those in

[51] Further test in Section 2.5.3 shows that the reversals mainly come from investment-grade bonds.

Column (1). Consistent with Gebhardt et al. (2005) and Jostova et al. (2013), both current and lagged stock return are significantly related to bond return. Other control variables have similar results to those in Column (1), except that the industry momentum effect becomes insignificant.

Overall, the main results in Table 3 are consistent with my hypothesis that when transient institutional investors hold stocks of both the supplier and its customers, their trading of the supplier's bonds improves the efficiency of supplier bond price in reflecting customer information.

2.5.3 Robustness checks

I conduct nine robustness checks to validate or extend my main results. Firstly, I examine whether the main results hold for firms which have transient institutional shareholder overlap with their customers but these overlapping institutional shareholders do not trade their bonds in the bond market. If my main results just come from the endogeneity of overlapping transient institutional ownership, the main results will hold even when these transient institutional investors do not trade the firm's bonds. Secondly, I examine whether the main results are more significant when customer concentration is high and customers are in low competition industries. Thirdly, I check the main analysis for investment grade and non-investment grade firms separately. Fourthly, I exclude the firm–customer relationships where overlapping transient institutional shareholders who trade suppliers' bonds never exist in my sample. Fifthly, I choose the most important customer (the largest percentage of sales to the customer) to check whether my main results still hold. Sixthly, I use the predicted value of overlapping ownership of transient institutional shareholders who trade the firm's bonds in the corresponding year, to further alleviate the endogeneity

concern. Seventhly, I use the portfolio approach to test my hypothesis. Eighthly, to show that overlapping transient institutional ownership is more than a proxy for investor attention, I examine whether overlapping transient institutional ownership has incremental effect to bondholder overlap. Lastly, I test whether the overlapping transient institutional shareholders trade based on the customer information.

2.5.3.1 Subsample where overlapping transient institutional shareholders do not trade the firm's bonds

Overlapping transient institutional ownership may proxy for some characteristics of the firm, its customers or firm–customer relationships. For example, Bushee and Noe (2000) find that high AIMR disclosure rankings attract transient institutional investors. Jung (2013) presents that firms with an investor overlap with a first mover in providing more information than the SEC requires are more likely to adopt a similar disclosure policy, showing a monitoring role of overlapping institutional investors in improving disclosure quality. Hence, transient institutional shareholder overlap may be a proxy for more transparent information of the firm and its customer. Obviously, these alternative arguments are unrelated to whether the overlapping transient institutional investors trade the firm's bonds. So, if these arguments are valid, my main results will still hold for the subsample where overlapping transient institutional shareholders do not trade the firm's bonds.

Table 4 shows the results. The coefficient on Customer $r_{i,t-1}^{b}$, which suggests the existence of customer momentum, is marginally significant (p=0.103). The coefficient on Customer $r_{i,t-1}^{b}$ * TRA^{NT}, where TRA^{NT} is the minimum cumulative ownership of all overlapping transient institutional investors hold in the firm and

its customer, is insignificant. All other variables have similar results to those in Table 3. Therefore, my main results are robust to some endogenous factors whose effect tends to be unrelated to the transient institutional shareholders' trading decision in the bond market.

2.5.3.2 Results for firms in high customer concentration and low industry competition

Pfeffer and Salancik (1978) argue that the dependence of one firm (A) on another (B) is determined by the extent to which its important resources are controlled by B. If the firm's products are only sold to a few firms (customer concentration is high) and meanwhile, the firm cannot find alternative customers (competition of the customer industry is low), the major customers are essential to the firm. Hence, when customer concentration is high and these customers are in low competition industry, customer performance is more correlated with the firm. As a result, I predict my main results are more significant in this group. Following Patatoukas (2012), I use sales-based Herfindahl–Hirschman index to measure customer concentration. Customer concentration for supplier i with j customers in year t equals $\sum_{j=1}^{n}\left(\frac{\text{sales to customer}_{i,j,t}}{\text{total sales}_{i,t}}\right)^2$. I also use the sales-based Herfindahl–Hirschman index[52] to measure customer industry competition based on the sales of all COMPUSTAT firms with the same three-digit SIC code. Firms have high (low) customer concentration if their customer concentration is above (below) the sample median. Similarly, firms have high (low) customer industry competition if their customer industry competition is above (below) the sample median.

[52] Higher Herfindahl–Hirschman index means lower industry competition.

Table 5 reports the results. The coefficient on Customer $r_{i,t-1}^{b}$ * TRA is significantly negative (p<0.05) in the HL group (high customer concentration and low customer industry competition) but insignificant in the LH group (low customer concentration and high customer industry competition). In the HL group, the coefficient on Customer $r_{i,t-1}^{s}$ * TRA becomes significantly negative, suggesting that overlapping transient institutional shareholders trading in the bond market still play a role in disseminating customer information conveyed in stock returns. Since overlapping ownership of transient institutional investors trading the firm's bonds (TRA) in the HL group is small (median: 0; mean: 0.08%; upper quartile: 0.005%), the absolute coefficients on Customer $r_{i,t-1}^{b}$ * TRA and Customer $r_{i,t-1}^{s}$ * TRA are much greater than those in Table 3. Further test shows that even at the upper quartile of TRA, the marginal effect of Customer $r_{i,t-1}^{b}$ (Customer $r_{i,t-1}^{s}$) is insignificant. Alternatively, I use an indicator for the existence of overlapping ownership of transient institutional investors trading the firm's bonds rather than the true value of such overlapping ownership, rerun the regression in the two groups, and gain a similar result. To alleviate the nonlinear effect of TRA, I rerun the regression in the LH group with TRA greater than 0.[53] The results are qualitatively similar.

2.5.3.3 Results between investment grade firms vs. non-investment grade firms

Prior research on bond market generally find a difference between investment grade and non-investment grade bonds (e.g., Easton et al., 2009; Jostova et al., 2013). For example, Easton et al. (2009) find that the coefficient relating bond returns with the change in earnings is larger for bonds with

[53] In this sub-subsample, TRA is not significantly different from that in the HL group. But the sample size of this sub-subsample decreases a lot to 208 valid observations. Hence, the reader needs to be cautious to interpret this result.

speculative grade. Jostova et al. (2013) find a momentum in bond returns for non-investment grade bonds but not for investment grade bonds, suggesting that bond price of non-investment grade bonds is less informative than that of investment grade bonds. Since the role of information intermediaries tends to be more significant for more opaque information environment, I predict that my main results will be more significant for non-investment grade bonds. Since my analysis is conducted at a firm level rather than a bond level, I need to convert bond-level credit ratings to firm-level ones. Firstly, I follow Jostova et al. (2013) to convert the S&P ratings into a numeric scale from 1 to 22: 1=AAA, 2=AA+, …, D=22. Then, I weight the scores to a firm level by the market value of each bond. If the most recent weighted average score of a firm at the beginning of month t is greater than 10 (BBB^-), I classify it as non-investment grade firm at month t; otherwise I classify it as investment grade firm.

Table 6 shows the results. The coefficient on Customer $r_{i,t-1}^b$ * TRA is significantly negative (p<0.05) in the Non-Investment Grade group but insignificant in the Investment Grade group, consistent with my prediction. Moreover, this result refutes an alternative explanation to my main result that partners with TRA greater than 0 have more transparent information and thus attract higher overlapping transient institutional ownership. If that is the case, the coefficient on Customer $r_{i,t-1}^b$ * TRA will be more significant in the Investment Grade group. The absolute coefficient on Customer $r_{i,t-1}^b$ * TRA in the Non-Investment Grade group is large because TRA is small in this group (median: 0; mean: 0.04%; 75% quantile: 0; 90% quantile: 0.01%). Further test shows that even at the 90% quantile of TRA, the marginal effect of Customer $r_{i,t-1}^b$ is insignificant. However, in the Investment Grade group, the marginal effect of

Customer $r_{i,t-1}^{b}$ is significantly positive at the 75% quantile of overlapping transient institutional ownership (0.08%). The difference between the two groups should not come from the nonlinear effect of TRA in that TRA in the Non-Investment Grade group is significantly smaller than that in the Investment Grade group (p<0.01).

2.5.3.4 Excluding firms which never have an overlapping transient institutional shareholder trading the firms' bonds in my sample

To alleviate the concern that firm–customer relationships where overlapping transient institutional shareholders trading the firm's bonds never exist may affect my results, I exclude firms which never have an overlapping transient institutional shareholder trading their bonds and thus conduct a within treatment group test.

Table 7 shows the result. The coefficient on Customer $r_{i,t-1}^{b}$ * TRA is still significantly negative (p<0.10) although the significance level decreases. The marginal effect of Customer $r_{i,t-1}^{b}$ at the upper quartile of TRA (0.068%) is 0.004 which is insignificant but significantly decreased by 65% (0.068%*12.472/0.013) from the level where TRA equals 0. The coefficient on Customer $r_{i,t-1}^{s}$ * TRA is still insignificant. Other variables have similar results to those in Table 3.

Hence, result of the within treatment group test confirms my main results that bondholders who are also overlapping transient institutional shareholders between the firm and its customers significantly improve the efficiency of bond price to reflect customer information.

2.5.3.5 Using the largest customer for each firm year

My tests in the prior sections are based on a customer portfolio to deal with repeating data issue. Under this method, customer specific and firm–customer relationship level variables are weighted by the percentage of sales to each

customer. An alternative method is to choose a typical customer for each firm year. I choose the largest customer to which percentage of sales is largest for each firm year to test my hypothesis.

Table 8 shows the results. In the full sample (Column (1)), the coefficient on Customer $r_{i,t-1}^{b}$ * TRA is significantly negative (p<0.01), consistent with Table 3. Other variables have similar results to those in Table 3. When the overlapping transient shareholders do not trade the firm's bonds (Non-Trader in Column (2)), the coefficient on Customer $r_{i,t-1}^{b}$ * TRA becomes insignificant, consistent with Table 4. Comparing the result in HL group (where firms have high customer concentration and low customer industry competition) with that in LH group (where firms have low customer concentration and high customer industry competition) in Columns (3) and (4), I find that the coefficient on Customer $r_{i,t-1}^{b}$ * TRA is only significant in the HL group (p<0.05), consistent with Table 5. The results in the Investment Grade group (Columns (5)) and those in the Non-Investment Grade group (Columns (6)) show that the significance of the coefficient on Customer $r_{i,t-1}^{b}$ * TRA comes from the Non-Investment Grade group, consistent with Table 6. Furthermore, the prediction that bond returns exhibit reversals mainly for firms with investment grade is more obvious here than in Table 6. However, I do not find a bond momentum phenomenon in the Non-Investment Grade group as shown in Jostova et al. (2013).[54] When firms that never have an overlapping transient institutional shareholder trading their bonds in the corresponding period are excluded (Within Treatment Group in Column (7)),

[54] The difference might be related to different sample periods or different holding period for bond returns. Jostova et al. (2013) use a sample from January 1973 to June 2011 and use 6-month bond returns for main analysis.

the coefficient on Customer $r_{i,t-1}^{b}$ * TRA is still significantly negative (p<0.1), consistent with Table 7.

In sum, the results using the firm–largest customer relationships are consistent with those using the customer-portfolio method. Hence, results in the prior sections are robust to the different methods to deal with the repeating data issue.

2.5.3.6 Using the predicted overlapping ownership of transient institutional investors who trade the firm's bonds

To further address the endogeneity issue, I use the predicted overlapping ownership of transient institutional investors who trade the firm's bonds as an instrumental variable of the actual value to estimate Model (2) using two-stage least squares (2SLS) method. The prediction model is discussed in details in Appendix. First, I control for the self-selection bias of customer information disclosure (Ellis et al., 2012) and estimate inverse Mills ratios (Heckman, 1979) using all COMPUSTAT firms, exclusive of financial and utility firms for the period 1992–2011.[55] Then, I predict the normal value of overlapping ownership of transient institutional investors who trade the supplier's bonds (TRA) using a Tobit model which performs well with censored data with inverse Mills ratio as a control variable. The determinants of customer information disclosure are set forth in Appendix A and the details of the prediction model of TRA are given in Appendix B. Table AI shows the result for the determinants of customer information disclosure. Except for two variables (Net intangibles to assets and Ln(Assets)), other variables have similar results to the counterparts in Ellis et al.

[55] FISD bond transaction data start from 1994. Since I leave a nearly 6-month gap between the fiscal year end and the first transaction date, the earliest available fiscal year is 1992.

(2012).[56] Table AII presents the result for the prediction model of TRA. The coefficients on OVPAN and OVPAU are insignificant in my sample, alleviating the concern that overlapping analyst and overlapping auditor between the partners as alternative third-party intermediaries drive my results. The coefficient on mutual dependence (MDEP) is insignificant, while that on absolute asymmetric interdependence (abs(ADEP)) is significantly positive (p<0.05). The positive effect of absolute asymmetric interdependence on TRA implies that the alleviation effect of TRA on customer momentum probably does not come from the efficient information transfer channel between the partners. Schloetzer (2012) finds that symmetric interdependence is negatively associated with the extent of process integration and information sharing. The coefficient on credit risk (CR) is significantly negative (p<0.01), suggesting that overlapping transient institutional shareholders tend to hold bonds with low credit risk. Zscore is also added to control for credit risk, but it is insignificant. Consistent with Hotchkiss and Jostova (2007), issue size is positively associated with bond trade decision. Bond return is positively associated with bond trade decision and stock market return is positively associated with institutional ownership. Inverse Mills ratio (IMR) is insignificant, suggesting that firm level characteristics affecting customer information disclosure do not affect TRA. Other variables are based on the literature on institutional investors and generally consistent with prior research.[57]

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[56] Unlike the results of Ellis et al. (2012), Net intangibles to assets is insignificantly associated with customer-information disclosure in my sample. Ln(Assets) is significantly negatively associated with customer-information disclosure in my sample but consistent with their prediction that smaller firms are more likely to disclose customer information because they are more likely to be affected by the disclosure requirement than larger firms.

[57] According to Chung and Zhang (2011), stock price (bid-ask spread) is positively (negatively) associated with institutional ownership. Given my limited sample size, the opposite effects of the two variables may come from the non-linear effect of them. The median (mean) average stock prices of the suppliers and customers are 37.992 (32.583) and 45.431 (47.600) respectively, much greater than those in their paper with a mean (median) as 21.011 (15.820). The median (mean) bid-ask spreads of the suppliers and

Table 9 presents the results. The coefficient on Customer $r_{i,t-1}^{b}$ * TRA is significantly negative (p<0.01) in both the full sample where customers of each firm are treated as a portfolio (Column (1)) and the firm–largest customer subsample (Column (2)), consistent with the main results. When TRA increases from 0 to the mean level of my main sample (0.07%), the effect of Customer $r_{i,t-1}^{b}$ on $r_{i,t}^{b}$ decreases from 0.058 (0.049) to 0.021 (0.015) in the full sample (firm–largest customer subsample) with a decreasing rate of 64.37% (69.49%). At this mean level, the marginal effect of Customer $r_{i,t-1}^{b}$ on $r_{i,t}^{b}$ is insignificant in either the full sample or the firm–largest customer subsample. In addition, the coefficient on Customer $r_{i,t-1}^{s}$ is significantly positive in the two samples (p<0.05) and the coefficient on Customer $r_{i,t-1}^{s}$ * TRA is significantly negative in both the full sample (p<0.05) and the firm–largest customer subsample (p<0.10), suggesting that overlapping transient institutional investors who are bondholders of the firm also help disseminate customer information revealed by customer stock return to bond traders. However, at the mean level of TRA in my main sample (0.07%), the marginal effect of Customer $r_{i,t-1}^{s}$ on $r_{i,t}^{b}$ is significantly positive for both the full sample (p<0.10) and the firm–largest customer subsample (p<0.05). Hence, TRA does not fully alleviate the prediction of customer stock return to supplier bond return. In sum, the results using predicted TRA as an instrumental variable of TRA further support my hypothesis.

2.5.3.7 Using the portfolio approach

Prior research on market efficiency tends to use the portfolio approach (e.g., Bondt and Thaler, 1985; Jegadeesh and Titman, 2001; Gebhardt et al., 2005;

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customers are 0.036 (0.027) and 0.033 (0.026) respectively, much greater than those in their paper with a mean (median) as 0.008 (0.004).

Jostova et al., 2013). To be consistent with those researches, I alternatively use the portfolio approach to examine the effect of bondholders who are overlapping transient institutional shareholders between the firm and its customers on customer information dissemination. Based on the result of Elton et al. (1995) who show that bond market index is the best if we try to find a single factor to predict individual bond return, I use the market adjusted bond return to measure excess bond return. I calculate the bond market index as the simple average of all available bond returns for each month. At the beginning of each month, I divide all eligible firms into 5 portfolios based on customer returns at last month (Customer $r_{i,t-1}^{b}$). Then, I calculate the median excess bond returns within each portfolio during the first month after portfolio formation. To detect the role of bondholders who are transient institutional investors holding stocks of both the firm and its customers in the corresponding period, I further divide the full sample into two subsamples based on whether such bondholders exist (Overlap group and Non-Overlap group). To be consistent with analyses in the prior sections, I provide results for both firm–customer portfolio relationships and firm–largest customer relationships.

Table 10 presents the results. In Panel A, I treat all customers for each firm as a portfolio. In either full sample or the Overlap group, the strategy of long the Q1 portfolio and short the Q5 portfolio does not ensure a significant gain. However, in the Non-Overlap group, Q5 portfolio performs marginally better than Q1 by 0.25% (p<0.10). In Panel B, I choose the firm–largest customer relationships. The result is stronger than that in Panel A. Q5 performs significantly better than Q1 by 0.28% (p<0.01) in the full sample. Again in the Overlap group, the difference in performance between Q5 and Q1 is insignificant.

However, in the Non-Overlap group, the strategy of long the Q1 and short the Q5 earns 0.33% which is both statistically (p<0.01) and economically significant. The median monthly market adjusted bond return (unreported) in the full sample is only -0.1%.

Therefore, the results using the portfolio approach further confirm the prediction that bondholders who are overlapping transient institutional shareholders between the firm and its customers help disseminate customer information in the bond market, consistent with my hypothesis.

2.5.3.8 Does overlapping transient ownership proxy only for investor attention?

Cohen and Frazzini (2008) use the fraction of all mutual funds who hold stocks of both the supplier and the customer to proxy for investor attention and explain that common mutual funds holding both securities are more likely to gather information of both the supplier and the customer or monitor the two firms closely. Although common investors can alleviate the problem of limited attention, common transient institutional ownership may proxy for more than investor attention because of heterogeneous common investors. Given different incentives, different specialties in gathering or processing information and different trading strategies, the informational roles of different common investors could be different. In Section 2.2.1, I argue that although all institutional investors have incentive to gather private information and specialty in interpreting information, the informational role of transient institutional investors is more significant than that of dedicated or quasi-indexing institutional investors because of frequent trading. It is trading that disseminates the information of investors. When it comes to bond market, there are overlapping bondholders who hold bonds of both the firm and its customers. Compared with shareholders, bondholders mainly concern

about the firm's downside risk and rely on public information (Krishnaswami et al., 1999). But rationally speaking, overlapping bondholders collect information of both the firm and its customers, alleviating investor inattention in the bond market. Hence, I examine the incremental role of bondholders who are overlapping transient institutional shareholders between the firm and its customers to the role in alleviating investor inattention by comparing their effect with the effect of overlapping bondholders on customer information dissemination.

To do so, I identify whether one bondholder of the firm holds the bonds of its customer based on the trader's name in Mergent bond transaction database. The overlapping bondholders I identify are all institutional investors. Firstly, I add an indicator (OVPB) for the existence of overlapping bondholders who hold bonds of the firm and its customers and its interactions with customer bond return and stock return to regression model (2) directly. Secondly, I assume that overlapping bondholders play a role in improving bond price informativeness based on limited attention hypothesis. I use an ordered variable (INF) which equals 2 if the firm has at least one common transient institutional shareholder trading its bonds and one common bondholder with its customers, 1 if the firm has at least one common transient institutional shareholder trading its bonds but not any common bondholders with its customers, and 0 otherwise.

Table 11 presents the result. Columns (1) and (2) provide the results based on firm–customer portfolio relationships. Column (1) shows that after controlling for the effect of overlapping bondholders, the coefficient on Customer $r_{i,t-1}^{b}$ * TRA is significantly negative (p<0.05), while the coefficient on Customer $r_{i,t-1}^{b}$ * OVPB is insignificant. My review of data reveals that in 67% of the cases, the firm has an overlapping transient institutional shareholder trading its bond and also an

overlapping bondholder with its customers. Thus, the insignificance of the coefficient on Customer $r_{i,t-1}^{b}$ * OVPB may be resulted from multicollinearity. To alleviate this concern, I replace TRA and OVPB by the ordered variable (INF) in Column (2). The coefficient on Customer $r_{i,t-1}^{b}$ * INF is significantly negative (p<0.05), showing that, on average, both overlapping transient institutional shareholders who are also bondholders and overlapping bondholders play a role in disseminating customer information. Columns (3) and (4) provide the results based on firm–largest customer relationships. The results are quite similar to those in Columns (1) and (2).

To sum it up, consistent with limited attention hypothesis, both overlapping shareholders who are also bondholders and overlapping bondholders play a role in disseminating customer information. However, overlapping transient institutional shareholders trading the firm's bonds have incremental role to the overlapping bondholders, consistent with my prediction that overlapping transient institutional ownership is not just a simple proxy for investor attention. The incremental role probably comes from the fact that transient institutional shareholders have private information which helps the shareholders determine how to interpret and to which extent to react to the public information.

2.5.3.9 Do overlapping transient institutional shareholders trade based on the customer information?

Boehmer and Kelley (2009) argue that trading activity is one mechanism through which price becomes more efficient. In this section, I directly test the informational role of overlapping transient institutional shareholders trading the firm's bonds in the corresponding period via testing the relationship between current customer information and their trading volume. Following Hotchkiss and

Jostova (2007), I control for issue size, age of the bond, credit risk, interest rate, stock market return, and stock trading volume in addition to the firm's current and lagged stock return, the firm's current and lagged bond return and the customer's current and lagged stock return. The regression model is as follows:

$$VOLB_{\mathrm{t}} = \gamma_0 + \gamma_1 Customer\ r_{i,t}^{b} + \gamma_2 Customer\ r_{i,t-1}^{b} + \gamma_3 Customer\ r_{i,t}^{s} + \gamma_4 Customer\ r_{i,t-1}^{s} + \gamma_5 r_{i,t}^{b} + \gamma_6 r_{i,t-1}^{b} + \gamma_7 r_{i,t}^{s} + \gamma_8 r_{i,t-1}^{s} + \gamma_9 VOLS_t + \gamma_{10} RF_t + \gamma_{11} RM_t + \gamma_{12} AGE_t + \gamma_{13} SIZE_t + \gamma_{14} Customer\ industry\ r_{i,t}^{b} + \gamma_{15} VOLB_{t-1} + \gamma_{16} Credit\ risk_{t-1} + \delta \quad (3)$$

where *VOLB* is trading volume in par value at month t scaled by the offering amount of the bond. *VOLS* is stock trading volume of the firm. *AGE* is the age of the bond in month. *SIZE* is the logarithm of the offering amount of the bonds the firm issues. *Credit risk* is the numeric scale of S&P credit rating as shown in Section 2.5.3.3. It is the most recent S&P credit rating before month t. Other variables are defined as in Model (2). Consistent with prior analyses, all bond-level variables are converted to the firm level based on the market value of each bond. If overlapping transient shareholders between the firm and its customers indeed trade based on the customer information, γ_1 will be significantly positive.

Table 12 shows the result. In column (1), I treat all the customers for each firm as a portfolio. The coefficient on Customer $r_{i,t}^{b}$ is significantly positive (p<0.10), indicating that the overlapping transient shareholders trade based on the customer information. The insignificant coefficient on Customer $r_{i,t-1}^{b}$ suggests that the overlapping transient shareholders do not underreact to the customer information. In Columns (2) and (3), I present the results using firm–largest customer relationships. If I use all the available observations as shown in Column

(2), the coefficient on Customer $r_{i,t}^{b}$ is insignificant. Further test shows that the percentage of sales to the largest customer is significantly smaller than that in the full sample of firm–largest customer relationships (p<0.01). The insignificance may be a result of an insignificant customer in the sample. Hence, I provide the result for the relationships where the percentage of sales to the largest customer lies above 2/3 quantile. Consistent with my expectation, the coefficient on Customer $r_{i,t}^{b}$ is significantly positive in this group (p<0.05). In summary, the results are generally consistent with the prediction that overlapping transient shareholders who are also bondholders of the firm disseminate the customer information to the bond market through trading, further confirming my hypothesis.

Overall, the results in Section 2.5 provide comprehensive evidence that when transient institutional investors hold stocks of both the supplier and its customers, their trading of the supplier's bonds improves the efficiency of supplier bond price in reflecting customer information, consistent with my hypothesis.

2.6 Analysis of Real effects

In this section, I examine the real effects of customer information on bondholders. Specifically, I test whether it is rational for bondholders to react to their debtors' customer information.

Prior research (e.g., Kolay et al., 2013) has shown that customer information is valuable for bondholders. However, little research directly tests that a firm's customer information helps creditors predict the firm's default risk in a general setting.[58] Shumway (2001) shows that EBIT/total assets is a significant predictor

[58] Most researchers (e.g., Banerjee et al., 2008; Chen et al., 2013a; Chen et al., 2013c) just find a contemporary correlation between customer characteristics and supplier capital structure or credit risk. Kolay

of credit risk. Hence, I test directly whether customer information significantly predicts future EBIT/total assets. For each firm, I focus on the largest customer in the sample period and then examine the time-series relations between the firm and this customer. The regression model is as follows:

$$(EBIT/TA)_{t+1} = \alpha_0 + \alpha_1 Link_t + \alpha_2 Customer\ r_{i,t}^{b} + \alpha_3 Customer\ r_{i,t}^{s} + \alpha_4 Link_t * Customer\ r_{i,t}^{b} + \alpha_5 Link_t * Customer\ r_{i,t}^{s} + \alpha_6 Size_t + \alpha_7 (EBIT/TA)_t + \sum_i \alpha_{8i} industry_i + \sum_j \alpha_{9j} year_i + \theta \quad (4)$$

The dependent variable, *EBIT/TA*, is earnings before interest and tax divided by total assets. $Link_t$ equals 1 if there is a supplier–customer relationship at time t, and 0 otherwise. *Customer* $r_{i,t}^{b}$ is the annualized customer bond return. *Customer* $r_{i,t}^{s}$ is the annualized customer stock return. Following Shumway (2001), missing monthly stock return is replaced by the value-weighted market return at that month. I add size to control for the scale effect and $(EBIT/TA)_t$ to control for the mean-reverting effect of EBIT/TA. *Size* is the logarithm of total assets. I estimate the model using median regression to alleviate the concern of outliers.[59] The coefficient on $Link_t$ * Customer $r_{i,t}^{b}$ indicates the predictive power of customer bond returns over suppliers' subsequent EBIT/TA.

Table 13 presents the result. When the firm and the customer are not linked by the supplier–customer relationship, the effect of Customer $r_{i,t}^{b}$ on future EBIT/TA is not significant. Once they are linked, the effect of Customer $r_{i,t}^{b}$ on future EBIT/TA ($Link_t$ * Customer $r_{i,t}^{b}$) is significantly improved (p<0.10),

et al. (2013) do show that customer financial status predicts the supplier's future performance. But they only focus on distressed firms.

[59] I also use median regression for my main analysis (unreported). The result for Customer $r_{i,t}^{b}$ * TRA is qualitatively consistent with that in Table 3, while the coefficient on Customer $r_{i,t}^{s}$ * TRA becomes significantly negative.

suggesting the predictive power of customer bond returns over suppliers' subsequent EBIT/TA, which is a significant predictor of default risk. Hence, it is rational for bondholders to trade based on the customer information proxied by customer bond returns.

In sum, this section provides evidence that customer information is valuable for bondholders to predict the supplier's credit risk. Overlapping transient institutional shareholders between the firm and its customer understand this link and trade the firm's bonds based on the customer information. In contrast, other bondholders do not realize this link because of limited attention or underreact to customer information because of insufficient information. As a result, overlapping transient institutional shareholders improve the efficiency of supplier bond price to reflect the customer information through trading suppliers' bonds.

2.7 Conclusion

This paper examines the informational role of overlapping transient institutional investors who hold stocks of both the firm and its customers in disseminating customer information to the firm's bond market. Results show that when transient institutional investors hold stocks of both the supplier and its customers, their trading of the supplier's bonds improves the efficiency of supplier bond price in reflecting customer information mainly proxied by customer bond return. These results are more pronounced for firms with high customer concentration but low customer industry competition and non-investment grade firms. To alleviate endogeneity issue, firstly, I limit the test to the subsample where overlapping transient institutional shareholders do not trade suppliers' bonds. Secondly, I utilize the predicted ownership of overlapping transient institutional investors who trade the suppliers' bonds in the

corresponding year as an instrumental variable of the actual ownership to test my hypothesis using two-stage least squares (2SLS) method. For the first method, as predicted, I do not find a significant role of overlapping transient institutional shareholders in that subsample. For the latter one, the results are consistent with those using the actual overlapping ownership. Hence, my main results do not come from endogeneity. Alternatively, I use the portfolio approach to test the hypothesis and gain consistent results. Furthermore, I find that overlapping transient institutional ownership is more than a proxy for investor attention. Private information of overlapping transient institutional shareholders may help them interpret the customer information and thus react to it efficiently. To directly test the hypothesis, I examine the relationship between current customer information and the trading volume of bondholders who are overlapping transient shareholders and find a significantly positive relationship which suggests that these bondholders indeed trade based on the customer information. Finally, I find a significant predictive power of customer information to suppliers' future credit risk, suggesting the rationality for bondholders to trade based on their debtors' customer information.

My study contributes to the literature in several ways. It is the first study to examine the informational role of overlapping institutional investors in the bond market. It is also the first one to document the existence of customer momentum in the bond market. It also provides evidence about the informational role of transient institutional investors in the bond market in the post-regulation FD period. Thus, my study provides a useful insight to investors and credit rating agencies to predict a firm's credit risk.

I have some limitations in this study. Although I have attempted to control for the endogeneity issue, the issue may not be fully controlled for. The bond transaction data I base on come from insurance companies, which represent only a part of transactions in the bond market. Future study using a comprehensive set of bond transaction data is worthwhile. Since my study only focuses on bond market, future research may extend it to other financial derivative markets.

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Table 1
Sample description

Supplier–customer relationships are identified from COMPUSTAT segment files. Full sample consists of all distinct suppliers and customers. Firm (Customer) % coverage of bond issuer universe (EW) is the number of suppliers (customers) in the sample divided by the total number of bond issuers with valid bond return. % coverage of bond issuer universe (VW) is total bond value of the firms in the sample divided by the total bond value at the end of per year. Bond % coverage of bond universe (EW) is the number of bonds covered in the sample divided by the total number of bonds with valid bond return. Industry is defined as the two-digit SIC code. Size is the firm's market value of equity. Book-to-market is book value of equity over market value of equity. Compustat universe includes all Compustat firms exclusive of finance and utility firms during fiscal year 2001–2011.

	MIN	MEDIAN	MAX	MEAN	STD
Panel A: Time Series (11 Annual Observations, 2002-2012)					
Number of firms in the sample per year	12	159	175	132	56
Number of customers in the sample per year	15	109	125	94	37
Number of firms in the full sample per year	27	252	279	213	86
Full sample % coverage of bond issuer universe (EW)	36.6%	43.4%	47.9%	43.4%	3.8%
Full sample % coverage of bond issuer universe (VW)	29.1%	46.1%	51.0%	44.1%	6.3%
Full sample bond % coverage of bond universe (EW)	28.4%	38.0%	46.2%	37.3%	6.1%
Firm % coverage of bond issuer universe (EW)	17.6%	27.7%	30.1%	26.2%	4.0%
Firm % coverage of bond issuer universe (VW)	15.8%	19.3%	20.2%	18.7%	1.4%
Firm bond % coverage of bond universe (EW)	16.4%	20.3%	21.6%	19.7%	1.8%
Customer % coverage of bond issuer universe (EW)	16.5%	20.1%	22.1%	19.5%	1.8%
Customer % coverage of bond issuer universe (VW)	13.3%	31.5%	36.1%	29.1%	6.9%
Customer bond % coverage of bond universe (EW)	11.9%	21.1%	28.3%	20.4%	5.5%
% of firm–customer in the same industry	11.0%	20.4%	26.7%	20.4%	4.2%
Panel B: Firm Characteristics (Pooled Firm-Year Observations)					
Firm size (in millions)	0.936	2214.799	219196.800	11973.214	30447.148
Customer size (in millions)	57.154	24334.607	504239.580	55135.732	73175.476
Firm size of Compustat universe	0.030	346.323	504239.580	3982.244	17329.730
Firm book-to-market	-172.200	0.352	7.053	0.106	5.785
Customer book-to-market	-44.101	0.394	3.750	0.389	1.835
book-to-market of Compustat universe	-769.339	0.467	74.510	0.529	4.507
Number of customers per firm	1	1	9	2	1
Percentage of sales to customer	0.002	0.140	0.960	0.173	0.118

Table 2
Descriptive statistics

This table presents the descriptive statistics of variables used in my main test. Sample size is 6130 observations. $r_{i,t}^{b}$ ($r_{i,t-1}^{b}$) is the monthly firm-level bond return. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm.

Variable	MEAN	STD	MIN	MEDIAN	MAX
$r_{i,t}^{b}$	0.77%	3.04%	-13.84%	0.65%	19.22%
Customer $r_{i,t-1}^{b}$	0.64%	1.83%	-10.10%	0.52%	18.08%
Customer $r_{i,t-1}^{s}$	0.80%	6.97%	-37.84%	0.84%	47.72%
TRA	0.07%	0.20%	0.00%	0.00%	1.41%
$r_{i,t}^{s}$	1.18%	10.61%	-40.45%	1.04%	62.00%
RF	0.15%	0.16%	0.00%	0.08%	0.43%
SMB	0.27%	2.35%	-4.22%	-0.08%	5.79%
HML	0.00%	2.48%	-9.86%	-0.03%	7.58%
RM	0.73%	4.73%	-18.46%	1.17%	11.40%
TERM	0.58%	3.26%	-9.93%	0.48%	13.44%
DEF	-0.11%	3.18%	-8.78%	0.10%	9.45%
Industry $r_{i,t-1}^{b}$	0.59%	1.18%	-9.25%	0.53%	9.66%
Customer industry $r_{i,t-1}^{b}$	0.58%	1.08%	-7.44%	0.51%	9.66%

Table 3
The effect of overlapping transient institutional ownership on customer information dissemination

This table presents the effect of overlapping transient institutional shareholders trading in the bond market on customer information dissemination. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). I weight bond-level returns by the market value of each bond to convert them to firm level. $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	(1)		(2)	
Intercept	0.003	***	0.002	***
	4.352		3.204	
Customer $r_{i,t-1}^{b}$	0.068	**	0.031	
	2.240		0.945	
Customer $r_{i,t-1}^{s}$			-0.004	
			-0.544	
TRA	-0.448	***	-0.319	***
	-3.758		-2.711	
Customer $r_{i,t-1}^{b}$ * TRA	**-25.198**	***	**-16.640**	***
	-4.471		**-2.818**	
Customer $r_{i,t-1}^{s}$ *TRA			-2.439	
			-0.966	
$r_{i,t-1}^{b}$	-0.044	*	-0.103	***
	-1.702		-3.896	
$r_{i,t}^{s}$			0.088	***
			9.118	
$r_{i,t-1}^{s}$			0.033	***
			5.949	
RF_t	0.134		0.558	**
	0.508		2.341	
SMB_t	0.035	*	0.024	
	1.758		1.374	
HML_t	-0.063	***	-0.085	***
	-3.271		-4.095	

	(1)		(2)	
RM_t	0.110	***	0.019	
	6.875		1.423	
$TERM_t$	0.597	***	0.633	***
	10.687		11.502	
DEF_t	0.636	***	0.653	***
	13.069		13.595	
Industry $r_{i,t-1}$ [b]	0.180	**	0.102	
	2.357		1.515	
Customer industry $r_{i,t-1}$ [b]	0.038		0.089	
	0.440		1.108	
Adjusted R^2	0.130		0.215	
Number of clusters	207		195	
Obs.	6624		6130	
Marginal effect of Customer $r_{i,t-1}$ [b] at the mean level of TRA (0.07%)	**0.050**	*	**0.019**	
	1.75		**0.62**	

Table 4

The effect of overlapping transient institutional shareholders who do not trade the firm's bonds on customer information dissemination

This table presents the main results in the subsample where the overlapping transient institutional shareholders do not trade the firm's bonds. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). I weight bond-level returns by the market value of each bond to convert them to firm level. $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). TRA^{NT} is the minimum total ownership of overlapping institutional investors hold in the firm and its customer. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclus9ive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	0.003	**
	2.348	
Customer $r_{i,t-1}^{b}$	0.075	
	1.637	
Customer $r_{i,t-1}^{s}$	-0.009	
	-0.934	
TRA^{NT}	0.018	
	0.171	
Customer $r_{i,t-1}^{b}$ * TRA^{NT}	**-5.177**	
	-0.990	
Customer $r_{i,t-1}^{s}$ *TRA^{NT}	0.667	
	0.740	
$r_{i,t-1}^{b}$	-0.107	***
	-3.693	
$r_{i,t}^{s}$	0.088	***
	8.363	
$r_{i,t-1}^{s}$	0.033	***
	5.189	
RF_t	0.424	
	1.367	
SMB_t	0.039	*
	1.674	
HML_t	-0.098	***
	-3.495	
RM_t	0.045	***

	2.987	
$TERM_t$	0.493	***
	7.585	
DEF_t	0.528	***
	9.218	
Industry $r_{i,t-1}$ [b]	0.111	
	1.457	
Customer industry $r_{i,t-1}$ [b]	0.125	
	1.245	
Adjusted R^2	0.193	
Number of clusters	184	
Obs.	4357	

Table 5
The effect of overlapping transient institutional ownership on customer information dissemination grouping by customer concentration and customer industry competition

This table presents the effect of overlapping transient institutional shareholders trading in the bond market on customer information dissemination in the high customer concentration and low customer industry competition group (HL) and low customer concentration and high customer industry competition group (LH). HL (LH) group is where customer concentration is above (below) the sample median and customer industry competition is below (above) the sample median. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	HL		LH	
Intercept	0.001		0.003	
	0.522		1.577	
Customer $r_{i,t-1}^{b}$	0.090		-0.015	
	1.119		-0.249	
Customer $r_{i,t-1}^{s}$	-0.005		0.007	
	-0.393		0.432	
TRA	-0.220		0.125	
	-1.450		0.142	
Customer $r_{i,t-1}^{b}$ * TRA	**-39.816**	**	**-10.031**	
	-2.632		**-0.362**	
Customer $r_{i,t-1}^{s}$ *TRA	-7.176	**	-10.682	
	-2.652		-0.748	
$r_{i,t-1}^{b}$	-0.077		-0.068	
	-1.566		-1.257	
$r_{i,t}^{s}$	0.096	***	0.077	***
	4.322		5.703	
$r_{i,t-1}^{s}$	0.039	***	0.019	
	5.130		1.659	
RF_t	1.114	***	0.011	

	HL		LH	
	2.828		0.019	
SMB_t	0.057		0.023	
	1.658		0.442	
HML_t	-0.103	***	-0.095	*
	-3.317		-1.913	
RM_t	0.010		0.054	**
	0.479		2.356	
$TERM_t$	0.666	***	0.499	***
	9.159		4.442	
DEF_t	0.682	***	0.538	***
	9.949		5.216	
Industry $r_{i,t-1}$ [b]	-0.182	*	0.116	
	-1.905		0.793	
Customer industry $r_{i,t-1}$ [b]	0.332	**	0.234	*
	2.519		1.778	
Adjusted R^2	0.223		0.202	
Number of clusters	59		62	
Obs.	1733		1078	

Table 6

The effect of overlapping transient institutional ownership on customer information dissemination between investment grade firms vs. non-investment grade firms

This table presents the main results group by investment grade and non-investment grade firms. I follow Jostova et al. (2013) to convert the S&P ratings into a numeric scale from 1 to 22: 1=AAA, 2=AA+, …, D=22. Non-Investment (Investment) Grade group consists of all firms whose weighted numeric scale of bond ratings by market value of each bond are (not) greater than 10. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Investment Grade		Non-Investment Grade	
Intercept	0.001	*	0.003	***
	1.689		2.980	
Customer $r_{i,t-1}^{b}$	0.065	*	0.012	
	1.854		0.217	
Customer $r_{i,t-1}^{s}$	-0.006		0.011	
	-0.970		0.933	
TRA	-0.055		-0.394	**
	-0.347		-2.166	
Customer $r_{i,t-1}^{b}$ * TRA	**0.416**		**-26.047**	**
	0.057		**-2.084**	
Customer $r_{i,t-1}^{s}$ *TRA	-4.394		4.452	
	-1.401		0.900	
$r_{i,t-1}^{b}$	-0.234	***	-0.070	*
	-6.420		-1.950	
$r_{i,t}^{s}$	0.029	**	0.075	***
	2.172		6.067	
$r_{i,t-1}^{s}$	0.014	**	0.034	***
	2.199		4.215	
RF_t	0.720	***	0.420	
	3.834		1.024	
SMB_t	-0.010		0.039	
	-0.521		1.233	

	Investment Grade		Non-Investment Grade	
HML_t	-0.010		-0.171	***
	-0.547		-4.701	
RM_t	-0.027	**	0.108	***
	-2.536		6.081	
$TERM_t$	0.811	***	0.460	***
	11.547		5.290	
DEF_t	0.826	***	0.458	***
	14.618		6.366	
Industry $r_{i,t-1}$ [b]	0.078		0.233	**
	0.964		2.145	
Customer industry $r_{i,t-1}$ [b]	0.104		0.026	
	1.073		0.214	
Adjusted R^2	0.305		0.209	
Number of clusters	75		104	
Obs.	3015		2659	

Table 7

The effect of overlapping transient institutional ownership on customer information dissemination (within treatment group test)

This table presents the main results within the treatment group. Firms which never have an overlapping transient institutional shareholder with their customers who trade their bonds in the corresponding fiscal year are excluded. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	0.001	*
	1.966	
Customer $r_{i,t-1}^{b}$	0.013	
	0.336	
Customer $r_{i,t-1}^{s}$	0.002	
	0.196	
TRA	-0.195	
	-1.546	
Customer $r_{i,t-1}^{b}$ * TRA	**-12.472**	*
	-1.895	
Customer $r_{i,t-1}^{s}$ *TRA	-3.167	
	-1.210	
$r_{i,t-1}^{b}$	-0.091	***
	-2.927	
$r_{i,t}^{s}$	0.094	***
	6.528	
$r_{i,t-1}^{s}$	0.032	***
	4.440	
RF_t	0.688	***
	2.705	
SMB_t	0.023	
	1.235	
HML_t	-0.065	***
	-3.011	

RM_t	-0.008	
	-0.512	
$TERM_t$	0.765	***
	13.448	
DEF_t	0.759	***
	15.062	
Industry $r_{i,t-1}$ [b]	0.026	
	0.324	
Customer industry $r_{i,t-1}$ [b]	0.060	
	0.603	
Adjusted R^2	0.265	
Number of clusters	95	
Obs.	4280	

Table 8

The effect of overlapping transient institutional ownership on customer information dissemination (firm–largest customer relationships)

This table presents the effect of overlapping transient institutional ownership on customer information dissemination using firm–largest customer relationships. For each supplier, I choose the largest customer the percentage of sales to which is largest. Non-Trader group refers to the subsample where the overlapping transient shareholders do not trade the firm's bonds in the corresponding fiscal year. HL (LH) group is where customer concentration is above (below) the sample median and customer industry competition is below (above) the sample median. Non-Investment (Investment) Grade group consists of all firms whose weighted numeric scale of bond ratings by market value of each bond are (not) greater than 10. I follow Jostova et al. (2013) to convert the S&P ratings into a numeric scale from 1 to 22: 1=AAA, 2=AA+, …, D=22. In the Within Treatment Group, firms which never have an overlapping transient institutional shareholder with their largest customer who trade their bonds in the corresponding period are excluded. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	(1) Full Sample		(2) Non-Trader		(3) HL		(4) LH		(5) Investment Grade		(6) Non-Investment Grade		(7) Within Treatment Group	
Intercept	0.002	***	0.003	***	0.001		0.004	**	0.001	**	0.002	**	0.001	
	3.346		3.239		0.614		2.344		2.210		2.208		1.631	
Customer $r_{i,t-1}^{b}$	0.032		0.053		0.045		0.042		0.059	*	0.029		0.012	
	0.949		1.077		0.663		0.615		1.734		0.515		0.315	
Customer $r_{i,t-1}^{s}$	0.001		-0.004		0.006		-0.000		-0.003		0.011		0.010	
	0.069		-0.385		0.430		-0.006		-0.500		0.868		1.047	
TRA	-0.272	**	-0.059		-0.362	*	0.463		-0.049		-0.288		-0.099	
	-2.467		-0.708		-1.984		0.488		-0.337		-1.601		-0.873	
Customer $r_{i,t-1}^{b}$ * TRA	**-16.907**	***	**-1.250**		**-26.925**	**	**-28.951**		**0.570**		**-28.338**	**	**-10.567**	*

	(1) Full Sample		(2) Non-Trader		(3) HL		(4) LH		(5) Investment Grade		(6) Non-Investment Grade		(7) Within Treatment Group	
	-2.981		**-0.285**		**-2.175**		**-0.859**		**0.085**		**-2.517**		**-1.690**	
Customer $r_{i,t-1}^{s}$ *TRA	-3.166		0.487		-11.522	***	-8.869		-4.283		2.758		-4.799	*
	-1.325		0.560		-3.500		-0.617		-1.452		0.594		-1.890	
$r_{i,t-1}^{b}$	-0.083	***	-0.085	***	-0.084		-0.029		-0.233	***	-0.038		-0.098	***
	-3.032		-2.787		-1.665		-0.572		-6.360		-1.015		-2.969	
$r_{i,t}^{s}$	0.090	***	0.093	***	0.099	***	0.075	***	0.028	**	0.081	***	0.092	***
	8.812		8.200		4.473		6.005		2.252		6.217		6.110	
$r_{i,t-1}^{s}$	0.027	***	0.027	***	0.039	***	0.014		0.012	*	0.026	***	0.022	***
	5.323		4.612		5.309		1.240		1.947		3.794		4.048	
RF_t	0.529	**	0.311		1.189	***	-0.363		0.685	***	0.597		0.531	**
	2.040		0.997		2.999		-0.715		3.849		1.304		2.152	
SMB_t	0.020		0.035		0.057	*	0.006		-0.012		0.042		0.013	
	1.146		1.480		1.727		0.126		-0.638		1.298		0.879	
HML_t	-0.094	***	-0.114	***	-0.119	***	-0.086		-0.010		-0.167	***	-0.053	**
	-4.397		-4.153		-3.723		-1.565		-0.540		-4.756		-2.523	
RM_t	0.019		0.047	***	0.005		0.054	**	-0.025	**	0.107	***	-0.014	
	1.552		3.232		0.232		2.602		-2.540		5.826		-1.015	
$TERM_t$	0.600	***	0.461	***	0.678	***	0.397	***	0.789	***	0.412	***	0.769	***
	11.137		7.404		8.996		3.240		11.870		5.046		13.066	
DEF_t	0.633	***	0.511	***	0.696	***	0.440	***	0.807	***	0.429	***	0.785	***
	13.271		9.192		10.033		3.918		14.856		5.933		15.479	
Industry $r_{i,t-1}^{b}$	0.099		0.110		-0.159	*	0.140		0.085		0.226	**	0.076	
	1.552		1.483		-1.822		0.867		1.141		2.135		0.994	
Customer industry $r_{i,t-1}^{b}$	0.080		0.108		0.295	***	0.143		0.093		0.074		0.042	
	1.076		1.195		2.714		0.855		1.189		0.596		0.477	
Adjusted R^2	0.210		0.193		0.221		0.190		0.300		0.212		0.286	
Number of clusters	196		181		60		59		78		105		88	

	(1) Full Sample	(2) Non-Trader	(3) HL	(4) LH	(5) Investment Grade	(6) Non-Investment Grade	(7) Within Treatment Group
Obs.	6183	4394	1742	1092	3115	2637	3887

Table 9
The effect of overlapping transient institutional ownership on customer information dissemination (2SLS regression)

This table presents the effect of overlapping transient institutional ownership on customer information dissemination using two-stage least squares (2SLS) method. I use a predicted overlapping transient institutional ownership as an instrumental variable of overlapping transient institutional ownership. The prediction model is in Appendix. In column (1), all customers for each supplier are treated as a portfolio, and both the customer specific and relationship level variables are weighted by the percentage of sales to each customer. In column (2), I choose the largest customer the percentage of sales to which is biggest. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. The values below coefficients are t statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	(1) Customer Portfolio		(2) Largest Customer	
Intercept	0.001		0.001	
	1.447		1.431	
Customer $r_{i,t-1}^{b}$	0.058		0.049	
	1.574		1.472	
Customer $r_{i,t-1}^{s}$	0.020	**	0.019	**
	2.277		2.306	
TRA	-0.125		-0.107	
	-0.390		-0.332	
Customer $r_{i,t-1}^{b}$ * TRA	**-53.338**	***	**-48.644**	***
	-3.145		**-2.981**	
Customer $r_{i,t-1}^{s}$ *TRA	-9.156	**	-7.397	*
	-2.013		-1.734	
$r_{i,t-1}^{b}$	-0.107	***	-0.100	***
	-4.920		-4.597	
$r_{i,t}^{s}$	0.076	***	0.074	***
	14.503		14.155	
$r_{i,t-1}^{s}$	0.024	***	0.021	***
	4.555		3.988	

	(1) Customer Portfolio		(2) Largest Customer	
RF_t	0.397		0.335	
	1.236		1.028	
SMB_t	0.003		0.003	
	0.147		0.158	
HML_t	-0.065	***	-0.060	***
	-3.595		-3.298	
RM_t	-0.014		-0.009	
	-1.218		-0.744	
$TERM_t$	0.808	***	0.781	***
	21.568		20.687	
DEF_t	0.799	***	0.774	***
	21.643		20.717	
Industry $r_{i,t-1}$ [b]	0.086		0.081	
	1.446		1.374	
Customer industry $r_{i,t-1}$ [b]	0.065		0.088	
	0.873		1.179	
Adjusted R^2	0.308		0.294	
Obs.	2301		2320	

Table 10
Portfolio approach

This table presents the median market-adjusted bond returns during the first month after portfolio formation. Bond return for each firm is the value-weighted average of the returns of all the eligible bonds the firm issues. Bond market index is the simple average of all available bond returns for each month. At the beginning of each month, all eligible firms are divided into 5 portfolios based on customer bond returns at last month (Customer $r_{i,t-1}^{b}$). In Panel A, all customers of each firm are treated as a portfolio. In Panel B, for each firm, the largest customer to which the percentage of sales is largest is chosen. Overlap group consists of all firms with at least one overlapping transient institutional shareholder trading their bonds in the corresponding period. Non-Overlap group consists of all firms which either have no overlapping transient institutional shareholders or the overlapping transient institutional shareholders do not trade the firm's bonds in the corresponding period.

Panel A: All Customers As a Portfolio						
Customer $r_{i,t-1}^{b}$	Full Sample		Overlap	Non-Overlap	
Q1 (lowest)	-0.12%		-0.15%	-0.12%	
Q5 (highest)	0.05%		-0.19%	0.13%	
Q5-Q1	0.17%		-0.04%	0.25%	*
Wilcoxon test (Z value)	1.1724		-0.1769	1.4434	
Panel B: Firm–Largest Customer Relationships					
Q1 (lowest)	-0.15%		-0.26%	-0.12%	
Q5 (highest)	0.13%		-0.21%	0.20%	
Q5-Q1	0.28%	***	0.05%	0.33%	***
Wilcoxon test (Z value)	2.6722		0.2995	2.862	

Table 11
Further test on the informational role of overlapping transient institutional investors

This table presents further test on the informational role of overlapping transient institutional investors, compared with the role of overlapping bondholders between the firm and its customers. In Column (1) and (2), I present the results where customers for each firm are treated as a portfolio. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. In Column (3) and (4), I choose the largest customer to which the percentage of sales is largest to do the test. The dependent variable is the firm-level monthly bond return at month t ($r_{i,t}^{b}$). $r_{i,t-1}^{b}$ is the firm-level monthly bond return at month t-1. $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). I weight bond-level returns by the market value of each bond to convert them to firm level. TRA is the overlapping transient institutional ownership measured as shown in Section 2.4.1.1. OVPB is an indicator for the existence of overlapping bondholders between the firm and its customers during the year. INF equals 2 if both overlapping transient institutional shareholder trading the firm's bonds and overlapping bondholder exist, 1 if only overlapping transient institutional shareholder trading the firm's bonds exists and 0 otherwise. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. SMB is the difference between the simple average of the monthly stock returns on the three Fama-French small-stock portfolios and the simple average of the monthly stock returns on the three Fama-French big-stock portfolios. HML is the difference between the simple average of the monthly stock returns on the two Fama-French high-BE/ME portfolios and the simple average of the monthly stock returns on the two Fama-French low-BE/ME portfolios. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. TERM is the difference between monthly long-term government bond return and monthly 30-day Treasury bill return at the beginning of month t. DEF is the difference between long-term corporate bond return and long-term government bond return. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Customer Portfolio				Largest Customer			
	(1)		(2)		(3)		(4)	
Intercept	0.003	***	0.002	***	0.003	***	0.002	***
	3.777		3.227		3.832		3.426	
Customer $r_{i,t-1}^{b}$	0.039		0.040		0.036		0.039	
	0.858		1.155		0.806		1.086	
Customer $r_{i,t-1}^{s}$	0.000		0.000		0.006		0.003	
	0.010		-0.045		0.534		0.381	
TRA	-0.183				-0.164			
	-1.563				-1.454			
Customer $r_{i,t-1}^{b}$ *TRA	**-15.092**	**			**-15.657**	***		
	-2.564				**-2.659**			
Customer $r_{i,t-1}^{s}$ *TRA	-1.674				-2.245			
	-0.638				-0.935			
OVPB	-0.002	***			-0.002	**		
	-2.842				-2.326			

	Customer Portfolio				Largest Customer			
	(1)		(2)		(3)		(4)	
Customer $r_{i,t-1}^{b}$ *OVPB	-0.018				-0.015			
	-0.330				-0.288			
Customer $r_{i,t-1}^{s}$ *OVPB	-0.010				-0.013			
	-0.989				-1.181			
INF			-0.001	***			-0.001	**
			-2.649				-2.548	
Customer $r_{i,t-1}^{b}$ *INF			**-0.047**	**			**-0.046**	**
			-2.392				**-2.346**	
Customer $r_{i,t-1}^{s}$ *INF			-0.013	*			-0.011	*
			-1.807				-1.783	
$r_{i,t-1}^{b}$	-0.105	***	-0.102	***	-0.085	***	-0.083	***
	-3.927		-3.872		-3.073		-3.019	
$r_{i,t}^{s}$	0.088	***	0.088	***	0.090	***	0.090	***
	9.132		9.128		8.826		8.813	
$r_{i,t-1}^{s}$	0.033	***	0.033	***	0.027	***	0.027	***
	5.934		5.893		5.348		5.326	
RF_t	0.575	**	0.551	**	0.546	**	0.518	**
	2.391		2.341		2.080		2.023	
SMB_t	0.026		0.024		0.022		0.019	
	1.479		1.343		1.241		1.106	
HML_t	-0.083	***	-0.084	***	-0.092	***	-0.092	***
	-4.008		-4.020		-4.309		-4.320	
RM_t	0.017		0.017		0.018		0.018	
	1.316		1.331		1.451		1.464	
$TERM_t$	0.635	***	0.636	***	0.602	***	0.603	***
	11.444		11.466		11.073		11.115	
DEF_t	0.653	***	0.652	***	0.633	***	0.633	***
	13.541		13.568		13.205		13.228	
Industry $r_{i,t-1}^{b}$	0.103		0.108		0.099		0.106	*
	1.521		1.611		1.557		1.668	
Customer industry $r_{i,t-1}^{b}$	0.083		0.083		0.078		0.074	
	1.032		1.034		1.044		0.988	
Adjusted R^2	0.216		0.216		0.210		0.210	
Number of clusters	195		195		196		196	
Obs.	6130		6130		6183		6183	

Table 12
The effect of current customer information on the trading volume of overlapping transient institutional shareholders

This table presents the effect of current customer information on the trading volume of overlapping transient institutional shareholders in the bond market. In Column (1), all customers for each firm are treated as a portfolio. Customer specific and relationship-level variables are weighted by the percentage of sales to the customer for each firm. In column (2) and (3), only the largest customer to which the percentage of sales is largest for each firm is chosen. In column (3), the percentage of sales to the largest customer lies above 2/3 quantile. The dependent variable is trading volume of overlapping transient institutional shareholders in par value at month t scaled by the offering amount of the bond ($VOLB_t$). $r_{i,t}^{b}$ ($r_{i,t-1}^{b}$) is the monthly bond return at firm level at month t (t-1). $r_{i,t}^{s}$ ($r_{i,t-1}^{s}$) is the monthly stock return at month t (t-1). $VOLS_{i,t}$ is stock trading volume of the firm at month t. RF is the risk free rate measured as the monthly return of 30-day Treasury bill. RM is the value-weighted stock return inclusive of dividends in the CRSP stock market. AGE is the age of the bond in month. SIZE is the logarithm of the offering amount of the bonds the firm issues. Industry bond return is the median monthly bond return of the industry. The classification of industries is based on the two-digit SIC code. Credit risk is the numeric scale of S&P credit rating. I follow Jostova et al. (2013) to convert the S&P ratings into a numeric scale from 1 to 22: 1=AAA, 2=AA+, …, D=22. I weight bond-level variables by the market value of each bond (bond price at the end of moth t*offering amount) to convert them to firm level. The values below coefficients are t statistics using clustered standard error by firm. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

	Customer Portfolio		Largest Customer			
	(1)		(2)		High Percentage of Sales to the Customer (3)	
Intercept	25.824	***	24.297	***	29.139	**
	5.393		5.215		2.613	
Customer $r_{i,t}^{b}$	**106.234**	*	**83.101**		**113.496**	**
	1.960		**1.355**		**2.333**	
Customer $r_{i,t-1}^{b}$	**7.986**		**14.812**		**-9.597**	
	0.191		**0.318**		**-0.184**	
Customer $r_{i,t}^{s}$	0.757		1.957		4.593	
	0.122		0.325		0.510	
Customer $r_{i,t-1}^{s}$	-1.099		-0.192		-0.498	
	-0.154		-0.023		-0.041	
$r_{i,t}^{b}$	-27.180		-32.795		-64.036	
	-0.889		-1.074		-0.616	
$r_{i,t-1}^{b}$	10.199		13.278		-27.978	
	0.415		0.443		-0.717	
$r_{i,t}^{s}$	15.988		16.866		33.504	***
	1.515		1.614		3.212	
$r_{i,t-1}^{s}$	9.997		9.531		11.360	
	1.311		1.204		0.712	
$VOLS_{i,t}$	12.895	**	12.643	**	17.487	*
	2.440		2.295		1.851	

	Customer Portfolio		Largest Customer			
	(1)		(2)		High Percentage of Sales to the Customer (3)	
RF_t	-57.362		-108.859		273.242	
	-0.147		-0.285		0.362	
RM_t	-11.195		-14.352		7.469	
	-0.932		-1.117		0.482	
AGE_t	0.058		0.066		0.129	
	0.887		0.898		0.599	
$SIZE_t$	-1.745	***	-1.649	***	-1.953	***
	-5.133		-5.154		-3.271	
Customer industry $r_{i,t-1}$ [b]	-92.711		-57.705		-47.026	
	-1.614		-0.779		-0.439	
$VOLB_{t-1}$	-0.025		-0.019		-0.087	
	-0.323		-0.242		-0.838	
Credit $risk_{t-1}$	-0.052		-0.049		-0.471	**
	-0.352		-0.322		-2.394	
Adjusted R^2	0.177		0.161		0.097	
Number of clusters	29		31		14	
Obs.	241		240		69	

Table 13
Real effects of customer information

This table presents the real effects of customer information on bondholders. For each firm, I choose the largest customer in the sample period and examine the time-series relations between the firm and this customer. The dependent variable is earnings before interest and tax divided by total assets at fiscal year t+1 ($(EBIT/TA)_{t+1}$). Link equals 1 if there is a supplier–customer relationship, and 0 otherwise. Customer $r_{i,t}^{b}$ is the annualized customer bond return. Customer $r_{i,t}^{s}$ is the annualized customer stock return. The missing monthly stock return is replaced by the value-weighted market return at that month. Size is the logarithm of total assets. $EBIT_t/TA_t$ is earnings before interest and tax divided by total assets at fiscal year t. I estimate the model using median regression. Industry[60] and year fixed effects are controlled for. The values below coefficients are t statistics calculated using resampling method with 10000 resampling times. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	-0.016	
	-0.883	
$Link_t$	-0.003	
	-0.804	
Customer $r_{i,t}^{b}$	0.016	
	1.535	
Customer $r_{i,t}^{s}$	-0.057	
	-1.203	
$Link_t$* Customer $r_{i,t}^{b}$	**0.096**	*
	1.725	
$Link_t$* Customer $r_{i,t}^{s}$	0.003	
	0.162	
$Size_t$	0.004	***
	3.531	
$EBIT_t/TA_t$	0.821	***
	28.183	
Obs.	871	

[60] Industries with observations less than 10 are grouped together to alleviate multicollinearity problem.

Appendix

A. Determinants of customer disclosure

From Ellis et al. (2012), managers choose to disclose the information of their customers with a tradeoff between the benefits of reducing information asymmetry and the costs of leaking proprietary information. To control for this self-selection issue, I run a PROBIT model to estimate the probability for the managers to disclose customers' information using all COMPUSTAT observations exclusive of financial and utility firm-years from 1992 to 2011 and get inverse Mills ratios (Heckman, 1979). The determinants are all those found by Ellis et al. (2012). The model is:

$$\begin{aligned}\text{customer\_disclosure} &= \mathrm{F}(\epsilon_0 + \epsilon_1 \text{R\&D to sales} + \epsilon_2 \text{Net intangibles to assets} \\ &+ \epsilon_3 \text{Advertising to sales} + \epsilon_4 \text{SEO within next year} \\ &+ \epsilon_5 \text{Ln(Assets)} + \epsilon_6 \text{BigN auditor} \\ &+ \epsilon_7 \text{Supplier industry nondisclosure rate} + \varepsilon) \qquad \text{(A)}\end{aligned}$$

where customer_disclsoure equals 1 if the firm discloses major customers information and 0 otherwise. F refers to the standard normal distribution function. R&D to sales is R&D expenditure over sales. I treat the missing R&D expenditure as 0. Net intangibles to assets is calculated as (total intangible assets - goodwill) / total assets. Advertising to sales is advertising expense over sales and the missing advertising expense is set to be 0. SEO within next year is 1 if common shares issued change from t-1 to t and 0 otherwise. Ln(Assets) is the logarithm of total assets. BigN auditor is 1 if the audit firm is Big 4 and 0 otherwise. Supplier

industry nondisclosure rate is the proportion of firms within the same four-digit SIC code who don't disclose customer information.

Table AI
The determinants of customer information disclosure

This table presents the determinants of customer information disclosure. The regression model is Model A. The event is 1 if the firm discloses identifiable customer information and 0 otherwise. The values below coefficients are Chi-square statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	0.978	***
	866.222	
R&D to sales	-0.037	***
	79.877	
Net intangibles to assets	0.100	
	2.673	
Advertising to sales	-0.401	**
	4.498	
SEO within next year	0.089	***
	25.363	
Ln(Assets)	-0.069	***
	477.449	
BigN auditor	0.120	***
	34.510	
Supplier industry nondisclosure rate	-1.882	***
	4065.246	
Events	15709	
Observations	52663	
Log Likelihood	-29613.067	

B. Determinants of overlapping ownership of transient institutional shareholders holding the supplier's bonds

Prior research such as Chung and Zhang (2011), Huang (2010) and Bushee and Noe (2000) shows the endogeniety of institutional ownership. Also, for relationships which either have no overlapping transient institutional shareholders or the overlapping transient institutional shareholders do not hold the supplier's bonds, the explanatory variable of interest regarding the overlapping ownership of transient institutional shareholders holding supplier's bonds (TRA) is 0. To solve for the endogenity problem of institutional ownership and the problem coming from censored data, I use the Tobit model to estimate the predicted minimum

value of the two ownerships the overlapping transient institutional shareholders who are also the bondholders of the supplier hold in the supplier and the customer. The regression model is:

$$\begin{aligned}\text{TRA} = {} & \theta_0 + \theta_1 \text{OVPAN} + \theta_2 \text{OVPD} + \theta_3\ \text{OVPAU} + \theta_4 \text{MDEP} + \theta_5 \text{abs(ADEP)} \\ & + \theta_6 \text{Same industry} + \theta_7 \text{Same city} + \theta_8 \text{size} + \theta_9 \text{customer size} \\ & + \theta_{10}\ \text{hhi} + \theta_{11} \text{customer hhi} + \theta_{12} \text{sectorovpinst} \\ & + \theta_{13} \text{customer sectorovpinst} + \theta_{14} \text{leverage}_{t-1} \\ & + \theta_{15} \text{customer leverage}_{t-1} + \theta_{16} \text{ROA}_{t-1} \\ & + \theta_{17} \text{customer ROA}_{t-1} + \theta_{18} \text{tangibility} \\ & + \theta_{19} \text{customer tangibility} + \theta_{20} \text{turnover} \\ & + \theta_{21} \text{customer turnover} + \theta_{22}\ \text{log(price)} \\ & + \theta_{23}\ \text{customer log(price)} + \theta_{24} \text{tobinq} + \theta_{25} \text{customer tobinq} \\ & + \theta_{26} \text{age} + \theta_{27} \text{customer age} + \theta_{28} \text{return} \\ & + \theta_{29} \text{customer return} + \theta_{30} \text{volatility} + \theta_{31} \text{customer volatility} \\ & + \theta_{32} \text{baspread} + \theta_{33} \text{customer baspread} + \theta_{34} \text{Zscore} \\ & + \theta_{35} \text{credit rating} + \theta_{36} \text{issue size} + \theta_{37} \text{bond return} \\ & + \theta_{38} \text{bond age} + \theta_{39} \text{market return} + \theta_{40} \text{IMR} + \epsilon \qquad \text{(B)}\end{aligned}$$

TRA refers to the minimum value of ownerships overlapping transient institutional shareholders who are bondholders of the supplier in the corresponding year hold in the suppler and the customer. Subscript t is omitted for simplicity. I include the characteristics of both partners. From Brennan and Hughes (1991), analysts can be treated as information intermediaries, affecting investors' holdings. So, an overlap in analyst (OVPAN) may induce the overlap in institutional investors. From Reppenhagen (2010), an overlapping director

(OVPD), an overlapping auditor (OVPAU) and small geographical distance (Same city) facilitate the communication between two firms. So, firms with an overlapping director or with an overlapping auditor or geographically close to each other may be more likely to be covered by the same institutional investor. Prior research such as Gupta and Sapienza (1992) shows institutional investors' preferences towards industry diversification, so, I include an indicator, whether the two firms are in the same industry (Same industry), to grasp the effect. The proportion of overlapping institutional investors in an industry (sectorovpinst) is included to detect the herding behavior of investors (e.g., Sias, 2004). I include mutual dependence (MDEP) and interdependence asymmetry (ADEP) between the customer and the supplier and competition level of the industries (hhi) to examine whether the existence of overlapping institutional investors is a result of supplier's or customer's demand for monitoring the supplier–customer relationship. MDEP is the minimum value of the percentage of supplier sales to the customer and the percentage of customer cost of goods sold from the supplier. ADEP is the difference between the two percentages. According to Casciaro and Piskorski (2005), the supplier (customer) which is highly dependent on the customer (supplier) is more likely to explore certain mechanism to be safeguarded, but the other partner has both the incentive and power to inhibit such a behavior and both the supplier and the customer have the incentive to explore the safeguarding mechanism if their mutual dependence is high. Based on literature on supply chain management, intense competition (Li, 2002) in the product market is an important reason for a supplier and a customer to keep a friendly relationship with each other because in this situation, the benefit of the

relationship is more likely to exceed the cost. Chung and Zhang (2011) show that institutional investors prefer firms with large size (size: log(total assets)), high leverage (leverage: the ratio of long-term debt to total assets), low ROA (ROA: earnings before extraordinary items, deflated by net assets), high tangibility ratio (tangibility: capital expenditure divided by total assets), high stock turnover (turnover: average monthly trading volume divided by common shares outstanding), high prior stock price (log(price): log(average monthly stock price)), low Tobin's Q (tobinq: (stock price at the end of the fiscal year * common shares outstanding + total liabilities)/total assets), long history of listing (age: logarithm of the duration of the firm from IPO year or the first year in COMPUSTAT to year t), high stock return (return: annual stock return), low stock volatility (volatility: standard deviation of the firm's midpoint of bid and ask price during fiscal year t) and low bid–ask spread (baspread: average bid–ask spread during fiscal year t). So, I include those factors to predict the ownership of overlapping transient institutional investors. I include Zscore and credit rating to measure the default risk of the supplier, which is an essential factor determining the bond trading activity of institutional investors (Hotchkiss and Jostova, 2007). According to Altman (1968), Zscore is calculated as (0.012 * working capital + 0.014 * retained earnings + 0.033 * earnings before interest and tax + 0.999 * sales) / total assets + 0.006 * price at the end of fiscal year * common shares outstanding / total debt. Credit rating is the numeric scale of S&P credit rating. I follow Jostova et al. (2013) to convert the S&P ratings into a numeric scale from 1 to 22: 1=AAA, 2=AA+, …, D=22. According to Hotchkiss and Jostova (2007), I include bond issue size, bond age, bond return and market stock return (market

return) to detect bond trading decisions. Issue size is the sum of offering amount of all bonds the supplier issues and not due at the beginning of the year. Bond age is the logarithm of average age of those bonds. Bond return is annualized. I replace missing bond return with the median bond return in my sample at the same year. Inverse Mills ratio (IMR) estimated in Model A is included to control for self-selection bias from customer disclosure.

Table AII

This table presents the determinants of overlapping ownership of transient institutional shareholders holding the supplier's bonds. The regression model is Model B. The dependent variable is the minimum value of ownerships overlapping transient institutional shareholders who are bondholders of the supplier in the corresponding year hold in the suppler and the customer (TRA). The definitions of variables are below Model B. The values below coefficients are t statistics. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

Intercept	-0.011	*
	-1.771	
OVPAN	0.000	
	0.818	
OVPAU	0.000	
	-0.914	
MDEP	-0.001	
	-0.084	
abs(ADEP)	0.007	**
	2.546	
Same industry	0.000	
	0.110	
Same city	0.002	
	1.574	
size	0.000	
	0.968	
customer size	0.000	
	0.765	
hhi	0.007	
	0.346	
customer hhi	0.045	*
	1.932	
sectorovpinst	0.006	
	1.431	
customer sectorovpinst	-0.005	
	-1.059	
$leverage_{t-1}$	0.003	
	1.427	
customer $leverage_{t-1}$	-0.004	
	-1.593	
ROA_{t-1}	-0.005	
	-1.582	

customer ROA_{t-1}	0.005	
	0.644	
tangibility	0.000	
	0.002	
customer tangibility	0.001	
	0.136	
turnover	0.003	*
	1.670	
customer turnover	0.000	
	0.068	
log(price)	-0.001	**
	-2.098	
customer log(price)	-0.002	***
	-2.831	
tobinq	-0.000	
	-1.217	
customer tobinq	0.000	
	0.243	
age	0.000	
	1.020	
customer age	0.000	
	0.718	
return	0.002	***
	2.694	
customer return	0.000	
	-0.393	
volatility	0.000	
	0.639	
customer volatility	0.000	**
	2.148	
baspread	0.029	***
	3.332	
customer baspread	0.042	***
	4.168	
Zscore	0.000	
	-0.265	
credit rating	0.000	***
	-3.545	
Issue size	0.000	*
	1.779	
bond return	0.007	**
	2.276	
bond age	-0.001	
	-1.616	
market return	0.005	***
	4.401	
IMR	0.001	
	0.930	
Censored	171	
Observations	413	
-2 log likelihood ratio	215.607	***

CURRICULUM VITAE

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